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*Kiritimati Atoll Conservation
Area Project (KACAP)*

Project Preparation Document

January 1999



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KIRITIMATI ATOLL
CONSERVATION AREA PROJECT
(KACAP)

South Pacific Biodiversity Conservation Programme

PROJECT PREPARATION DOCUMENT

Ministry of Line and Phoenix Development
Ronton, Kiritimati
Republic of Kiribati

January 1999

Prepared with the assistance of South Pacific Regional Environment Programme/South Pacific Biodiversity Conservation Programme consultants, R. R. Thaman and R. Tuxson of The University of the South Pacific, Suva, Fiji, and Bwere Eritaia of the Environment Unit, Ministry of Environment and Social Development, Bikenibeu, Tarawa in February 1996, with additional fieldwork in 1998 and subsequent redrafting in January 1999 by the Ministry of Line and Phoenix Development and SPBCP.

FOREWORD

It is with considerable pleasure that I forward this Project Preparation Document for the Kiritimati Atoll Conservation Area to the South Pacific Regional Environment Programme. This represents an important step in the Republic of Kiribati's desire to promote the sustainable utilisation of the terrestrial and marine resources of Kiritimati, our largest, perhaps The Republic of Kiribati's most unique, island in terms of its natural history and fauna.

I feel that the approach we have taken towards biodiversity conservation is an appropriate one for Kiribati. By including a cultural component in the definition of biodiversity, and by designating the entire atoll and its surrounding marine environment part of the Conservation Area, we believe that the suggested activities of the Kiritimati Atoll Conservation Area Project (KACAP) can reinforce our traditional use and appreciation of plants and animals of our atoll and ocean environment, while at the same time promoting appropriate modern development that can make life better for the people who live on the island and that can contribute to the sustainable development of the Republic of Kiribati as a modern nation.

In the following pages we attempt to present information on the growing international interest in biodiversity, relate this to the South Pacific Biodiversity Conservation Programme, and discuss the rationale for selecting Kiritimati Atoll as a Conservation Area. We then attempt to summarise, very briefly, the information on the biodiversity of Kiritimati and on demographic, economic and institutional factors related to environmental management and sustainable development. Finally, the details of activities to conserve biodiversity identified in consultation with the communities of Kiritimati are provided.

Although the KACAP is ambitious, the Ministry of Environment and Social Development, the Ministry of Line and Phoenix Development and the communities of Kiritimati believe it is workable. We feel this way because of the stated commitment of the Government, non-government organisations and the communities of Kiritimati to the project, and the compatibility of the project methodology to the Kiribati way of life.

Finally, I wish to take this opportunity to express the sincere thanks of the Government of the Republic of Kiribati to SPREP and the South Pacific Biodiversity Conservation Programme for their support of the objective of biodiversity conservation as a basis for sustainable development in both Kiribati and the Pacific Islands. I would also like to thank those people who have contributed their time and ideas to help in the completion of this Project Preparation Document. Finally, particular thanks are due to the people of Kiritimati, whose enthusiasm and commitment remains the most important ingredient for the sustainable management of the terrestrial and marine resources of Kiritimati for the benefit of future generations of I-Kiribati and the world.

Te Maori, Te Roi e Te Tabemoa

The Honourable Timbo Keariki
Minister of Environment and Social Development

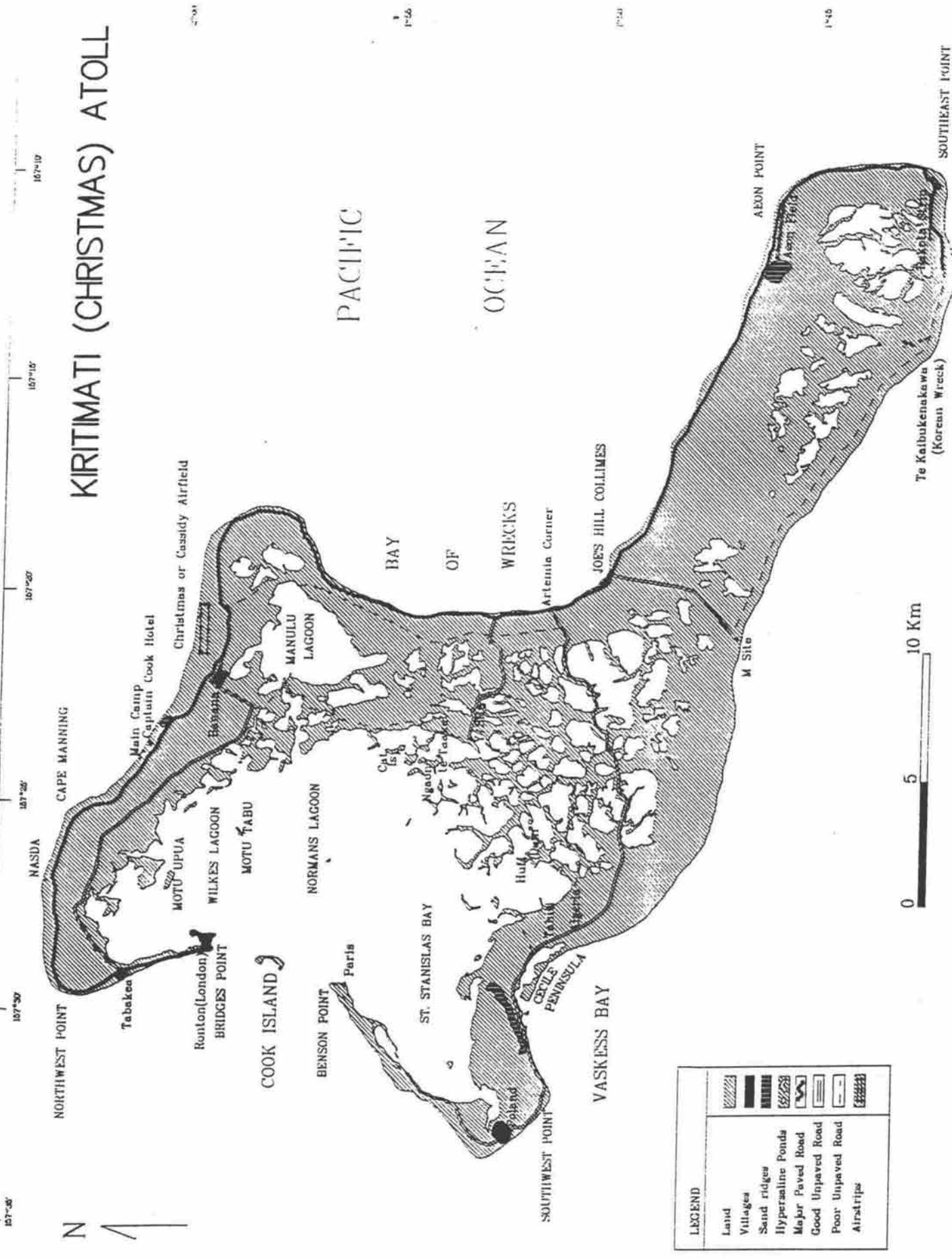
ACRONYMS AND ABBREVIATIONS

CASO	Conservation Area Support Officer (Kiritimati)
ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau (now AusAID)
CA	Conservation Area
CACC	Conservation Area Coordinating Committee
EEZ	Exclusive (Extended) (200-mile) Economic Zone
ENSO	El Nino (Ninyo) Southern Oscillation
EU	Environment Unit
FFA	Forum Fisheries Agency
FSP	Foundation for the Peoples of the South Pacific
GEF	Global Environment Facility
IUCN	International Union for the Conservation of Nature and Natural Resources
KACA	Kiritimati Atoll Conservation Area
KACAP	Kiritimati Atoll Conservation Area Project
KMEL	Kiritimati Marine Export Ltd.
KTFE	Kiribati Task Force on the Environment
MENRD	Ministry of Environment and Natural Resources Development
MESD	Ministry of Environment and Social Development
MHARD	Ministry of Home Affairs and Rural Development
MHFPSW	Ministry of Health, Family Planning and Social Welfare
MLPD	Ministry of Line and Phoenix Development
MTCT	Ministry of Transport, Communication and Tourism
MWE	Ministry of Works and Energy
NASDA	Nippon Aeronautic and Space Development Agency
NEMS	National Environmental Management Strategy
NGO	Non-Governmental Organisation
NOAA	US National Oceanic and Atmospheric Administration
PPD	Project Preparation Document
SOPAC	South Pacific Applied Geoscience Commission
SPRMTCP	South Pacific Regional Marine Turtle Conservation Programme
SPBCP	South Pacific Biodiversity Conservation Programme
SPC	Secretariat for the Pacific Community
SPREP	South Pacific Regional Environment Programme
TLMP	Tarawa Lagoon Management Plan
TOGA	Tropical Oceanic Global Atmosphere Programme
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

TABLE OF CONTENTS

1	Introduction	6
2	Project Background	7
3	Biodiversity and Biodiversity Conservation	9
4	Important Environmental Issues	10
5	The Environment of Kiribati and Kiritimati Atoll	12
	5.1 Natural resources endowment	12
	5.2 Land and ocean area of Kiribati	12
	5.3 Kiritimati Island's environment	13
	5.4 Climate	14
	5.5 Water resources	14
	5.6 Soils	15
	5.7 Terrestrial and marine ecosystems	15
	5.8 Flora	22
	5.9 Terrestrial Fauna	26
	5.10 Marine Resources	29
6	Settlement and Economic Development History	34
7	Population Distribution and Growth	36
8	Institutional Arrangements - Legislation, Policies and Programmes	36
	8.1 Environmental Legislation	38
	8.2 Land and Marine Tenure	39
	8.3 International Conventions	41
	8.4 UNCED Report	42
	8.5 National Environment Management Strategy (NEMS)	42
	8.6 Outer Islands Development	42
	8.7 Agriculture, Fisheries and Ecotourism	43
	8.8 Water and Sanitation	44
	8.9 Climate Change and Sea level rise	45
	8.10 Tarawa Lagoon Management Plan	45
	8.11 Training, Education and Public Awareness	48
	8.12 Non-governmental initiatives	49
9	Description of the Project	51
	9.1 Project Objectives	51
	9.2 Constraints to Conservation and Sustainable Use of Biodiversity	51
	9.3 Project Management	54
	9.4 Background to Project Activities and Budget	57
	9.5 Budget	58
	9.6 Details of Project Activities	62
	9.7 Proposed Work Schedule	81
	Bibliography and References	84
	Annex 1: Suggested Criteria and classification system	89
	Annex 2: Person consulted in Kiritimati	91
	Annex 3: Terms of Reference for CASO	94
	Annex 4: Food and Multipurpose species of priority status for protection	95
	Annex 5: Checklist of bird species reportedly breeding on Kiritimati	97

KIRITIMATI (CHRISTMAS) ATOLL



LEGEND	
	Land
	Villages
	Sand ridges
	Hyperaline Ponds
	Major Paved Road
	Good Unpaved Road
	Poor Unpaved Road
	Airstrips



1 INTRODUCTION

The Government of the Republic of Kiribati has selected two localities as Conservation Area Projects (CAPs) under the South Pacific Biodiversity Conservation Programme (SPBCP) of the South Pacific Regional Environment Programme (SPREP). These CAP localities were initially designated as Naa CAP, the northernmost islet of Kiritimati Atoll in the Gilbert Group, and Cook Island CAP, an islet located in the mouth of the central lagoon of Kiritimati (Christmas Island) in the Line Islands. In the preparation of this document, which refers only to the second of these localities, the designation Cook Island Conservation Area Project will be replaced by the more appropriate name, Kiritimati Atoll Conservation Area Project (KACAP). In accordance with SPBCP guidelines, this document – the Project Preparation Document (PPD) for the Kiritimati Atoll Conservation Area Project (KACAP) – constitutes Stage II of the SPBCP's CAP process.

The PPD has been developed in conjunction with appropriate authorities in Kiribati and Kiritimati, and after formal and informal meetings with some of the local communities within the proposed Kiritimati Atoll Conservation Area (KACA). The document's main objectives are:

1. To provide relevant background information on the proposed KACA;
2. To draw attention to issues of concern relevant to biodiversity conservation within the KACA;
3. To identify suitable objectives, activities, strategies, and an organisational or management structure for the KACA; and,
4. To provide a detailed Work Plan of activities for the implementation of the KACAP.

For the preparation of this PPD a mission was undertaken to Kiritimati Atoll in July 1996 by SPREP/SPBCP consultants Prof. Randy Thaman and Mr. Robert Tuxson of the University of the South Pacific, together with Mr. Bwere Eritaia (Environment Section, Ministry of Environment and Social Development, Republic of Kiribati), who has been designated as Conservation Area Support Officer (CASO) for the CAPs in Kiribati. In May 1998, a second series of community consultation was undertaken involving Mr. Sam Sesega (Programme Officer Resource Management) of SPREP, Mr. Bwere Eritaia (MESD) and Ms Teboranga Tioti of the Ministry of Line and Phoenix Development (MLPD). The objectives of the two PPD missions were:

1. To determine the degree of community interest in and willingness to become active participants in the KACAP;
2. To identify the constraints against, the activities that might promote, and the people's major concerns relating to biodiversity conservation and sustainable development;

3. To collect relevant background information on the nature of the proposed KACA and the communities within it, the character of the biodiversity, the nature of current development, and the political, community, and developmental infrastructure of the area; and,
4. To consider, and discuss with local communities, community leaders, and government authorities, potential strategies, activities, and project-management alternatives.

The information collected on the missions has subsequently been incorporated into this PPD, which, thus, reflects to a great extent the views of the local residents and government officials. Persons consulted are listed in Appendix 1. This PPD focuses primarily on the environment of Kiritimati Atoll and the proposed KACA. Detailed information on the Republic of Kiribati, its environment, demography, economy, environmental institutions and legislation and constraints to sustainable development are covered in detail in the North Tarawa Conservation Area Project Preparation Document submitted to SPREP in 1995 (Thaman, Clarke, Tebano and Eritaia 1995). Detailed information on Kiritimati Atoll and its current economy, infrastructural development and potential for future development are covered in detail in the *Northern Line Islands Integrated Development Plan for the Republic of Kiribati*, Volumes I - II (1993) prepared by AGRIC⁹ of New Zealand and funded by the Asian Development Bank (ADB)

2 PROJECT BACKGROUND

This section provides background on the Republic of Kiribati's initiative to develop a Kiritimati Atoll Conservation Area (KACA) under the SPBCP. It includes information on: 1) increasing international interest in biodiversity conservation and management; 2) SPBCP and Conservation Area Project development; and 3) the rationale for the proposed Kiritimati Atoll Conservation Area Project (KACAP) under SPBCP.

2.1 Increasing International Interest in Biodiversity

The formalisation of the Convention on Biological Diversity (CBD) at the United Nations Conference on Environment and Development (UNCED), the "Earth Summit", held in Rio de Janeiro in June 1992, underlined the importance of biodiversity conservation as a basis for sustainable development everywhere. The CBD, which provides a framework for the protection of both terrestrial and marine biodiversity, was signed by nine Pacific island countries, including Kiribati. The Convention is particularly important to countries of the Pacific Islands, which have "globally significant areas of biological diversity", such as Kiritimati, and whose people, cultures, and economies depend on the protection and sustainable use of their terrestrial and marine life. The importance of the protection of small island ecosystems is also included in *Agenda 21*, the UNCED action plan for the attainment of sustainable development.

The implementation of the CBD in the Pacific Islands is being facilitated by the SPREP-based South Pacific Biodiversity Conservation Program (SPBCP), a five-year, \$US10

million programme funded through the Global Environment Facility (GEF) and the Government of Australia. The GEF is designed to help developing countries deal with critical regional and global environmental issues, which include ozone depletion and climate change, the use and protection of international waters and biodiversity conservation. It is administered by the World Bank, the United Nations Environment Programme (UNEP), and the United Nations Development Programme (UNDP).

Kiribati has also completed a National Environmental Management Strategy (NEMS) which has among its major programmes, initiatives that will be protective of biodiversity and that would be significantly furthered by the establishment of the KACA.

2.2 Rationale for SPBCP and Conservation Area Project Development

The main aim of the SPBCP is to develop strategies and to provide technical and financial assistance to eligible independent Pacific Forum countries, such as Kiribati, for the conservation and sustainable use of biodiversity. The SPBCP seeks to establish, in eligible countries, a system of diverse Conservation Areas (CAs) in which human activities will be guided to protect important ecological features and to enable sustainable use of natural resources within the CA. SPBCP activities related to the establishment of CAs include the provision of information, protection of endangered terrestrial and marine species and ecosystems, the promotion of improved awareness and education on biodiversity conservation issues within the region, and the improvement of capabilities and working relationships between different sectors and agencies that have roles to play in the conservation of biodiversity at both the local and regional levels.

The rationale for the establishment of a system of CAs is that in areas, such as the Kiritimati Atoll CA, where people depend heavily on their terrestrial and marine resources for their subsistence and cash production, there is a need to promote the conservation and sustainable utilisation of these resources. Under the SPBCP, CAs are not areas to be preserved wherein development is prohibited. Rather, CAs are to be areas where resources are sustainably utilised in a way that also conserves terrestrial and marine biodiversity for the benefit of future generations. This approach differs from national parks and conservation areas in industrialised countries where people are not so dependent on their natural environment for their day-to-day survival, and where conservation efforts are focused mainly on protection and recreation, rather than on sustainable utilisation. Major emphasis is placed on the convictions, first, that local communities must play an integral role in the initiation and planning of the project, agreeing to participate in its development and implementation; and, second, that once Conservation Area Projects (CAPs) are established, they should be community driven and owned and reflect the on-going wishes and desires of the local people, with local communities ultimately taking over the administration and management of the CA.

The SPBCP also recognises that:

1. There will probably be a lack of awareness and management skills amongst the local communities who have the most immediate need to conserve the environment;

2. There will need to be a gain in tangible benefits, including financial returns, from sustainable-development activities if local communities are to be willing to conserve the biodiversity of the areas selected as CAPs; and,
3. There will need to be an understanding that sustainable development is an ongoing and lengthy process, extending beyond the initial funding period of SPBCP, and that, in the long term, the communities in a CAP will have to become self-reliant and substantially dependent on their own community resources to carry out the conservation measures needed to ensure the protection and enhancement of the environment for future generations.

2.3 Rationale for the Proposed Kiritimati Atoll Conservation Area

After taking into consideration the above criteria and the economic and environmental conditions prevailing in Kiribati, the Ministry of Environment and Social Development (MESD), as the proposing ministry, and the Ministry of Line and Phoenix Development (MLPD), as the implementing ministry, in consultation with SPBCP professionals and the Biodiversity Sub-Committee of the Kiribati Task Force on the Environment proposed that Kiritimati Atoll be targeted as a CA because of:

1. the atoll's unique terrestrial and marine environment, its extensive resident and nesting seabird populations which are of global conservation importance;
2. the unusually high, and comparatively underexploited, biodiversity of its marine environment; and,
3. the atoll's continuing role as the focus of resettlement of people from the highly populated islands of Kiribati's main Gilbert group.

3 BIODIVERSITY AND BIODIVERSITY CONSERVATION

3.1 Biodiversity in the Context of Kiritimati Atoll CAP

In the context of the KACAP, the concepts of biodiversity and biodiversity conservation would include:

1. All terrestrial and marine ecosystems (*e.g.*, coastal strand vegetation, gardens, agroforests, and *babai* pits (excavated plots of giant swamp taro *Cyrtosperma chamissonis*), relict stands of forest, reefs, lagoons, and the open ocean. (See section 4.7 on terrestrial and marine resources below for a more detailed account of the ecosystems of Kiritimati Atoll.)
2. All plant and animal species and varieties found in these ecosystems (*e.g.*, all species of trees, shrubs, vines, herbs, grasses, seaweeds, shellfish, finfish,

beche-de-mer, crustaceans, and other marine life, and all varieties of domesticated plants and animals, such as coconuts, pandanus, breadfruit, pigs and chickens).

3. The knowledge, uses, beliefs, and language that the people of Kiritimati Atoll have in relation to their biodiversity. This would include the time-tested "biodiversity-management systems" which have served as a basis for the relatively sustainable habitation of the atoll islets for over three thousand years, beginning long before the introduction of the cash economy into Kiribati.

3.2 Biodiversity Conservation

In the context of the SPBCP, biodiversity conservation is seen as synonymous with sustainable use. It is argued – based on the experiences of other areas of the world – that if the biodiversity of Kiritimati Atoll is not conserved or used on a sustainable basis, and if traditional sustainable management practices, and the knowledge and language (*e.g.*, plant and animal names and the language associated with farming and fishing techniques, seasons, tides, etc.) are not maintained or strengthened, then forms of modern development by themselves may prove inadequate to sustain the people in the long term. Moreover, as stressed in the SPBCP programme document, it is the resource owners and users at the community level – the people who catch the local fish, collect bird's eggs and shellfish, plant breadfruit and coconut palms, and raise pigs on land – who hold the long-lasting key to biodiversity conservation on isolated islands like Kiritimati.

4 IMPORTANT ENVIRONMENTAL ISSUES

An important first step in the maintenance of Kiritimati Atoll as a Conservation Area wherein biodiversity conservation and sustainable development are promoted together is the identification of potentially sensitive environmental issues that need to be addressed to ensure that development is sustainable on the island. Once these issues are identified, then suitable projects or activities can be tailored to address these issues in the interest of promoting biodiversity conservation and sustainable development. Some of the main environmental issues that should be addressed during the on-going development process on Kiritimati, include:

1. Protection of the unique environmental features of Kiritimati.
2. Protection and sustainable use of Kiritimati's unique terrestrial wildlife inheritance, particularly its birdlife.
3. Protection and sustainable use of Kiritimati's marine resources and the marine environment.
4. Minimisation of environmental degradation due to development projects.
5. Protection of the local biota from introduced pests and pathogens.

6. Protection and enrichment of Kiritimati's freshwater resources.
7. Protection of human health due to development related activities, including exposure to residual radioactivity due to the nuclear weapons testing conducted on the island in the past.
8. Optimisation of energy self-sufficiency and use of renewable energy resources.
9. Protection of the island and its coastal waters from pollution.
10. Keeping population levels within the carrying capacity of the environment.
11. Maintenance of reasonable levels of self-sufficiency and diversity of economic opportunities for Kiritimati settlers and long-term residents.
12. The need for increased environmental awareness, within both local communities and outside development agencies.
13. The need for scientific research on the environment and biodiversity of Kiritimati before and during major developments to provide baseline data for enlightened decisionmaking and to assess the impact of a given development.

The Government of Kiribati firmly believes that the establishment of Kiritimati as a Conservation Area under SPREP's South Pacific Biodiversity Conservation Programme is one of the most systematic means of addressing many of these constraints simultaneously so that Kiritimati Island remains suitable for future habitation by both people and indigenous flora and fauna.

To do so, the following activities are suggested as components of the Kiritimati Atoll Conservation Area Project (KACAP):

1. Establishment and maintenance of Cook Island National Marine Park and a system of Conservation Areas and Protected Sites.
2. Development and enforcement of a Marine Resources Management Plan to ensure the sustainable use of Kiritimati's marine resources and the marine environment.
3. Protection and enhancement of village biodiversity.
4. Public awareness campaign and production of educational and promotional materials on Kiritimati Atoll as a Conservation Area and ecotourism destination.

Activities 1 and 2 are essential for the protection of the unique terrestrial and marine biodiversity inheritances of Kiritimati Atoll and are central to the successful maintenance of the island as a Conservation Area under SPBCP. Activity 3 is important for the enhancement of on-island incomes (cash and non-cash) and the improvement of the quality of life for long-term residents and new settlers on the island. It would also serve to increase biodiversity and

ecotouristic potential of the island. Activity 4 is seen as necessary to improve local, regional and international overseas awareness of the uniqueness of Kiritimati Atoll and to provide up-to-date information on the island's ecosystems and biodiversity as a basis for both biodiversity conservation and management and the promotion of ecotourism. All these activities have as integral components participatory Community-based Biodiversity Conservation Planning Workshops to ensure that local communities are involved in the planning, implementation and monitoring of all activities. These activities are described in detail in section 9 below.

5 THE ENVIRONMENT OF KIRIBATI AND KIRITIMATI

This section provides a brief overview of the environment and the potential for sustainable development in the Republic of Kiribati and, more particularly, within the Kiritimati CA.

5.1 Natural Resource Endowment

The natural resources of the Republic of Kiribati are either extremely limited, as in the case of terrestrial, lagoonal and near-shore resources, or extremely vast and difficult to utilise and manage, as in the case of the country's oceanic marine and seafloor resources within its extended exclusive economic zone (EEZ) of 3.55 million km². In either case, it will be a demanding matter to develop and manage these resources effectively, on a long-term basis, to serve the commercial and subsistence needs of current and future generations of I-Kiribati (the people of Kiribati).

With regard to the terrestrial, lagoonal, and near-shore resources, effective management will require practical developmental research on the living and non-living natural resources of atolls. Such research might include: 1) generation of data on the extent, nature, and current use or development and conservation status of the available natural resources; 2) evaluation of current and potential development strategies (both traditional/local and modern/imported); and 3) assessment of the impact that different development or management alternatives might have on resources or on the potential for sustainable management of these resources by the people of Kiribati. Without such data, resource development, management, and conservation will be problematic.

5.2 Land and Ocean Area of Kiribati

The Republic of Kiribati has a total land area of only 822.8 km². It consists of 33 islands in three main groups - the Gilbert Islands (formerly part of the British Gilbert and Ellice Islands Colony and known locally as Tungaru) in the west, the Phoenix Islands in the centre, the Northern and Southern Line Islands to the east, plus the single island of Banaba, 400km to the west of the Gilbert Islands. The islands are extremely isolated and fragmented, covering an ocean area of some 13 million km² between 4 deg 43 min N and 11 deg 25 min S latitude and 169 deg 32 min and 150 deg 14 min W longitude. They extend some 3,870 km from Banaba on the west to Kiritimati (Christmas Is.) in the east and 2,050 km from Teraina (Washington Is.) in the Northern Line Islands to Flint Island in the Southern Line Islands. There is very limited land area, spread over millions of square kilometres of deep ocean.

The Line Islands are made up of three northern islands, Teraina (Washington), Tabuaeran (Fanning) and Kiritimati (Christmas) and five southern islands, Malden, Starbuck, Vostok, Caroline and Flint. They have a total land area of 515.7 km² and constitute 62.7 per cent of the land area of Kiribati. The largest island in the group, and the largest island in Kiribati, is Kiritimati with an area of 363.7 km². A fourth and most northerly island in the Line group is Palmyra, which is not permanently inhabited and is a possession of the United States of America.

The sparsely inhabited Phoenix group to the east of the Gilberts Group consists of eight scattered islands which have a total land area of only 28.7 km². All are low atolls with enclosed lagoons.

The main Gilbert (Tungaru) group, consists of 16 small atolls or limestone islets extending 640 km from north to south and located 700 km to east of Nauru, 400 km east of Banaba, and about 250 km from the atoll nations of Tuvalu on the south and the Marshall Islands on the north. Although the total claimed land area of Kiribati is 822.8 km², some 93.3 per cent of the population of 72,298 live in the Gilbert Group, which makes up only 278.4 km² (33.8 per cent) of the total area. The islands, of the group, from north to south, include, Makin, Butaritari, Marakei, Abaiang, Tarawa, Maiana, Kuria, Aranuka, Abemama, Nonouti, Tabiteuea, Onotoa, Beru, Nikunau, Tamana and Arorae. All are true atolls with central lagoons, with encircling islets of varying size and shape, except Makin, Kuria, Nikunau, Tamana and Arorae, which are slightly raised limestone islets or "table reefs" with no lagoons. The size of individual islands ranges from Tamana and Makin, with areas of 5.2 and 7.2 km², to Maiana, Abaiang and Tabiteuea, with areas of 28.1, 28.5 and 49 km². Tarawa, the most populous island, where the capital is located, has islets with an estimated area of 19.9 km², extending over 64 km from north to south.

Banaba, an uplifted coral-limestone island is located 400km west of the Gilbert group at 0 deg. 53 min. S. lat. and 169 deg. 35 min. E. long.

5.3 Kiritimati Island

Kiritimati is located in the Northern Line Islands about 3,300 km east of Tarawa, 2,500 km south of Honolulu and 2,700 km north of Tahiti. Kiritimati is considered to be the largest atoll in the world. With a total area of 363.7 km², it makes up 44% of the total land area of Kiribati. The Line Group consists of three inhabited islands in the north, Kiritimati (Christmas), Tabuaeran (Fanning) and Teraina (Washington), and five uninhabited islands in the south. Kiritimati is the administrative centre for the Line and Phoenix Islands, along with Tarawa, is one of Kiribati's two ports of entry.

It is, however, extremely drought-prone, has very poor soils, and has a very limited terrestrial flora; thus limiting its suitability for human habitation and agricultural development. It does, however, have very large sea bird populations, rich marine resources and unique terrestrial and marine landforms that are of considerable global conservation and scientific importance, as well as offering some potential for sustainable ecotourism and marine resource development.

Most of the islands of the Republic of Kiribati consist of true atolls, with reefs and low-lying islets with limited land areas that encircle or partly encircle central lagoons, or small, low-lying limestone or reef islands, with no lagoons. There is also the uplifted phosphatic limestone island of Banaba. Kiritimati Atoll is, however, very different. It is higher, much larger and has a much more unique and diverse environment than the other islands of Kiribati.

Physically, most of Kiritimati's land area of 363.7 km², is composed of one continuous surface, unbroken by passes or channels to the ocean, which almost completely encircles a central tidal lagoon with an area of about 160 km². There is a large peninsula, Southeast Point, extending towards the southeast (see the map of Kiritimati Island), and a single entrance to the open ocean in the west of the island. The surface is covered by countless landlocked hypersaline lakes or lagoons, with a total area of about 168 km², in a matrix of limestone hardpan (Leonard 1993).

The main tidal Lagoon is connected by very small channels to Manulu and Ava Lagoons in the northeast. There are a number of islets within the main lagoon, the largest of which are Motu Tabu, Motu Upua and Cook Islet, the latter which is located in the northwest-central part of the lagoon directly in the center of the entrance to the open ocean.

5.4 Climate

Kiritimati is located in the dry equatorial oceanic climate zone and receives an average annual rainfall of only 766 mm (30.2 in), and is subject to frequent extended droughts. Compared to Tabuaeran (Fanning) and Teraina (Washington), to the north which are both influenced by the intertropical convergence zone (ITCZ), which have average annual rainfalls of 2,086 mm (82.1 in) and 2,902 mm (114.3 in), respectively. Based on average monthly rainfall for Kiritimati from 1951-88, the wet season normally falls from January to July, with the driest months being August to December, with the highest rainfall occurring during April (Leonard 1993). Kiritimati also experiences fairly strong winds throughout most of the year, which adds an additional desiccating effect, and has been the main contributing factor to the existence of sand dunes and the high elevation of the atoll.

5.5 Water Resources

The only permanent freshwater resource on Kiritimati is groundwater in the form of a "lens" of often slightly brackish freshwater, hydrostatically "floating" on the higher density saltwater beneath the island. The height of the lens above sea level and the level of salinity vary in relation to the elevation, shape and width of islets and the amount of water use and rainfall. The lens is most highly developed on the northern part of the island. Replenishment or recharge of the lens is solely dependent on rainfall. In areas where the lens is close to the surface, pools are often found during excessively wet periods, especially during high tides.

The location and degree of development of the groundwater resource influences the nature of the vegetation as well as the location of village wells and cultivation pits. The quantity and

quality of groundwater and the habitability of islands is severely affected during times of extended drought. This is particularly true in areas where the lens is less well-developed.

Studies in the 1960s indicate that the freshwater lens could yield about 20,000 kl/day, which at an estimated consumption rate of 50 l/day suggests that, based on water availability alone, Kiritimati could support a maximum of 10,000 people (AGRIC⁹ of New Zealand 1993).

5.6 Soils

The atoll soils and substrate of Kiritimati are very infertile. They include young calcareous soils, sandy soils, limited areas of hydromorphic soils, highly alkaline hardpans, and very limited areas of phosphate-rich, guano derived soils under seabird rookeries.

In general, the soils are young, shallow, alkaline, coarse-textured and have carbonatic mineralogy. Because of their immaturity, they vary little from the original coral-limestone parent material. They are composed of a variable layer of organic matter and coral sand, foraminifera, fragments of shells and other marine organisms overlaying a limestone platform. Based on research elsewhere in Kiribati, potassium levels are often extremely low, and pH values of up to 8.2 to 8.9 and high CaCO_3 levels make scarce trace elements, particularly iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn), unavailable to plants. Activity of soil micro-organisms is limited, soil water-holding capacity is very low because of coarse texture, and ground water is often saline. Fertility is highly dependent on organic matter to lower soil pH, to capture and recycle plant nutrients, and to retain soil water in the excessively fast draining soils. These factors together make conventional agriculture, as practiced on other larger Pacific islands, almost impossible on Kiritimati.

Although there is some organic matter in some areas of undisturbed soils in areas of higher water availability under natural vegetation, it can decrease dramatically as a result of clearance by fire or replacement by coconut plantations or other introduced plants.

The unstable sandy areas of the island are likewise very nutrient-deficient and, unless highly modified, only suitable for coconut cultivation and the planting or protection of indigenous coastal strand plants.

5.7 Terrestrial and Marine Ecosystems

Terrestrial and marine habitats or ecosystems of ecological and economic importance on Kiritimati Island are listed in Table 1. All of these habitats are in some way important to the ecological and economic future of Kiritimati, and their identification and protection should be an integral part of the plan for the development of Kiritimati as a conservation area, as well as for any other intended developments.

Table 1. Terrestrial and marine habitats or ecosystems of ecological and economic importance on Kiritimati Island.

TERRESTRIAL HABITATS OR ECOSYSTEMS

Beaches
Coral Rubble Ramparts
Sand Dunes
Limestone Hardpans
Lagoon Islets
Pisonia Forests
Lepturus Grasslands
Scaevola - Tournefortia Littoral Forests
Tournefortia woodlands
Scaevola Scrubland
Mixed Herblands
Heliotropium-Portulaca Herblands
Coconut Plantations
Village and Houseyard Gardens

MARINE HABITATS OR ECOSYSTEMS

Hypersaline Ponds
Inner Lagoon
Main Lagoon
Fringing Reefs
Offshore and Deep Reefs
Open Ocean (Pelagic)

5.7.1 Beaches

Kiritimati has hundreds of kilometres of clean, unpolluted, coral-sand beaches that offer great potential for ecotourism development. Some of the main areas of extensive white sand beaches include: 1) the coastline from Ronton (London) extending north and along most of the north coast to Northeast Point; 2) the coast extending south from Joe's Corner, south of the Bay of Wrecks, to Aeon Point; 3) the entire south coast from southeast Point extending to Vaskess Bay and around Southwest Point to Benson Point at the south of the Lagoon mouth on the west of the island; and, 4) numerous white sand beaches on the lagoon-side of the island south of Benson Point and encircling reefs islets, such as Cook Island, Motu Upua and Motu Tabu.

The beaches are commonly bordered on the seaward margin by limestone substrate in the intertidal zone and by *Scaevola* scrub or *Scaevola-Tournefortia* strand or littoral forest on the landward side. In some areas on the outer coast, and more commonly on beaches within the

lagoon, the succulent, **et boi n tari** (*Sesuvium portulacastrum*) is found in the outpost littoral vegetation. Common fauna include ghost crabs or **te kaviki** (*Ocypode ceratophthalma*) and striate surf clams or **te katura** (*Atactodea striata*), as well as land hermit crabs or **te makauro/te wi ura** (*Coenobita perlatus*) which are found in abundance straying from the surrounding vegetation or coral ramparts.

5.7.2 Coral Rubble Ramparts

There are also areas of extensive coral rubble ramparts, composed of large, slab-like, water-worn and weathered hard coral pieces, some weighing as much as 10 kg or more. These ramparts, which rise in some places to up to 3 to 6 m above sea level, are an indication of the power of the waves and storm surge that effect some coasts of the island. The main concentration of these coral ramparts extends from Northeast Point south along the Bay of Wrecks to just north of Artemia Corner, and in scattered other locations on east and west-facing coasts (e.g., about 1 km west of the Captain Cook Hotel and on the northwest coast of Cook Islet). The fauna in these areas consists mainly of land hermit crabs or **te makauro/te wiura** (*Coenobita perlatus*) and grapsid shore crabs or **te kamakama**, such as *Grapsus albolineatus*.

These ramparts, especially along the Bay of Wrecks are very scenic and constitute a unique island environment that is of considerable international and ecotouristic importance.

5.7.3 Sand Dunes

There are a number of concentrations of well-formed sand dunes that have developed over thousands of years due to the strong winds and rough seas that have been responsible for the relatively high elevation of Kiritimati in comparison with other atolls which rarely attain elevations of greater than 2 or 3 m above sea level. The main concentrations of sand dunes (referred to locally as sand ridges) include: 1) Joe's Hill Collines, just to the south of the Bay of Wrecks, which attains an estimated elevation of 20 m above sea level; 2) a number of smaller, lower dunes just inland from the coast between Joe's Hill and Aeon Field; 3) some extensive dunes near the west end of Aeon Field; 4) a sand hill inland from Southeast Point; 5) some lower dunes about 1 km east of the Captain Cook Hotel; and 6) a small raised area of dunes on the east coast of Cook Islet.

These dunes, in particular Joe's Hill, are ecologically unique in the Pacific Islands, offer considerable ecotourism potential, and should be protected as reserve areas. Some of the dunes, such as those near Aeon Field, may have to be included in future infrastructural developments related to the proposed Japanese development, but with care could be utilised with only minimal degradation.

5.7.4 Limestone Hardpans

There are extensive areas of limestone hardpans which form the matrix for countless hypersaline ponds (see 3.8? below). These areas are colonised by salt-tolerant scrub vegetation,

dominated mainly by *Suriana maritima*, *Scaevola taccada* and *Tournefortia argentea*, with scattered *Heliotropium procumbens*, *Sida fallax*, *Portulaca lutea* and the epiphyte *Cassytha filiformis*. Although offering little productive potential, they constitute important seabird nesting areas, especially near Y-Site and the Ngaaon te Taake (Frigatebird reserve) along the eastern side of the central lagoon. They are unique landforms of some scenic and scientific importance, and should be kept free from solid waste disposal.

5.7.5 Lagoon Islets

There are a number of uninhabited islets in the main lagoon. The largest are Cook Islet (Island), Motu Upua and Motu Tabu. These are among the most important seabird nesting areas on Kiritimati, and the most easily protected because of their isolation from the mainland. All of these should continue to be designated protected, limited-entry areas for I-Kiribati, local expatriates and visitors. In the case of Cook Islet, the entire island and its offshore reefs and lagoon should be declared a national park and marine reserve. This would ensure that the wildlife and natural environment of these unique islets are preserved for the benefit of ecotourists, scientists and future generations of I-Kiribati and expatriate residents and students.

Cook Islet also deserves recognition historically as the site where Captain James Cook became the first recorded European to visit the island when he discovered it on 24 December 1777 before spending Christmas day somewhere on Kiritimati.

5.7.6 Natural Vegetation

Although **te buka** (*Pisonia grandis*) is the dominant tree on many uninhabited atolls and atolls islets, there are only three remaining single-species stands of this tree on Kiritimati. These are: 1) a large stand of an estimated 200 or more large trees near K site just inland from Southeast Point; 2) a grove of 70 to 100 trees on the northcentral part of Motu Tabu; and, 3) a small stand of trees on the northern part of the island southeast of NASDA. These trees are well-known as the most important seabird rookery species in the Pacific Islands and are of critical ecological importance and should be incorporated into a system of seabird sanctuaries.

There are extensive areas of *Lepturus* grasslands in a number of different sites on the island. These include: 1) an area just north of Tabakea Village; 2) fairly extensive areas in the centre of the northern part of the island between Northwest Point and Cape Manning; 3) a large area extending to the east of Cassidy Airfield toward Northeast Point; 4) areas south of Aeon Field and near Dakota Strip and extending to the west on the southeast peninsula; 5) the area west of Tahiti and south of Te Kaba (New Zealand Airfield); 6) the Poland Plains, just north of Poland Village in the southwest; and, 7) small areas on the lagoon islets of Cook Islet, Motu Tabu and Motu Upua.

The dominant species in these areas is *Lepturus repens* (**te uteute**), with other important species being *Tribulus cistoides* (**te maukinikin**), *Boerhavia repens* (**te wao**), with scattered *Tournefortia argentea* (**te ren**) trees and less commonly *Scaevola taccada* (**te Mao**), both commonly festooned with the epiphyte *Cassytha filiformis* (**te ntanini**). These sites constitute

some of the more favourable bird nesting sites, especially for shearwaters (*Puffinus* spp.) and boobies (*Sula* spp.). Attempts should be made to ensure the protection of the more favourable sites, particularly those on the Cook Islet, Motu Tabu and Motu Upua and south of Y Site.

Tournefortia woodlands and scrublands are also common in some areas, and grade into the *Lepturus* grassland areas. These areas, particularly those on Cook Islet, are very important nesting sites, particularly for sooty terns (*Sterna fuscata*)(**te keeu**), the common black and brown noddies, *Anous minutus* (**te mangkiri**) and *Anous stolidus* (**te lo**), white or fairy terns (*Gygis alba*)(**te matawa**), and the red-tailed tropicbird (*Phaethon rubricauda*)(**te taake**).

The vegetation of the remaining, less favourable drier, hardpan or more exposed sites includes *Scaevola* - *Tournefortia* littoral forest, *Scaevola* and *Tournefortia* scrublands, *Heliotropium-Portulaca-Sida* herblands, and mixed herblands. Some of these are also important nesting sites for some of the same species, including the great frigatebird (*Fregata minor*)(**te eitei**), the lesser frigatebird (*Fregata ariel*)(**te eitei**), the masked booby (*Sula dactylatra*)(**te mouakena**), and the red-footed booby (*Sula sula*)(**te kota**), which nest in *Tournefortia* and *Scaevola* scrub in areas south of Y Site, and the blue-grey noddy (*Procelsterna cerulea*)(**te raurau**), which nests in the natural camouflage of the *Heliotropium-Portulaca-Sida* herblands on Cook Islet and Motu Tabu.

5.7.7 Coconut Plantations and Village Gardens

Although the main opportunities for export income and the generation of foreign exchange in Kiritimati are related to the exploitation of marine resources, ecotourism and large-scale developments such as the proposed NASDA Hope-X Landing Site, coconut plantations and the trees and plants that people cultivate and protect in villages and their houseyard gardens provide for many cash and subsistence needs. They must be seen as a basis, perhaps a foundation, for sustainable living in the dry atoll environment of Kiritimati. Their protection, maintenance and the encouragement of further planting must be seen as a priority for any further resettlement of major development.

The coconut palm remains the "tree of life" to the I-Kiribati, and copra remains the main source of livelihood for many people on Kiritimati. The income received is not great, but does provide limited cash income needed to purchase some necessities from the outside cash economy. Along with fish, coconut constitutes the main, locally available staple food (i.e., a food that supplies the majority of the calories in the diet). It is also the source of toddy (both sweet and fermented, made from the sap of the coconut flower spathe), fuel, medicine, thatch, timber, oil and a wide array of other products of economic and cultural value.

The village and houseyard gardens also contain a range of important food trees and crops and other culturally and ecologically valuable plants, most of which have been introduced to Kiritimati from the wetter Line Islands, Teraina (Washington Island) and Tabuaeran (Fanning Island), the main Gilbert Group, or even Hawai'i. Important trees in village gardens include coconut palms, **te ni** (*Cocos nucifera*), edible pandanus, **te kaina** (*Pandanus tectorius*), breadfruit, **te mai** (*Artocarpus altilis* and *A. mariannensis*), tropical almond, **te kunikun** (*Terminalia*

catappa), native fig, **te bero** (*Ficus tinctoria*), **te itai** (*Calophyllum inophyllum*), **te kanawa** (*Cordia subcordata*), **te uri** (*Guettarda speciosa*), **te non** (*Morinda citrifolia*), **te kiaiai** (*Hibiscus tiliaceus*), plus frangipani, **te meria** (*Plumeria* spp.), sebesten plum (*Cordia sebestina*), hibiscus, **te roti** (*Hibiscus rosa-sinensis*), lantana, **te kaiboia** (*Lantana camara*), hedge panax, **te toara** (*Polyscias* spp.) and a small range of other ornamentals.

There has also been the active official promotion of the establishment of small houseyard vegetable gardens. The main plants found in these gardens include Chinese cabbage, pumpkins, amaranth spinach (*Amaranthus* spp.), hibiscus spinach (*Abelmoschus manihot*), chili peppers, tomatoes, egg plants, rock melon, cucumbers, sweet potato, cassava, rock melon or cantaloupe, papaya and the drumstick or horseradish tree (*Moringa oleifera*).

Almost all of the plants in villages and houseyard gardens are culturally and economically very important for making habitation possible on Kiritimati. The increased planting of trees, a wide range of other plants, and the maintenance of small food gardens should be an integral component of all development programs on the island, including the proposed NASDA Hope-X Landing Site development.

5.7.8 Hypersaline Ponds

The hundreds of landlocked hypersaline, algae-rich ponds, concentrated to the east of the central lagoon and in the southeast of the island, are the main breeding grounds of, and fishing grounds for, the economically, culturally and nutritionally important milkfish (*Chanos chanos*)(**te baneawa**). Milkfish constitute a very important, readily available, commercially harvestable, staple food and protein source that can be produced on a sustainable basis. These algae-rich ponds, many of which are controlled and harvested by specific people, should also be protected and seen as a very important basis for production of milkfish, some of which is sun-dried and exported to Tarawa and Hawai'i as a "cottage industry".

The introduced tilapia (*Oreochromis mossambica*) is reportedly present in many of the saline ponds and having a negative effect on milkfish production. Attempts should be made to control or eradicate tilapia, unless it is considered to be a potential food resource. Further information is required to determine the relationship between the two species and actions that could be taken to address the problem.

5.7.9 Inner Lagoon

The inner parts of the main lagoon are the main fishing grounds for the world renowned bonefish, **te ikarii** (*Albula glossodonta*). Catch-and-release (no-kill) bonefishing is a very important seasonal economic activity which attracts a considerable number of tourist flyfishermen to the island. These fishermen stay almost exclusively at the Captain Cook Hotel, and hire the services of a considerable number of guides, boatmen and other support personnel. It would not be an overstatement to say that bonefishing has put Kiritimati on the game fisherman's map. Its natural history, behaviour and fighting "spirit" make it a desirable target for game fishermen around the

world. Milkfish are also common in the inner lagoon, as some other species discussed below that are found in the central and outer reaches of the main lagoon.

5.7.10 Main Lagoon

The main tidal lagoon has an estimated area of about 160 km². It opens to the ocean on the west and contains inlets, bays and interconnected saline ponds to the east and southeast. Cook Islet, a figure-8 shaped islet, about 1.2 km long, lies almost equidistant between the two points that form the passage or "mouth" of the lagoon. From Paris Point in the south to London Point in the north the passage to the lagoon is almost 6 km wide which is sufficient to allow adequate circulation of seawater and the migration of biota between the inner lagoon and the open ocean area beyond Cook Islet. The health of the lagoon will depend on keeping this passage free from any development that could interrupt the circulation of sea water through the pass and in the lagoon.

Reconnaissance surveys indicate that the fisheries resources are considerable and include the highly sought-after bonefish, and range of trevally species (Carangidae) and many other finfish of considerable subsistence and economic importance.

5.7.11 Fringing Reefs, Reef flats and Associated Communities

The entire perimeter of Kiritimati, both leeward and windward, is surrounded by coastal reef formations. Where surf and current conditions are more turbulent the corals are deeper and less exposed, such as in the Bay of Wrecks area to the east of the atoll. In other areas, such as near Poland or off Cook Islet, the fringing reef formation is more extensive with substantial intertidal, subtidal, neritic and benthic communities represented.

A two-hour reef snorkel taken near Poland on the leeward coast indicated that many of these area remained relatively unexploited. Judging by the population densities of the giant clam species, *Tridacna maxima* and *T. squamosa*, of approximately 15 per 1.5 m in diameter *Porites* coral heads, and up to 100 per 5m x 5m quadrant, the reefs remain healthy and rarely gleaned for food. The variety and number of fish, including two species of shark, indicate that spear fishing effort is not yet excessive. These area, thus, and offer great potential for recreational snorkelling and SCUBA diving and considerable potential for controlled subsistence use of these resources (see section 5.10 below for a more detailed description of marine species).

5.7.12 Offshore and Deep Reefs

Coral formations associated with deeper water are usually larger and can be more ecologically fragile than inshore areas as they are less subject to intertidal fluctuations, wind associated forces and wave action. Such areas provide habitat for a variety of marine organisms, such as deepwater snapper, that are the focal point for pelagic fish of large size.

These areas are of significant economic importance for edible and collectible commercial fisheries both of which occur in Kiritimati. It has been reported that foreign licences and unlicensed fishermen are currently overexploiting stocks of some fish species associated with deep reefs. There is also concern over damage to reefs and danger to human health (i.e., health of scuba divers) due to the rapid expansion of the export of marine aquarium fish.

5.7.13 Ocean and Pelagic Area

The deeper ocean surrounding Kiritimati teems with pelagic fish species and a range of deepwater snapper species on the deep reefs and on sea mounts in the area. Tuna, mainly skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*) are the species in greatest abundance and the main target species for both local offshore fishermen and foreign commercial vessels fishing in Kiribati's EEZ. A range of trevallies (family Carangidae) are also found in this zone and constitute an important target species for fishing sport fishermen. The amberjack (*Seriola rivoliana*), dogtooth tuna (*Gymnosarda unicolor*), wahoo (*Acanthocybium solandri*) and the rainbow runner (*Elagatis bipinnulata*) are also present.

Pelagic sharks, which were formerly abundant, have been seriously overfished by foreign fishing vessels and are now considered to be uncommon or endangered. They now represent only about 2 to 3% of current catches

Deepwater demersal species include eteline snappers (*Pristipomoides filamentosus* and *P. zonatus*), Lutjanid snappers (*Lutjanus* spp.) and Serranids (mainly *Epinephelus areolatus* and *E. morrhua*).

Thought must be given to a systematised method of licensing and control before commercial species become overharvested.

5.8 Flora

The flora of Kiritimati, including both the indigenous and introduced floras, is extremely limited due to the island's extreme isolation, low rainfall, frequent prolonged droughts, and its extremely poor soils. There has also been serious human disturbance due to over one hundred years of coconut plantation agriculture, occupation of the island for nuclear testing by the British and Americans in the 1950s and 1960s, and the resettlement of the island by I-Kiribati from the more populous islands of the main Gilbert group of Kiribati. The following analysis is based on surveys by Thaman in 1996, a reconnaissance survey by Hassall in 1995, and a listing of species reported present in the past on Kiritimati and the Northern Line Islands by Wester (1985).

The current flora seems to consist of about 104 species, of which only 22 seem to be indigenous. There are no indigenous or introduced ferns or gymnosperms present on the island, although a number of ferns are found on other wetter atolls in both the wetter Line Islands and the Gilbert group.

5.8.1 Indigenous Flora

There are only 22 monocotyledons, 7 of which might be indigenous. The only indigenous monocotyledons seem to be grasses and sedges, and possibly the coconut (*Cocos nucifera*) and pandanus (*Pandanus tectorius*), although some of these may have also been introduced by humans. The indigenous grasses include *Digitaria pacifica*, *Eragrostis whitneyi* and *Lepturus repens*. The indigenous sedges are *Fimbristylis atollensis* and *Mariscus javanicus*. Common non-indigenous species include the grasses, *Cenchrus echinitus*, *Chloris inflata*, *Eleusine indica* and *Eragrostis tenella*, and the sedges, *Cyperus compressus* and *Cyperus rotundus*. Other introduced monocotyledons include the food plants, giant swamp taro or **te babai** (*Cyrtosperma chamissonis*), bananas or **te banana** (*Musa* cultivars) and sugarcane or **te kaitioka** (*Saccharum officinarum*); the ornamentals, *Crimum asiaticum* and *Zephyranthes grandiflora*; and *Agave sisalana*.

Of about 82 dicotyledons present on Kiritimati, only 15 are possibly indigenous. The most common indigenous species include *Scaevola taccada* (**te mao**) and *Tournefortia argentea* (**te ren**), which are dominant in most coastal sites and in many inland areas; *Suriana maritima* (**te aroua**), which is particularly common in calcareous hardpan sites and on beaches on lagoon islets; *Sida fallax* (**te kaura**), *Boerhavia repens* (**te wao**), *Portulaca lutea* (**te boi**), *Tribulus cistoides* (**te maukinikin**), *Hedyotis romanzoffiensis* and *Heliotropium anomalum*, which dominate herbland sites; the epiphytes, *Cassytha filiformis* (**te ntanini**), which is commonly festooned over other vegetation throughout the island, and *Cuscuta campestris*, which is locally common in the southeast of the island; and, the sea-bird dispersed *Pisonia grandis* (**te buka**) which is found in three isolated stands, one on Motu Tabu, a small stand inland from the NASDA installation near Northwest Point, and one near K Site on the southeast peninsula. *Cordia subcordata* (**te kanawa**) is also possibly indigenous, and found in a few possibly natural coastal locations in the northern part of the island.

Widespread coastal strand plants that are indigenous to other wetter islands in the Line Islands, Teraina (Washington) and Tabuaeran (Fanning) and to islands of the Gilbert group, which have reportedly been introduced by humans to Kiritimati from these islands, include: the prostrate herb, *Triumfetta procumbens* (**te kiaou**) (an important I-Kiribati medicinal plant); the vines, *Ipomoea macrantha* (**te ruku**) and *Vigna marina* (**te kitoko**); the shrubby climber, *Clerodendrum inerme* (**te inato**); and the trees, *Calophyllum inophyllum* (**te itai**), *Guetarda speciosa* (**te uri**), *Hibiscus tiliaceus* (**te kiaiai**), *Morinda citrifolia* (**te non**), *Premna serratifolia* (**te ango**), *Terminalia catappa* (**te kunikun**) and *Terminalia littoralis* (**te ukin**). All of these, plus some of the possibly native species, such as *Cocos nucifera*, *Cordia subcordata* and *Pandanus tectorius*, are found cultivated in houseyard and village gardens, and, in the case of the coconut palms, in extensive monocultural plantations throughout the island.

5.8.2 Introduced Flora

Common introduced exotic dicotyledons include the food plants, ornamentals, a narrow range of other useful plants, and weedy species.

Common food plants include breadfruit (**te mai**, *Artocarpus altilis*), papaya (**te babaia**, **te mwemweara**, *Carica papaya*), native fig (**te bero**, *Ficus tinctoria*), lime (**te raim**, *Citrus aurantifolia*), sweet potato (**te kumara**, *Ipomoea batatas*), hibiscus spinach (**te nambere**, *Abelmoschus manihot*), Chinese cabbage (**te kabiti n Tiana**, *Brassica chinensis*, but mainly the "Saladeer" hybrid, *Brassica* x "Saladeer"), and pumpkin (**te baukin** or **te bamakin**, *Cucurbita pepo*). Less common food plants found in houseyard gardens, and in the small fenced food gardens promoted by the local health authorities, include amaranth spinach (**te moota**, *Amaranthus* spp.), sweet capsicum (**te beba**, *Capsicum annuum* var. *grossum*), perennial chili peppers (**te beneka**, *Capsicum frutescens*), cantaloupe (**te meren**, *Cucumis melo* var. *cantalupensis*), cucumber (*Cucumis sativus*), bottle gourd (*Lagenaria siceraria*), watermelon (*Citrullus lanatus*), bitter gourd (*Mormordica charantia*), sweet basil, **te merou** (*Ocimum basilicum*), eggplant or **te baigan** (*Solanum melongena*) and the horseradish or drumstick tree (**te taram**) (*Moringa oleifera*).

The useful trees, casuarina, **te burukam** ("blue gum") (*Casuarina equisetifolia*) and leucaena, **te kaitetua** ("the government tree") (*Leucaena leucocephala*) are both present, the first being well established and common in settlements.

Common ornamental trees or shrubs that seem to do well in the harsh Kiritimati atoll environment include frangipani, **te meria** (*Plumeria obtusa* and *Plumeria rubra*), yellow bells, **neikarairai** (*Tecoma stans*), false eranthemum (**te iaro**, *Pseuderanthemum carruthersii*), and bougainvillea (**te akanta**, *Bougainvillea* spp.), hedge panax (**te toara**, *Polyscias gulifoylei*), common hibiscus (**te roti**, *Hibiscus rosa-sinensis*) and lantana (**te kaibuaka**, *Lantana camara*), oleander (**te orian**, *Nerium oleander*) and the geiger tree (**te kanawa ni Imatang**, *Cordia sebestena*). Other less common ornamentals include Tahitian gardenia (**te tiare**, *Gardenia taitensis*), ixora (**te katuru** or **te katiru**, *Ixora casei*), four o'clock or the marvel of Peru (**te awa owa**, *Mirabilis jalapa*), slipper flower or red-bird cactus (*Pedilanthus tithymaloides*) and the short-term annuals, marigold (**te merikora**, *Tagetes erecta*) and zinnia (**te tinia**, *Zinnia elegans*). Ornamentals seen only as single specimens included bauhinia (*Bauhinia monandra*), croton (*Codiaeum variegatum*), poinsettia (*Euphorbia pulcherrima*) and the sunflower (*Helianthus annuus*).

Common weedy dicotyledons include the herbaceous spurge, *Chamaesyce* (*Euphorbia*) *prostrata*, *C. hirta* and *C. glomerifera*, iron weed (*Vernonia cinerea*), *Phyllanthus amarus*, pigweed or purselane (*Portulaca oleracea*) and the shrubby Indian and American pluchea (*Pluchea indica* and *P. odorata*). Other less-common species found in a few disturbed habitats include *Cassia occidentalis*, *Passiflora foetida* and *Physalis minima*.

5.8.3 Ecological and Cultural Utility of Flora

Although limited in diversity, the vegetation and flora of Kiritimati constitute a critical ecological and cultural resource. This is particularly true for the species that are indigenous or aboriginal introductions to Kiribati, virtually all of which have wide cultural utility within the subsistence economy and represent non-cash and cash income which cannot be replaced, or which would be extremely expensive to replace, with imported substitutes.

Environmental (ecological) functions that plants provide include shade, animal and plant habitats, soil improvement, material for mulching, land stabilisation, and protection from wind, erosion, flood and saltwater incursion, and the desiccating effects of salt spray.

Shade is important to humans, plants, and animals, especially in highly reflective low-lying coral island and lagoonal environments, and in villages and urban areas. As populations increase, and as the breakdown in the ozone layer exposes the Earth to higher levels of damaging ultraviolet radiation, shade and the role that trees and other coastal plants play as habitats for other animal and plant species will become more important.

Damage from wind, erosion, and flood increase when forests are removed; and coastal strand forests stabilise tidal-zone soils and reduce the impact of storm surge and ocean salt spray. This will be particularly important given the predicted sea-level rises resulting from global warming, to which atolls will be extremely vulnerable. The role of coastal plants in soil stabilisation is critical to the success of land reclamation and other low-cost coastal engineering works. Species used for land reclamation in various areas of Asia and the Pacific have included *Calophyllum inophyllum*, *Casuarina equisetifolia*, *Cocos micifera*, *Hibiscus tiliaceus*, *Scaevola taccada*, *Terminalia catappa* and *Tournefortia argentea*, all of which are present in Kiritimati.

The improvement of soil by the provision of organic material is another significant contribution that atoll vegetation makes to the success of agriculture in the nutritionally poor and highly permeable coastal soils. Organic material increases the soil's waterholding capacity, reduces soil pH to more favourable levels at which minerals become more available to plants. Organic matter also reduces runoff, water and wind erosion and water loss to evaporation. The I-Kiribati have evolved sophisticated systems of fertilisation and mulching using the leaves of coastal plants. The leaves of *Guettarda speciosa* (**te uri**), *Tournefortia argentea* (**te ren**) and *Sida fallax* (**te kaura**) are placed in pandanus baskets, along with other leaves and topsoil, as part of an elaborate mulching system for giant swamp taro, pandanus and breadfruit. *Sida fallax*, which is very abundant on Kiritimati, is considered to be such a strong fertiliser that it is only occasionally added fresh to the soil for fear of injuring plants.

Atoll plants possess great cultural utility, being used for medicine, general construction, body ornamentation, fuelwood, ceremony and ritual, cultivated or ornamental plants, toolmaking, food, boat or canoe making, dyes or pigments, magic and sorcery, fishing equipment, cordage and fibre, games or toys, perfumes and scenting coconut oil, fertiliser and mulching, woodcarving, weapons or traps, food parcelisation, subjects of legends, mythology, songs, riddles, and proverbs, domesticated and wild animal feed, handicrafts, cooking equipment, clothing, fish poisons, items for export of local sale, adhesives or caulking, and musical instruments. A recent study of the utility of atoll and coastal plants in the Pacific Islands shows the coconut to have the greatest number of uses — as many as 125 if distinct uses within categories (e.g., tools with distinct functions) are counted. Next in order of importance, all with 20 or more reported uses, are *Hibiscus tiliaceus*, *Pandanus tectorius*, *Calophyllum inophyllum*, *Cordia subcordata*, *Guettarda speciosa*, *Scaevola taccada*, *Pemphis acidula*, *Thespesia populnea*, *Rhizophora* spp., *Tournefortia argentea*, *Casuarina equisetifolia*, *Premna serratifolia*, *Morinda citrifolia*, *Pipturus argenteus*, *Terminalia catappa*, and *Ficus tinctoria*, all of which are found on Kiritimati, except for *Pemphis*, *Rhizophora* and

Pipturus, which are present in the Gilbert group (Appendix 10). Analyses of available data on Kiribati indicate 170 uses for 29 indigenous species and 104 uses for 39 exotic species. This gives a total 274 uses for 68 species, a clear indication of the cultural utility of plants in Kiribati.

Particularly important are the traditional food and beverage crops, the replacement of which by imported foods such as sugar, white rice and flour, cabin biscuits, noodles, canned fish, softdrinks, alcohol and tea, has led to dangerous levels of food dependency and some of the highest, or most rapidly increasing, incidences in the world of vitamin and mineral deficiency and nutrition related diseases. Diseases such as iron-deficiency anaemia, night blindness induced by vitamin-A deficiency, diabetes, cardiovascular disease, hypertension and stroke, gout and hyperuricemia, some forms of cancer and dental disease, which were rarely encountered in the past are now serious causes of morbidity and mortality in Kiribati, and among other atoll populations.

Because the vegetation and flora of Kiritimati still provide a strategic ecological and cultural resource for sustainable development, there is a need for planners and national development plans in Kiribati to place a high priority on vegetation protection. This will be one of the main objectives of the KACAP.

5.9 Terrestrial Fauna

The diversity of terrestrial animals in the Pacific generally decreases from west to east, from New Guinea, where the fauna is among the richest in the world, with a very high rates of endemism (uniqueness), to the atolls of the eastern Pacific where the fauna is very poor (has few species). For example, Kiribati's native terrestrial fauna consists of only one reported endemic terrestrial vertebrate, the Line Islands reed warbler (*Acrocephalus aequinoctialis*), which is found on Kiritimati, and probably no indigenous mammals. Papua New Guinea, in stark contrast, has about 100 species of mammals (mostly marsupials), 70 species of snakes, crocodiles, over 65 species of birds, and a very rich insect fauna, which includes some of the rarest and largest moths and butterflies, and the dreaded malaria vector, the *Anopheles* mosquito, which is fortunately absent from Kiribati. Even though conservation initiatives target areas such as Papua New Guinea with their great biodiversity and very high degree of endemism (high proportion of unique species), the endangerment of many of the few species that Kiribati has may suggest that biodiversity conservation, if we are really worried about conservation by and for people, is of much higher priority in places like Kiribati.

The main indigenous land animals consisting of birds, insects and some land crabs. With the exception of a few land birds, most birds are either sea birds or migratory species, with the lagoonal and pelagic environments of Kiritimati supporting one of the riches of marine avifaunas in the world.

Surveys carried out by the Smithsonian Institution Pacific Ocean Biological Survey Program in the 1960s and early 1970s indicated that the expanse of ocean encompassing the Line and Phoenix Islands form one of the world's largest marine avifauna flyways. Species include migratory species that use the north-south oriented island chains to stop and feed as well as those species that find the isolated atolls habitats ideal for breeding and nesting. Kiritimati Island, itself,

has one of the largest resident populations of Pacific marine avifauna in the world. Eighteen species of seabirds and at least one land bird breed on Kiritimati (Table 2 and Appendix 4). At peak breeding times, numbers are estimated to be over 6 million birds. This represents, possibly, the highest seabird species diversity and largest bird populations for any oceanic island in the world. Nesting areas cover many sites on the main land mass, interconnected land areas between the landlocked hypersaline lakes and inner lagoons, the smaller lagoon islets, and the three major islets of the central lagoon, Motu Upua, Motu Tabu and Cook Island (Islet).

Between the two islets of Motu Tabu and Cook Island (where the focus of the ornithological investigation was undertaken during the PPD consultancy, eleven species of the eighteen recorded by Schreiber and Ashmole (1971) were observed in egg-downy chick, downy chick, or fledgling (varying degrees of adult plumage) stages (see Appendix 4). In addition another five of the original list were also observed in varying numbers. Only the Audobon's shearwater, **te nna** (*Puffinus ilherminieri*) and the whitethroated storm petrel, **te bwebwenimarawa** (*Nesofregatta albigularis*) were not seen. This could be explained because the survey took place at very early stages in their breeding (nesting cycles); because they are not reported to be as abundant when nesting; or because of their relatively secretive behaviour patterns.

Although Kiritimati provides nesting, roosting, feeding, wintering and transit sites for over 40 bird species (Table 2; Appendix 4), it is the eighteen breeding/nesting species that contribute significantly to its uniqueness and, ironically, also to its vulnerability and fragility.

The rich avifauna constitutes an important resource both to the people of Kiribati and to the world and should be protected because of its important role in the oceanic ecosystem. Although no reserves exist in the Gilbert Islands, numerous reserves and wildlife sanctuaries have been established in the Line and Phoenix Islands. The consolidation and improvement of these reserves and increased community involvement in their maintenance and protection and the long-term benefits that local communities could gain from the reserves are major objectives of the KACAP.

The insect fauna constitutes the majority of the terrestrial animal species found on atolls. Many are important to the functioning of atoll ecosystems, whereas others such as mosquitos and flies, which spread disease, and cockroaches, are noxious pests. The *Papuana* taro beetle, which seriously affects the production of *Cyrtosperma* and *Colocasia* taros and bananas (*Musa* cultivars) is considered a major constraint to sustainable agricultural production. It is currently restricted to South Tarawa. A major concern within the proposed KACA is the maintenance of effective quarantine measures to keep Kiritimati Atoll free of this serious pest. The "toddy beetle" (*Sessinia livida*), which contaminates and consumes toddy when it is found in large numbers, is another significant pest.

Table 2. Indigenous bird species of Kiribati

(R = resident all year, but not necessarily breeding; M = migratory breeder, which breeds at the locality, but departs for the rest of the year; V = includes passage migrants as well as vagrants; W = winter resident; resident during the non-breeding season, from the bird's perspective, e.g. some species visit during the austral winter and some during the northern hemisphere winter; X = extinct; ? = unconfirmed record).

Common Name	Kiribati Name	Latin Name	Status
Line Islands reed warbler	te bokikokiko	<i>Acrocephalus aequinoctialis</i>	R
northern pintail	-	<i>Anas acuta</i>	V
northern shoveler	-	<i>Anas clypeata</i>	V
?green-winged teal	-	<i>Anas crecca</i>	V
mallard	-	<i>Anas platyrhynchos</i>	V
?gadwall	-	<i>Anas strepera</i>	X
black noddy	te mangkiri	<i>Anous minutus</i>	R
brown noddy	te lo	<i>Anous stolidus</i>	R
ruddy turnstone	te kitiba	<i>Arenaria interpres</i>	W
greater scaup	-	<i>Aythya marila</i>	V
cattle egret	-	<i>Bubulcus ibis</i>	V
sharp-tailed sandpiper	-	<i>Calidris acuminata</i>	V
sanderling	-	<i>Calidris alba</i>	W
willet	-	<i>Catoptrophorus semipalmatus</i>	V
Pacific reef heron	te kaai	<i>Egretta sacra</i>	M
lesser frigatebird	te eitei	<i>Fregata ariel</i>	R
great frigatebird	te eitei	<i>Fregata minor</i>	R
common fairy tern	te matawa	<i>Gygis alba</i>	R
wandering tattler	te kiriri	<i>Heteroscelus incanus</i>	W
laughing gull	-	<i>Larus atricilla</i>	V
ring-billed gull	-	<i>Larus delawarensis</i>	V
Franklin's gull	-	<i>Larus pipixcan</i>	V
white-throated storm petrel	te bwebwenimarawa	<i>Nesofregatta albigularis</i>	R
bristle-thighed curlew	te kewe	<i>Numenius tahitiensis</i>	W
?white-tailed tropic bird	-	<i>Phaethon lepturus</i>	R
red-tailed tropic bird	te taake	<i>Phaethon rubricauda</i>	R
lesser golden plover	te kun	<i>Pluvialis dominica</i>	W
blue-gray noddy	te raurau	<i>Procelsterna cerulea</i>	R
Phoenix petrel	te ruru	<i>Pterodroma alba</i>	R
?white-naped petrel	-	<i>Pterodroma cervicalis</i>	V
Audubon's shearwater	te nna	<i>Puffinus lherminieri</i>	M
Christmas shearwater	te tinebu	<i>Puffinus nativitatis</i>	R
wedge-tailed shearwater	te tanguiuoua	<i>Puffinus pacificus</i>	M
masked booby	te mouakena	<i>Sula dactylatra</i>	R
brown booby	te kibui	<i>Sula leucogaster</i>	R
red-footed bobby	te kota	<i>Sula sula</i>	R
great crested tern	te karakara	<i>Sterna bergii</i>	R

sooty tern	te keeu	<i>Sterna fuscata</i>	R
gray-backed tern	te taraongo	<i>Sterna lunata</i>	R
black-naped tern	te kiakia	<i>Sterna sumatrana</i>	V
scarlet-breasted lorikeet	te kura	<i>Vini kuhlii</i>	V

Source: Adapted from Pratt *et al.*, 1987; Perry and Garnett n.d.

5.10 Marine Resources

The atolls are not as impoverished in marine fauna, although there is still a decreasing abundance of species with distance from Papua New Guinea, where there are about 600 species of finfish, compared with Kiribati's estimated 300 to 400 species. Industrial fisheries make an important contribution to the national economy and small-scale fisheries are an important source of cash income and have important nutritional and social roles to play in sustainable development.

In terms of subsistence, the sea provides virtually all the animal protein in the diet, with terrestrial resources (seabirds, bird eggs, and pigs and chickens) constituting a minor part of the diet. Virtually all non-toxic finfish species over a few centimetres in length and many shellfish and other non-fish marine organisms are eaten, and various shells, teeth and other hard parts are used for handicrafts or other purposes. Because of the limited terrestrial protein and carbohydrate resources, fish consumption in Kiribati is among the highest in the world, with an estimated average consumption of 565 g/capita/day on rural atolls, thus satisfying both the minimum daily protein requirements and much of the daily energy requirements.

The main categories of fisheries resources in Kiribati include: 1) the lagoonal and reef, or "inshore" fishery; 2) the "offshore" fishery, which includes both the pelagic and near-shore deep water fisheries; and 3) mariculture or aquaculture of finfish and seaweed.

The main categories of lagoonal and reef resources include: 1) a wide range of finfish; and 2) a range of marine non-fish resources, including turtles, crustaceans, shellfish, holothurians (beche-de-mer), sipunculid sea worms and jellyfish; and 3) marine algae and seagrass. Kiribati's EEZ of over 3.55 million km² has considerable potential for pelagic fisheries development of tuna and flyingfish, game fishing, and, to a lesser extent, for the increased exploitation of deepwater bottomfish, sharks and harvesting of deepwater corals.

The main traditional fishing methods consist of: 1) reef gleaning at low tide in the intertidal zone; 2) poling and trolling for small surf and schooling tunas using pearl-shell lures; 3) the use of gill nets and encircling nets for catching bonefish, mullet, milkfish, etc.; 4) handlining for reef and lagoon fish (rarely at depths greater than 50 m); 5) underwater spearfishing; 6) scoopnetting for flying fish at night by the light of storm lanterns; and, 7) deepwater handlining, primarily for oilfish, which is also carried out at night in depths of up to 150 m. Within these categories fishermen have developed many specialised techniques involving different types of nets, hooks and lines, baits, lures, spears, nooses, traps and fences, poisons and gleaning strategies.

On most outer islands, fishing is carried out from traditional sailing or, more rarely, paddling canoes. In some areas, particularly in South Tarawa, these have been replaced by outboard-powered craft. In Kiritimati Atoll, both motorised and non-motorised fishing craft are important. More modern methods include improved tackle, boats, nets and ice boxes used by local artisanal fishermen, and the increasing use of improved deepwater handreels for commercial deepwater snapper and shark fishing. Particularly concerning is the use of **orooro** fishing where crow bars are used to beat the water to scare fish, particularly bonefish into gillnets, the use of up to 2 to 5 km long-lines for shark and tuna fishing within Tarawa Lagoon, and the limited use of scuba or hookah gear to collect beche-de-mer or aquarium or pet fish for export.

5.10.1 Finfish Resources

The more important finfish species for subsistence and local sale in Kiribati include: 1) a wide range of shallow-water snapper, rockcod, grouper, or coral trout species (*Cephalopholis*, *Epinephelus* and *Lutjanus* spp.); 2) emperors or breams (*Lethrinus* spp.); 3) goatfish (*Mulloidichthys*, *Parupeneus* and *Upeneus* spp.); 4) mullets (*Liza* spp. and *Valamulgil seheli*); 5) milkfish (*Chanos chanos*), 6) trevally or jacks (*Caranx*, *Carangoides* and *Seriola* spp.); 7) bonefish (*Albula glossodonta*); 8) small herrings, sardines, sprats and their relatives (*Dussumieria*, *Herclotsichthys*, *Sardinella*, *Spratelloides* and *Rhabdamia* spp.); and the larger deepwater or pelagic species including: 9) tunas (see below); 10) a wide range of sharks (*Aprionodon*, *Carcharhinus*, *Galeocerdo*, *Ginglymostoma*, *Mustelus*, *Negaprion*, *Odontaspis*, *Sphyrna*, *Squalus* and *Triaenodon* spp.); 11) barracudas and seapikes (*Sphyrna* spp.); 12) billfish (*Istophorus platypterus* and *Makaira* spp.) and, 13) flying fish (*Cheilopogon* and *Cypselurus* spp.). These species comprise the bulk of the subsistence and artisanal catch on most islands in Kiribati, with tunas, sharks, flying fish and billfish being of particular importance on those islands such as Arorae and Tamana, which have no lagoons, and from which sharkfin is the only fisheries export.

Other important species or groups of species include: parrotfish (*Scarus* spp.), rabbitfish or spinefoot (*Siganus* spp.), surgeonfish (*Acanthurus* spp.), squirrelfish or soldierfish (*Adioryx*, *Holocentrus* and *Myripristis* spp.), stingrays (*Aetobatus narinari* and *Himantura* and *Taeniura* spp.), wrasses (*Cheilinus* and *Cymolutes* spp.), silver biddy (*Gerres* spp.), moray eel (*Gymnothorax flavimarginatus*) and a range of other eels, barred garfish (*Hyporhamphus dussumieri*), topsail drummer (*Khyphosus* spp.), ponyfish (*Leiognathus* spp.), unicornfish (*Naso unicornis*), pufferfish (*Diodon* and *Arothron* spp.), oilfish (*Ruvettus pretiosus*) and longtom (*Tylosurus crocodilus*), all of which are important food fish.

The pelagic species of increasing industrial, export or local commercial in Kiribati importance include: the tuna species, skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and dogtooth tuna (*Gymnosarda unicolor*); the tuna-like species (also members of family Scombridae), bigeye scad (*Selar crumenophthalmus*), queenfish (*Scomberoides* spp.); and a number of other species including rainbow runner (*Elagatis bipinnulatus*), wahoo (*Acanthocybium solandri*), and dolphin fish or mahimahi (*Coryphaena hippurus*). Skipjack stocks seem to be sufficient to sustain both a substantial commercial fishery and the existing subsistence and artisanal fisheries. Shark fishing is also of increasing importance, and in danger of overfishing, given the high demand for shark fin from Chinese traders.

Deepsea bottomfish (demersal) species of increasing commercial importance in Kiribati include jobfish (*Aphareus* spp.) and the deepsea snappers (*Aprion*, *Etelis*, *Gnathodentex*, *Paracaesio*, *Pristipomoides* and *Tropidimus* spp.).

Species reportedly found in "good abundance" in Kiritimati include soldierfish (*Myripristis* spp.), squirrelfish (*Neoniphon* and *Sargocentron* spp.), flametail and humback snappers (*Lutjanus fulvus* and *L. gibbus*), yellowfin goatfish (*Mulloidichthys vanicolensis*), queenfish (*Scomberoides lysan*) and great trevally (*Caranx ignobilis*). Those reportedly in medium abundance are black-tip reef shark (*Carcharhinus melanopterus*), dusky trevally (*Caranx sexifasciatus*), yellow-saddle goatfish (*Parupeneus cyclostomus*), parrotfish (*Scarus* spp.), surgeonfish (*Acanthurus* spp.) and mullet (*Liza* and *Valamugil*).

Of recent importance are a range of small reef species currently exported for the tropical aquarium fish trade. The most important species are the flame angelfish (*Centropyge loriculus*) and two deepwater butterflyfish (*Chaetodon declivis wilderi* and *Chaetodon griffithii*, which are found at 100 to 250 feet deep) which are worth from US\$50-150 apiece on the open market, some 10-15 times the price paid to local suppliers). Other species exported include the lemon-peel angelfish (*Centropyge flavissimus*), the bicolor angelfish (*Centropyge bicolor*), the gold-flecked angelfish (*Apothemichthys xanthopunctatus*), the emperor angelfish (*Pomacanthus imperator*), the racoon butterflyfish (*Chaetodon humila*), the blue surgeonfish (*Paracanthurus hepatus*), the blue-banded or clown surgeonfish (*Acanthurus lineatus*), the wedge picassofish or humuhumu (*Rhinocanthus rectangulus*) and the fairy basslet (*Pseudanthias* sp.) (Anderson 1996; Habib 1993).

Deepwater species reported to be common in the Line Islands include yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and skipjack (*Katsuwonus pelamis*); billfish, including black marlin (*Makaira indica*), blue marlin (*Makaira nigricans*), striped marlin (*Tetrapturus audax*), swordfish (*Xiphias gladius*) and sailfish (*Istiophorus platypterus*); and a range of sharks. All of these species have been the target of Japanese, Taiwanese and Korean longline vessels fishing in the waters of the Line Islands over the past 35 years or more, although fishing effort and catches have been reduced substantially since the late 1970s due to the Kiribati's declaration of sovereignty over its 200-mile EEZ. Wahoo (*Acanthocybium solandri*) is also very common and the main species exported by Kiritimati Marine Exports Ltd. (Habib 1993).

5.10.2 Non-fish Resources

Marine non-fish species of considerable importance in Kiribati include: turtles; a wide range of crabs, shrimps, prawns, lobsters and other crustaceans; shellfish, including both bivalves and gastropods; holothurians or beche-de-mer; and a number of other marine organisms.

Occurring on the reefs and on lagoon floor of Kiritimati are a range of commercially important beche-de-mer species. These include lollyfish (*Halodeima atra*), sandfish (*Holothuria scabra*), prickly fish (*Thelanota ananas*), black teatfish (*Microthele nobilis*), blackfish (*Actinopyga miliaris*), white teatfish (*Microthele nobilis*), chalkyfish (*Bahadschia marmorata*) and leopardfish (*Bohadschia argus*) (Habib 1993). Some of these are now being collected and dried for export.

Octopus, giant clams (*Tridacna* spp.) and range of shellfish (e.g. *Turbo*, *Anadara*, *Periglypta*, *Asaphis*) are also present but not exploited to a great extent because of the abundance of finfish. Of the shellfish, the ark shell or **te bun** (*Anadara antiquata*), which is easily collected at low tide in the intertidal zone, is by far the most commonly consumed and marketed marine shellfish and, perhaps, the most commonly consumed marine food species in Kiribati. It is found in abundance on Tarawa, Abaiang, Marakei, Tabiteuea and Nonouti, and is reported to be locally occasional on Kiritimati. Octopus (*Octopus* sp.) is seasonally common on Kiritimati and widely exploited as a seasonally abundant subsistence resource. The black-lipped pearl oyster (*Pinctada margaritifera*) is found in small numbers on the sandy bottoms of the deeper parts of Kiritimati lagoon. The populations are insufficient to support a pearl shell export industry, although there is some long-term potential for the establishment of a pearl culture industry after the re-establishment of wild stocks (Habib 1993).

Both the hawksbill and green turtles (*Eretmochelys imbricata* and *Chelonia mydas*) are present in Kiribati. The green turtle is considered to be endangered, and sea turtles, in general, seem to be scarce as analysis of fisheries catch data for six islands in the Gilbert group recorded no turtle catches. Few sea turtles are seen in the ocean near Kiritimati. Despite international efforts to protect these overexploited and endangered species, both are actively hunted and eaten and the shell used for handicrafts. Turtle eggs are also eaten and considered a delicacy in Kiribati.

Crustacean catches are generally minimal and primarily for subsistence purposes, although lobster (*Panulirus* spp.) and mantis shrimp or **te waro** (*Lysiosquilla maculata*) are caught commercially for local sale or for limited airfreight export to Hawaii. The landcrab, **te manai** (*Cardisoma carniflex*) is extremely abundant on Kiritimati, with attempts to export it to Tarawa having been made in the past.

5.10.3 Seaweed

A range of indigenous marine seaweeds or macro-algae make up an important nutritional and commercial resource in many areas of the Pacific, although few are traditionally eaten in Kiribati. The most important of the indigenous species is sea grapes (*Caulerpa racemosa*), which is very common in Tarawa Lagoon, but which is not eaten. It is an important subsistence food and commercial product for local sale in Fiji. It is probably present in Kiritimati.

One of the main economic developments in Kiribati over the past decade has been maricultural production of echeuma seaweed (*Eucheuma cottonii*, properly *Kappaphycus alvarezii*). The dried seaweed is baled and exported to Europe, where it is refined to extract carrageenan, a commercial name for a class of indigestible polymers containing carbohydrate and sulphate, which are used to thicken or stabilise food and pharmaceutical products. The export is currently controlled by the Betio-based Atoll Seaweed Company, with the total crop originally going to a single buyer in Denmark, although some other shippers are now exporting it to Japan.

Studies indicate that a family farming a 1 ha farm with about 600 lines and 13,230 plants, could realise a yearly income of about \$US 1917 (Casa Tec 1993:59). Based on measurement of

the length of shoreline and the width and total useable area in favoured locations, it has been estimated that a maximum of about 22,000 MT of seaweed could be produced in the Gilbert (Tungaru) Group. Given low labour availability, the realistic maximum production, without the use of outside labour or labour-saving technology, is closer to 4000 MT. The major producers up until 1992, based on 1985-1992 production figures were Abaiang (1578 MT), Abemama (408 MT), Onotoa (201 MT), S. Tarawa (105 MT), N. Tabiteuea (98 MT) and Maiana (8 MT)(Casa Tec 1993:98). In the last two years, Kiritimati, which only entered into production in 1992, recently surpassed Abaiang as the island producing and exporting the most seaweed from Kiribati.

5.10.4 Importance of Marine Resources to Sustainable Development

These diverse marine resources, which have helped sustain the people of Kiribati since their first arrival over three thousand years ago, constitute a renewable subsistence and commercial resource if managed wisely. The potential sustainability of the resource is evidenced by the fact that, despite thousands of years of almost daily "reef gleaning" at low tide for almost anything edible, and of almost any size, it is still possible, even in South Tarawa and other densely populated areas, for poor families to glean their daily protein needs from the intertidal zone and fringing reef areas.

However, the scarcity of certain marine organisms, such as turtles, bonefish (*Albula vulpes*), large reef cods (Serranidae), snappers (Lutjanidae), goat fish (Mullidae) emperors (Lethrinidae), sharks (Charcharinidae) and giant clams (*Tridacna* spp.), and smaller catches and decreasing average size of some species, indicate that some of Kiribati's atolls have been overfished. There is also evidence in Kiritimati Atoll of declining yields of lobster, sharks, billfish and some other species due to local overfishing and overfishing by DWFN long-line vessels.

On Kiritimati, the main fish and marine products exporter is Kiritimati Marine Export Ltd. (KMEL), a limited liability company managed under MLPD. The main species that have been exported over the past six years have been wahoo, yellowfin and other tunas, trevally, milkfish, mullet and lobster (Habib 1993). There are a number of other operators who also periodically export some marine products to Hawaii or South Tarawa. At the time of the PPD study there were also six pet or aquarium fish exporters working on the island, with the possibility of even further expansion in this area. If the problem of the absence of regular flights out of Kiritimati is solved, air export of marine products could increase considerably.

Of great concern is that increasing commercialisation of many species, such as tuna, deepwater snapper, giant clams, beche-de-mer, sharkfin, aquarium fish, some corals and a wide range of other finfish and crustaceans, has put increasing pressure on these resources, thus underlining the need for protective legislation, sustainable production strategies and a "Marine Resources Management Plan.

Fortunately, the conservation ethic remains strong among most of Kiritimati Atoll's communities, where the wide range of conservation practices still in use indicates that I-Kiribati traditionally attempted to manage their marine resources on a sustainable basis. Their management was based on an extensive knowledge of fish, fishing technology, and the sea. Some of the main

mechanisms included secrecy about fishing grounds and techniques, temporary or seasonal taboos or bans on species or fishing grounds, restrictions on the consumption of certain species (e.g., some species such as turtles or giant clams were reserved for chiefs or priests), fines or penalties for resource abuses, and clan tenure or limited access to reef and lagoon areas.

Unfortunately, the principle of limited access and some of the other marine resource management mechanisms are breaking down. The main causes seem to be the amalgamation and relocation of settlements during the colonial period, an imposed belief in open access for marine resources, increased use of motorised boats capable of fishing in the open ocean, and increased emphasis on commercial fishing, modern education and development along Western lines.

6 SETTLEMENT AND ECONOMIC DEVELOPMENT HISTORY

Although Kiritimati was uninhabited when Captain James Cook landed on the island on Christmas Eve 1777, there are stone structures and artefacts from different periods on the island that indicate that it was at least temporarily settled in the past, possibly by Polynesians. The first ship known to have been wrecked there was the *Briton* in 1836.

The island was found to have guano deposits in the 1850s and an American, Captain J. L. Pendleton of the ship *John Marshall* took possession of the island in 1857. The U.S. Guano Company mined guano for several years after November 1858. The island was subsequently leased by the British Government to the Anglo-Australian Phosphate Company and Alfred Houlder, with a representative of the latter finding three men mining phosphate for an Hawaiian interest in 1872. Although the island had been formally possessed by the *USS Narragansett* around the same time, despite a protest, Captain William Wiseman of *HMS Caroline* annexed the island to Great Britain in 1888 (Carter 1984).

The first extensive coconut plantings were made by W. Greig in 1880. In 1902, Lever's Brothers Plantations Ltd. leased the island from the British Government for 99 years and planted it with some 73,000 coconut palms. The lease was taken over by Father Emmanuel Rougier in 1913 and, from 1914, extended the coconut plantations and worked them in the name of Central Pacific Coconut Plantations Ltd. Although the plantation was taken over after his death by his nephew, the island was abandoned during the Great Depression.

With the development of trans-pacific aviation in the 1930s, the island attracted attention as a possible refueling base, although the British prevented American claims to the island by sending representatives there in 1937. During the war the island was garrisoned by both U.S. and New Zealand troops and served as an airbase linking Honolulu with the U.S. base in Bora Bora in French Polynesia. The Americans did not leave until 1948. Meanwhile the Rougier lease lapsed, with the British Gilbert and Ellice Island Colony (GEIC) government taking over the running the island as Christmas Island Plantations (Lawrence 1993).

Although the island had been championed as a site for resettlement by G.E.I.C. Native Lands Commissioner, H. E. Maude, between 1938 and 1946, 36 men and their families from Kuria and Aranuka resettled there in 1949 found it impossible to grow **babai** and breadfruit and demanded repatriation in 1951 (Lawrence 1993).

From 1956 to 1962 Great Britain and the U.S.A. used Kiritimati as a base for nuclear weapons testing. Although the tests were restricted to the Southeast Peninsula, more than 100 km of tar-sealed roads and a high-quality airstrip were developed on the island as a whole.

Since the takeover of the island by the G.E.I.C., Christmas Island Plantations was corporatised as Atoll Plantations Ltd. which suffered financial collapse in 1981. To avoid the repatriation of copra cutters, the Kiribati government established a subsidised Kiritimati Copra Scheme which gave cutter licences which entitled the cutter and his family to residence on the island, a government house and the right to cut copra as long as production conditions were met. The Copra Scheme was abandoned in 1991 after it made substantial losses. The current

system is basically unregulated with copra cutter being allowed to stay in government quarters and anyone allowed to cut copra which is sold to the Copra Society which has buying points at Tabakea and Poland. In theory, civil servants living in Ronton and Banana are not supposed to cut and sell copra (Lawrence 1993).

Brine shrimp culture was attempted unsuccessfully in the 1970s and early 1980s, and a Solar Salt Project started in the late 1980s. Most recently the mariculture of *Echeuma* seaweed for export has proven successful off Ronton and Paris Point, with Kiritimati now the leading producer of seaweed for export to Denmark and Japan. Sportfishing, mainly for bonefish and trevally, and birdwatching are of growing importance, as are scuba diving, and the export of milkfish, aquarium fish and other marine products are also of increasing important, but seriously constrained by extremely irregular and undependable air and sea transport. The Japanese (Nippon) Aeronautics and Space Development Agency (NASDA) has established a tracking station on the north coast, the possibility of establishing a NASDA Hope-X Space vehicle landing site centred on Aeon Field in the southeast of the island is being investigated.

7 POPULATION DISTRIBUTION AND GROWTH

As of the 1990 Census there were 2537 people living on Kiritimati. The current population is estimated to be over 3000, with further increases expected as plans to resettle more people from the main Gilbert group are implemented. The population is comprised almost exclusively of I-Kiribati, with a small minority of persons of Tuvaluan ancestry (most of whom worked on the island when Kiribati and Tuvalu were both part of the British Gilbert and Ellice Island Colony) and other nationalities, some of whom are married to I-Kiribati. In 1990 there were 341 households, averaging 7.4 persons per household. There were 107 males to every 100 females. The population is youthful, with a marked absence of males and females between the ages of 10-19, greater numbers of males between 20-29, and a relative absence of old people compared to the rest of Kiribati. There is thus great inbuilt potential for future population growth and a need to implement family planning programs (AGRIC^o of New Zealand 1993).

Most people live in the four widely separated villages of Ronton (1014), Tabakea (653) and Banana in the north of the island (659) and Poland (211) in the southeast, with a few people living in areas near the Captain Cook Hotel (Main Camp), Crosby Field and the Japanese Nippon Aeronautic and Space Development Agency (NASDA) facility on the north coast of the island. The residents of Ronton and Banana are mainly Government employees and those of Tabakea and Poland, mainly longer-term residents who work as copra producers, although neither category precludes the other. At the 1990 Census, there were 1453 economically active people on Kiritimati, 766 males and 687 females. Of these 541 were engaged in cash employment and 878 in subsistence or village production. About two-third of those engaged in cash employment were employed in the public sector and a third in the private sector. Of the latter the main employers were the Captain Cook Hotel, the Kiritimati Marine Export Company, aquarium fish export companies, and the Kiritimati Cooperative (copra and retail), some of which are quasi-public enterprises (AGRIC^o of New Zealand 1993).

8 INSTITUTIONAL ARRANGEMENTS: ENVIRONMENTAL AND CONSERVATION LEGISLATION, LAND USE POLICIES AND PROGRAMMES

Kiribati does not have a comprehensive national environmental policy, but there are already in place legislation and sectoral policies addressing specific environmental concerns. These need both updating (including, in the case of legislation, amendments to meet current environmental concerns and to relate to relevant international conventions) and integration into a national multisectoral umbrella arrangement encompassing resource and environmental protection and management. In this vein, one of the stated objectives of the 6th and 7th National Development Plan 1987-91 is "sustainable use of resources".

Similarly, the September 1991 "Policy Statement" of the newly created Ministry of Environment and Natural Resources Development stressed the serious concern that the Government, at the time, had over a number of environmental issues. The need to take into account environmental considerations as an integral part of the development process and to promote sustainable development were recognised in the statement.

Acknowledging the need to address environmental issues cross-sectorally, the government established an Environment Unit (EU) within the Ministry of Environment and Natural Resources Development (MENRD); appointed an Environmental Coordinator for the EU; and set up a Kiribati Task Force on the Environment (KTFE).

The EU, now within the new Ministry of Environment and Social Development (MESD), is the prime body responsible for the co-ordination and integration of environmental concerns into development policies and programmes, although many environmental responsibilities are still vested in various government departments, Island and Town Councils. The Unit has been strengthened by the hiring of an Environment Officer, an Environmental Education Officer and a number of other project-related staff. It now also has a SPBCP-funded Conservation Area Support Officer (CASO) who will be responsible for the implementation of the KACAP (see Terms of Reference in Appendix 2). As stressed in the Kiribati NEMS, the operation of the EU is, however, still hampered by inadequate staffing for the size of the task, by a lack of specific scientific and environmental training, and by limited financial support, the result being that it has been re-active rather than pro-active.

The Kiribati Task Force on the Environment (KTFE) was initially set up informally for the sole purpose of preparing the National Report to the United Nations Conference on Environment and Development (UNCED). It has now been established formally to advise on environmental policies. Its composition, with members from all the relevant government agencies, the private sector and NGOs is intended to reflect the cross-sectoral nature of environmental concerns. There have been suggestions that KTFE establish operational sub-committees to focus on each of the main issues or problem areas, e.g., global warming, biodiversity conservation, waste management, etc., and that there be provisions made for greater involvement of the general public in the deliberations of the Task Force.

Most recently a *Kiribati State of the Environment Report* (Wilson 1994) and the *Kiribati National Environmental Management Strategy* (SPREP 1994) have been prepared as guidelines for sustainable development.

8.1 Environmental Legislation

The Constitution of the Republic of Kiribati does not include set clauses relating directly to environment policy, but its preambular declaration that "the natural resources of Kiribati are vested in the people and their Government" can be taken to imply the notion of sustainable resource use.

Existing legislation relevant to specific environmental concerns, such as 1) land or resource use and management and access to terrestrial and marine resources, 2) coastal management and protection, 3) conservation of strategic or endangered marine and terrestrial resources, 4) water, sanitation and environmental health, and 5) control of specific potentially polluting, dangerous or environmentally disruptive substances and materials, are all discussed in the *North Tarawa Conservation Area Project Preparation Document* (Thaman *et al.* 1995). Legislation that can facilitate the activities and objectives of the KACAP include:

1. Public Health Ordinance (1926) to maintain adequate standards of public health.
2. Prohibited Areas Ordinance (1957) to provide for certain islands and their territorial waters to be declared prohibited areas.
3. Importation of Animals Ordinance (1964) to regulate the importation of animals.
4. Foreshore and Land Reclamation Act (1969) to declare the ownership of the foreshore and regulate certain reclamation projects
5. Nuclear Installations (Gilbert and Ellice Islands) Order (1972) to apply provisions of the U.K. Nuclear Installations Act of 1965.
6. Land Planning Ordinance (1973) to provide for the control of the development and use of land.
7. Wildlife Conservation Ordinance (1975) to provide for the conservation of wildlife, in particular birdlife.
8. Merchant Shipping (Oil Pollution)(Gilbert Islands) Order (1975) to apply provisions of the U.K. Merchant Shipping (Oil Pollution) Act of 1971.
9. Plants Ordinance (1976) to provide for the protection of endangered or culturally important plants species within Kiribati.
10. Fisheries Ordinances (1978) to make provisions for the regulations of fishing and fisheries industries and to provide for the protection of specified fish species in Kiribati and within its EEZ.

11. Marine Zones (Declarations) Act (1983) to make provisions in respect of the internal waters, archipelagic waters, the territorial sea, the exclusive economic zone (EEZ) and the contiguous zone of Kiribati.
12. Fisheries (Pacific Island States' Treaty with the United States of America) Act (1988) to give effect to the Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States of America.
13. Quarantine Ordinance (1931) to regulate the importation of agricultural and other products which may harbour pathogens of danger to sustainable development.

In addition, the Local Government Act of 1984, which provides for the establishment of local government through a system of Island Councils, includes, among the Councils' wide-ranging functions, several which relate to environmental management and protection in areas such as agriculture, livestock and fisheries, building/town/village planning, forestry and trees, land management/protection (including the prevention and control of land erosion by the sea or other causes) and public health.

An example of how Island Councils have exercised the powers conferred on them by the Local Government Act, is that several Island Councils have by-laws prohibiting certain fishing methods (e.g., the use of pressure lamps and fishing nets to catch flying fish and prohibiting the use of motorised canoes for trolling) with the view of either conserving existing stocks or ensuring more equitable benefit to all members of the community from the resource.

8.2 Land and Marine Tenure

Almost all land in Kiribati belongs to the indigenous people, except for the Phoenix and Line Islands, small portions of reclaimed land owned by Government, and lands belonging to the Catholic and Protestant churches. The Native Lands Ordinance of 1956 states that native land cannot be alienated by sale, gift, lease or otherwise to a person who is not a native, although this does not prohibit the alienation of land to the State, a Local Government Council, the Housing Corporation, a registered society under the Cooperative Societies Ordinance or the National Loans Board. "Native" is defined under the Ordinance as "any aboriginal inhabitant, whether wholly or partly of aboriginal descent, who has not acquired non-native status under the Native Status Ordinance." Title to Native Land is acquired by registration by the Native Lands Commission and the Magistrate's Court. Such land can be transferred by the Magistrates Court. The Magistrate's Court has jurisdiction to hear and adjudicate in all cases both under the law and, where the law is not applicable, under customary law.

Provisions under law are also made for the granting of pieces of land and taro pits to neglected children, people who nurse children or who show kindness. Provisions are also included for the redistribution of property of absentee land owners and the sale of neglected lands to persons who have insufficient land to support themselves. There are also provisions for the exchange of lands, taro pits and fish ponds. There is also provision for the sale of land to other natives, as long as the Court considers the remaining lands sufficient to cater for family needs. The Courts can also give permission for someone to make a fish trap, a seawall, a pond, and eel burrow (**niba**) or a taro

pit on another person's land, although such improvements must then be registered in the Register of Native Lands. There are also provisions that allow for the use or leasing of house plots on other people's land and native and non-native leases.

In terms of Marine tenure, the Marine Zones Act of 1983 demarcates the following areas: 1) the "territorial sea" which extends 12 nautical mile out to sea from "certain baselines", which are determined by the low-water line of the coast or of fringing reefs, where these exist; 2) "internal waters" which are on the landward side of the lines from which the territorial sea is measured; and, 3) "archipelagic waters", which also allows for the designation of an Exclusive Economic Zone (EEZ) which normally extends beyond the territorial sea to a point 200 nautical miles from the same base line, except where it would impinge on another country's EEZ, in which case compromise arrangements are made.

Kiribati has the same jurisdiction over its internal waters and territorial sea as it does over land, although it must allow passage to ships and aircraft (Pulea and Farrier 1994).

Under the Foreshore and Land Reclamation Ordinance, the general position is that the State owns the foreshore and the seabed, subject to public right of navigation, fishing and passing over the foreshore, as well as any private rights that may exist. Foreshore in this case includes areas affected by tidal movement and not areas of seabed permanently covered by water. It is stressed by Pulea and Farrier (1994), in their *Kiribati Environmental Legislation Review* that the legislation does not seek to override customary rights in marine areas, which under the *Laws of Kiribati Act 1989* apply to: 1) the ownership by custom of rights in, over, or in connection with any sea or lagoon area, inland waters or foreshore or reef, or in or on the seabed, including rights of navigation and fishing; and, 2) the ownership by custom of water, or of rights in, over or to water. Under the Foreshore and Land Reclamation Ordinance, foreshore can also be declared "designated foreshore", under which a licence is required from the Chief Lands Officer for the removal of sand, gravel, reef mud, coral, rock and any similar substances. It also stipulates that landowners who "may be affected thereby" must be consulted.

The main problems areas relating to the Ordinance and its enforcement relate to the reclamation of land by dumping rubbish and other possible toxic material, a problem almost exclusively in South Tarawa, and the collection of reef rock, shingle, coral and sand from beaches and the foreshore which increases the threat of coastal erosion (Pulea and Farrier 1994; Woodroffe and McClean 1992).

Also relevant to the issue of marine tenure and resource use are the Fisheries Ordinances of 1977 and amendments and the Fisheries Act of 1984, which emphasise the Minister's role in "developing the fisheries of Kiribati by taking appropriate measures to ensure that fisheries resources are "exploited to the full for the benefit of the country". As stressed by Pulea and Farrier (1994:52), there are specific references to the President's power, with the advice of Cabinet, to make regulations relating to: 1) the conservation and protection of species of fish; 2) the establishment of closed seasons; 3) the designation of prohibited areas; 4) limits on size and quantity caught; 5) prohibitions on fishing practices and equipment likely to damage fish stocks; and, 6) the taking of coral and seaweed. Under this legislation immature and egg-bearing female lobsters (*Pamulirus* spp.) are protected, and fishing has been prohibited in designated areas of Kiritimati in the Line Islands. The taking of coral has reportedly also been banned on Tarawa and restricted on other islands, although this may have no legal basis.

Although all "local fishing vessels" being used commercially must be licensed, this does not include native boats and those less than seven metres long, even if they have an engine and are being used for commercial fishing. Licensed vessels must not fish within three miles of the shores of any island, except when fishing for baitfish within a lagoon (Pulea and Farrier 1994:53).

8.3 International Conventions

Because of the small size and limited political leverage of Kiribati and other Pacific Island states, regional and international conventions and initiatives have shown to be among the most effective ways of addressing both global and many national environmental issues.

Kiribati is a signatory, or has succeeded to the following environment-related conventions:

1. Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention).
2. South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty).
3. Nuclear Non-Proliferation Treaty.
4. Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific (Tarawa Declaration)
5. London Dumping Convention
6. International Maritime Organisation Convention
7. Maritime Pollution Convention (MARPOL)

Kiribati continues to devote considerable diplomatic effort to environmental matters and issues. At the 1983 meeting of the London Dumping Convention, Kiribati and Nauru proposed a complete ban on the dumping of all nuclear wastes in the ocean environment. The proposal, which sought to reverse the prevailing practices of allowing certain categories of acceptable disposal, met strong objections from the nuclear nations. As a compromise, Spain proposed a moratorium on all kinds of ocean dumping of radioactive wastes pending the review of the Kiribati/Nauru proposals by an expert group.

During the drafting of the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention), Kiribati insisted on a more extensive coverage of the Convention area to include the Northern Pacific areas as well as the high seas between the country's component groups or archipelagos (EEZs).

More recently, with increased international attention being given to global warming and rising sea levels, Kiribati has been a regular participant in relevant forums including the Alliance of

8.4 UNCED Report

The *Country Report for UNCED: Kiribati* (Thaman *et al.* 1992), prepared in consultation with the Kiribati Task Force on the Environment (KTFE) and a wide range of other government and non-government agencies for the United Nations Conference on Environment and Development (UNCED) held in June 1992, is a detailed document providing information on the status of the Kiribati national and cultural environments, major constraints to environmentally sustainable development and suggestions as to priority areas for action to address these problems. Kiribati was very well represented at UNCED, which was seen as an important event in increasing national and regional awareness of the need to address environmental problems as a basis for sustainable development for future generations.

8.5 National Environmental Management Strategy

As a follow-on to UNCED, SPREP has had as one of its priority activities the strengthening of the capabilities of Pacific Island governments to integrate environmental considerations into their development planning process. The main component of this programme has been the preparation of "state of environment reports" and "national environmental management strategies. With the assistance of SPREP, and funded by UNDP, Kiribati completed its *Kiribati State of the Environment Report* (Wilson 1994) and the *Kiribati National Environmental Management Strategy* (NEMS) in 1993 (SPREP 1994). A *Kiribati Review of Environmental Legislation* (Pulea and Farrier 1994) and a *Kiribati Review of Environmental Education* (Taylor 1994) were also completed as part of the NEMS process.

The NEMS, provides a long-term perspective of a range of strategies and programmes that could be used to promote sustainable development. These have been considered and endorsed by the Kiribati Task Force on the Environment (KTFE) and Cabinet. The NEMS stresses that the broad objective of the Kiribati government in the environment sector is "to achieve an environmentally sustainable development and a better quality of life" by "utilising the natural resources without compromising the ability of the future generations to live out of the same resources".

8.6 Outer Islands Development

The Ministry of Home Affairs and Rural Development (MHARD) is responsible for co-ordinating outer island development in the Gilbert Group while the Line and Phoenix Islands are administered under the Ministry of Line and Phoenix Development (MLPD). In addition to its administrative and accounting staff, MLPD has ten sections or units covering resource planning, tourism, wildlife, public works, housing, water, electricity, power generation, resettlement and stevedoring. Seven other ministries, including the agriculture and fisheries sections of the Ministry of Natural Resources Development (MNRD) and the Ministry of Health, Family Planning and Social Welfare, are represented on Kiritimati. Although they relate to their own ministries on

Tarawa on technical matters, they are under the administrative control of MLPD (AGRIC^Q 1993). Some of the responsibilities of these Ministries of relevance to the KACAP are discussed in section 8.7.

The Government's decentralisation efforts and resettlement programme aim to reduce high population densities in the Gilbert Group and to develop the Northern Line Islands by resettling people from South Tarawa and other islands in the Gilbert Group to the Line Islands. The success of these policies will depend in large measure on the economic opportunities and quality of life offered to the new Line Islands communities.

8.7 Agriculture, Fisheries and Ecotourism

Apart from its environmental rôle, the Ministry of the Natural Resources Development, as its name suggests, is responsible for the development of the country's natural resources through its two main divisions, the Agricultural and Fisheries Divisions.

There are five main areas of activity under the Agricultural Division. These are:

1. Coconut Replanting, which involves encouraging landowners to replant and rehabilitate their coconut groves in the hope that the production of copra for export and coconut for domestic consumption would be improved on a sustainable basis.
2. Coconut Timber Utilisation which involves the milling of senile coconut trees felled as part of the Coconut Replanting scheme.
3. Crop Research and Development which has placed major focus on research and development of both exotic varieties and traditional food crops.
4. Livestock Investigation and Development which has focused on the improvement of local chicken and pigs by cross breeding with high-grade imported stock. Activities in this area also include the commercial production of eggs, chicken and pork with the aim of making the urban centres self-sufficient in these products.
5. Pest Control and Quarantine which includes research into, and control of, various pests, particularly the taro beetle, the breadfruit mealy bug (scale insect) and rats. The Division also implements restrictions on the importation of plant and animal materials in an attempt to control the introduction of further pests and diseases.

The Fisheries Division is directly responsible for co-ordinating development of fisheries and marine resources. The main areas of activity include:

1. Assessment of fish stocks and species to establish their commercial and subsistence development potential.
2. Monitoring of fish catches (particularly commercially and nutritionally important species).

3. Aquaculture/mariculture.
4. Licensing of foreign fishing vessels.
5. Surveillance of Kiribati's EEZ.

There are concerns that increasing population, particularly in the urban areas, together with increasing commercial fishing and exploitation of other marine resources is likely to lead to overfishing and unsustainable production systems. In an effort to regulate and counteract these adverse effects, the Fisheries Division has instituted a programme of long-term monitoring of catches by artisanal fishermen, the national fishing company (Te Mautari Ltd.) and foreign vessels fishing in Kiribati's EEZ.

The Fisheries Ordinance provides for the introduction of conservation regulations as deemed necessary. Existing measures to regulate overfishing and over-exploitation of marine resources include the prohibition of purse seine fishing by foreign fishermen close to land, regulatory measures relating to lobsters (crayfish) and the suspension of the exportation of corals by a local businessman pending a detailed impact assessment.

Further efforts in the development of conservation regulations and measures are constrained by the lack of scientific data relating to the resource (species, size, distribution, reproductive/recruitment characteristics, degree of current exploitation, endangerment status, and ecosystem/habitat status).

The Fisheries Division also undertakes constant monitoring of environmental effects from pollution, seaweed farming, causeways and other human activities and man-made structures on marine life and ecology. The Fisheries Division has been instrumental in ensuring that causeway designs include openings to minimise disruption of lagoonal circulation and lagoonal/coastal ecosystems.

The Ministry of Transport, Communication and Tourism (MTCT) is involved in ecotourism development, particularly on Kiritimati Island, where the industry is based primarily on wildlife observation, with particular emphasis on the island's extensive seabird populations. The Kiribati Visitors Bureau is the main agency for the promotion of tourism to outer islands

8.8 Water and Sanitation

Many of the basic community health problems in Kiribati are largely attributable to the contamination of water supplies from inadequate sewerage facilities. Following the cholera epidemic of 1977, a major sewerage project (with a capital cost of A\$6.4 million) was implemented in 1978. The project, funded under the Australian Government's bilateral aid programme to Kiribati, provided for a salt water system with electrical pumping of sewage to outfalls beyond the reefs. The system has been fully operational since 1982 and is currently under the direct responsibility of the Public Utilities Board (PUB). The PUB is also responsible for the South Tarawa Water Supply system, a major Australian-funded project which began in 1983. In the case

of the islands outside Tarawa, an Outer Island Water Supply Unit has been established within the Ministry of Works and Energy to co-ordinate and prepare policy and guidelines for outer island water schemes. The aim of the Outer Island Water Supply Unit is to provide safe drinking water from one handpump well (or tap) for every ten households.

The Ministry of Health, Family Planning and Social Welfare (MHFPSW) is involved in routine monitoring of water resources. The samples are analysed for their total coliform, faecal coliform and dysentery bacteria counts. Regular monitoring of sewage for faecal coliform is also carried out.

MHFPSW is also active in the area of waste disposal, including both human and solid wastes. In the rural areas, the ministry provide materials, supervision of the building of, and advice on the siting (e.g., at least 30 metres from nearby wells) of water-seal toilets. Its network of Island Health Workers also provide advice on sanitary disposal of garbage (including advice on disposal pits) and the development and maintenance of small houseyard food gardens.

8.9 Climate Change and Rising Sea Level

A major environmental concern is the potentially disastrous impact that climate change or global warming and associated sea level rise could have on the habitability of the low-lying atolls of Kiribati. Climatic data in Kiribati are collected by the Meteorological Service of the Ministry of Transport and Communication, which operates 20 stations, including its headquarters on Betio, Tarawa and one on Kiritimati. Of these, only five, including Kiritimati, make full daily climatological observations which include wind speed and direction, rainfall and temperature and, in the case of 3 stations, barometric pressure. The remaining 15 stations record daily rainfall only.

As part of global efforts to monitor climatic change and rising sea levels, the Kiribati Meteorological Service is participating in the Tropical Oceanic Global Atmosphere (TOGA) programme, established by the World Meteorological Organisation and administered by the US National Oceanic and Atmospheric Administration (NOAA). The main emphasis of the programme is the study of the atmosphere and the oceans and the interface and interactions between them, in the area 20 degrees north and south of the Equator. As part of the programme, a TOGA project was started on Kanton Island in 1985. Operated by I-Kiribati personnel with technical backup provided by TOGA, the project observes and monitors tides, temperature, rainfall and upper wind velocity. The University of Hawaii also operates a tide gauge based at the Betio Harbour.

The 1989 South Pacific Forum in Tarawa agreed to establish a series of monitoring stations in the region, including Kiribati. The project is yet to be implemented.

8.10 Tarawa Lagoon Management Plan

Of particular relevance to the KACAP and the proposed development of a Marine Resources Management Plan is the Applied Atoll Ecological Study, a study of Tarawa Lagoon, a joint effort of the Government of Kiribati and US Agency for International Development (USAID). It covered the period from 1991-94, at an estimated cost of A\$1.6 million. The main objective of

study was to produce a "Strategic Plan for the Restoration of Tarawa Lagoon", which is currently in the form of a Draft *Tarawa Lagoon Management Plan* (TLMP)(Volumes I-III)(BioSystems 1994). The project conducted for MNRD by BioSystems Analysis Inc. of Tiberon, California, in conjunction with the University of the South Pacific Marine Studies Programme, and funded by USAID, included shellfish and benthic ecology assessments, a finfish assessment, with special emphasis on bonefish, a study of primary and secondary production and food chains (food webs), and lagoon circulation, with particular emphasis on the impact of causeway development.

The study pointed out that a TLMP is urgently needed to address serious pollution problems and deterioration of the lagoon's natural resources. The suggested TLMP included the establishment of a "Lagoon Management Council", which would be seen as part of the private sector and independent from government, but which would interact with relevant government ministries and NGOs, fishermen, fisherwomen and business people (the user public), and with Island Councils and Unamwane (Councils of Elders). A key aspect of the TLMP would be "comanagement" (co-operative management) of lagoon resources between the central government and local communities adjacent to the resources. Local control is considered essential because government does not have the financial or human resources to impose and enforce regulations. The Lagoon Management Council is designed to facilitate community-based efforts to manage the lagoon resources, and to help identify and seek funding for projects that will improve the conditions of the lagoon and address constraints to sustainable use.

The report notes that the current use of the lagoon is based on English Common law, i.e., that the lagoon is open to all for any use, a "Tragedy of the Commons" wherein every individual takes what they can, leaving the resultant depletion and degradation for future generations. An important aspect of the TLMP is, thus, to change people's attitudes so that the use of the lagoon's resources is sustainable.

The major objective of the TLMP is to increase the productivity of the lagoon to approach its maximum sustainable yield. To do so, there are some resources that will need to be protected for many years so that they can build up sufficient populations for sustainable harvesting in the future. Major recommendations include:

1. The banning or dramatic restriction of the use of gill nets in the lagoon, including the banning of the use of gill nets on reefs, and possibly a 5-year moratorium on the use of all gill nets, seen to be the quickest way to restore the lagoon to full productive potential.
2. Ban the use of scuba and hookah equipment and swim fins for collecting and harvesting of shellfish to maintain deep water stock as a reservoir of spawning-size adults that can seed shallow water areas (the use of such equipment should be restricted to scientific, tourism and public education uses), and that studies be continued to study the life cycle of **te bun** (*Anadara antiquata*).
3. That other gill net or net-related restriction might include ban on a) net fishing for turtles, b) the use of heavy iron bars/cross bars to frighten fish into nets (**orooro** fishing), c) gill net use in all areas with living coral, d) the sale and importation of all gill nets, e) the connection of multiple nets to make long nets, f) the sale of lagoon fish caught using gill nets, g) loans for purchasing gill net equipment, and, h) the institution of a time restriction on the use of gill nets.

4. That, to re-establish stocks of bonefish (**ikarii**) and goatfish (**maebo**), a ban be placed on bonefish fishing three days before to three days after the full moon, a ban be placed on goatfish fishing during the period of the new moon, a ban be placed on the use of gill nets of less than 3.5-inch mesh in the lagoon, and that there be continued research on the life-cycle of the bonefish.
5. That a restriction be placed on fishing for baitfish (**tarabuti**) in the lagoon and adjacent to the lagoon along the western reef, with particular emphasis on the banning of the use of the use of underwater lights (**bauki-ami**) fishing, and that all baitfish resources be restricted to use by local subsistence fishermen.
6. That there be a five-year moratorium on the harvest of giant clams, and that efforts be made to introduce community-based giant clam mariculture, and that some giant clams be provided to Tarawa residents for a test culture programme.
7. That a 25-year moratorium be placed on the harvest of sea turtles or, alternatively, that there be adherence to the South Pacific Regional Marine Turtle Conservation Programme (SPREPMTCP) which limits harvest to local ceremonial purpose and bans the use of turtle nets, harvesting of eggs and the export of any turtle products, and that Naa be protected as a turtle-breeding sanctuary.
8. That beche-de-mer (sea cucumber) harvesting be restricted to hand collection, that the use of weighted spear points, and scuba and hookah for deep harvesting be banned to protect deepwater reserve breeding populations, that a minimum size limit be set, that Tarawa businessmen be involved in a management programme, and that a public education programme on beche-de-mer be initiated.
9. That the harvest of mangroves be minimised through the establishment of a "no net loss policy" where if mangroves are harvested, they must be replanted or allowed to regenerate, that a mangrove replanting programmes be set up, and that a public mangrove education programme be initiated.
10. That an aquaculture development plan be put into effect to assess the potential and to promote the culture of giant clams, seaweed, black-lip pearl oysters and sponges.
11. That a system of protected areas be established to re-establish populations of bonefish and other endangered species (it is recommended that 20% of the lagoon be set aside to restore fish populations as quickly as possible).
12. That the anchoring of boats on reefs be banned.
13. That increased open ocean fishing be encouraged to reduce pressure on lagoon resources and to exploit the considerable tuna, flyingfish and other pelagic species, deepwater bottomfish and possible squid resources, and the associated establishment of a 200-mile exclusionary fishing zone around Tarawa to make tuna resources available to only the residents of Tarawa (current policy allows licensed tuna vessels to come within 12 miles of the islands to catch tuna and other by-catch, including sharks).

14. That a significant number of openings or passageways be made in all existing causeways between the islets of Tarawa Atoll to increase circulation and allow more fish and invertebrate larvae and juvenile fish to enter the lagoon and to allow for fishermen to have easier access to the ocean (studies at Tenaea indicate that the larvae or planktonic juvenile stages of over 30 species of finfish and shellfish, including bonefish, enter the lagoon through this channel which has a bridge, rather than a causeway).
15. That studies be conducted to assess the degree of pollution of south Tarawa Lagoon and to develop strategies for minimising input of human waste and sewage into the lagoon.
16. That all avenues be explored to establish jobs for the growing population of Tarawa, with particular emphasis on reducing rural to urban migration (this would include the creation of private sector jobs in tourism, aquaculture, research and monitoring, commercial ocean fishing, outer reef tropical fish collection and limited harvest of selected lagoon resources).
17. That a community awareness programme be implemented which goes beyond the use of the existing media, with the possible development of a newsletter, books and public meetings to discuss the development of the lagoon.

Most of these suggestions have relevance for the suggested Marine Resources Management Plan for Kiritimati (Activity 4)

8.11 Training, Education and Public Awareness

Without improved environmental awareness and a firm educational basis (in terms of both formal and non-formal education), improved environmental management and sustainable atoll development will be problematic. Accordingly, considerable effort must be placed on improving formal environmental education in primary and secondary schools, providing training in environment-related areas and in improving public awareness of environmental issues.

At the primary school level, there is currently an Environmental Studies course, which is more a "Nature Study" than a course that focuses on environmental change and human impact on the environment. There is obviously the need, as Sullivan and Gibson (1991) suggested, for materials on environmental change and human impacts on the environment to be introduced into the present Environmental Studies curriculum. This should include the concept of the climatic change and sea level rise and other issues/problems such as land degradation, loss of biodiversity, pollution and loss of traditional agricultural, fishing and environmental knowledge.

There is currently no formal Environmental Studies at the secondary level, although environmental issues are addressed in different subject areas such as Geography, Chemistry and Biology. There is a major focus on environmental issues and options for sustainable development in the Pacific Islands in the Geography component of the recently established Kiribati Seventh Form high school programme. This programme is based on University of the South Pacific's Foundation geography materials, with the major assignments and exams marked by USP staff. There is, nonetheless, the need for environmental studies to be taught as a separate multi-disciplinary subject examinable at the national Kiribati Junior and Form 6 levels.

Apart from plans by the Ministry of Health and Family Planning for overseas training in atmospheric monitoring in 1992, there are currently no plans for specialised training in environmental management, although a number of I-Kiribati graduates have Geography or Science (Environment-related) first degrees that may qualify them for postgraduate environmental studies. USP does offer a Bachelor of Science degree in Environmental Studies, a Diploma in Environmental Education, and a new Bachelor of Arts in Environmental Studies which are increasingly in demand from other regional countries, but which have not yet been utilised by Kiribati.

Although there is a considerable degree of public awareness of environmental issues, largely gained from personal experiences, only recently has there been an effort to heighten this awareness through radio programmes or other forms of public education. Radio Kiribati currently runs a regular programme on Public Health, which could become the model for a radio programme on environmental awareness. There has also been a major media campaign to promote water conservation. The Environmental Unit also has a radio programme and has worked with the local Itibwerere Drama Group to produce plays on turtle conservation and on the protection of marine resources.

With particular relevance to Kiritimati was the production of an inexpensive informative booklet, in both English and I-Kiribati, *Te hoki n reirei i bukin te abamwakoro ae Kiritimati (The natural history and birdlife of Christmas Island)*, published by the International Council for Bird Preservation, Cambridge and the Wildlife Conservation Unit, MLPD (Perry and Garnett; translated by K. Teeb'aki, no date). The book is now out-of-print, although the Canada Fund has recently agreed to republish in an updated form.

8.12 Non-Governmental Initiatives

Several non-government and regional initiatives have addressed some of the major environmental issues and promoted sustainable development. At the national level, these include women's organisations active in promoting sustainable development among women; and youth associations which are instrumental in mobilising youth effort directed towards activities contributing to sustainable development. On individual islands, traditional political structures such as the **Unimwane** (Council of Elders) have also been instrumental in identifying development needs. As repositories of local knowledge and experience, their advice and participation should be sought in the protection/management of the environment and in the promotion of sustainable development.

Almost all national non-governmental organisations (NGOs) are part of, or affiliated to, a wider network of regional or international networks of NGOs. Government should therefore facilitate the establishment of a national NGO umbrella arrangement which could be coordinated with and strengthened by national and regional or international efforts promoting sustainable development.

Several international agencies (both intergovernmental and non-governmental) have programmes supporting local NGO's initiatives in environmental management and education and the promotion of sustainable development, some of which have already benefited Kiribati, include:

1) the UNDP Integrated Atoll Development Programme; 2) the UNICEF and Foundation for the Peoples of the South Pacific (FSP)'s programmes promoting home food production and the strengthening of mixed food gardening; 3) the South Pacific Commission, which has active programmes in agriculture, fisheries, population, food and nutrition and health development, with a major Integrated Rural Development Project focused on Kiritimati Atoll; and 4) Save the Children Fund. Efforts should be intensified to strengthen links with these and other appropriate organisations.

9 DESCRIPTION OF THE PROJECT

This section contains: 1) the objectives of the Kiritimati Atoll Conservation Area Project (KACAP); 2) project management; 3) the specific activities that constitute the Work Plan during Phase I of the project; 4) the budget; and, 5) work plans for each activity.

9.1 Project Objectives

The primary objective of the KACAP and its Work Plan I (years 1 to 5) is

to promote the conservation and sustainable use of "biodiversity" within the Kiritimati Atoll Conservation Area (KACA)

In pursuing this overall objective, emphasis is placed on the:

- 1) formulation and implementation of management action plans for the protection of Kiritimati's unique avifauna and rich marine resources;
- 2) setting aside, consolidation and management of the Cook Islet and its surrounding lagoon and reef ecosystems as a national marine park and a network of other protected areas for fisheries and avifauna conservation purposes;
- 3) enhancing important culturally and economically important terrestrial biodiversity through replanting activities;
- 4) exploring opportunities for income generation based on the use of the biodiversity and natural resources and developing those with potential.
- 5) building the capacity of the implementing agencies and the community at large, and the
- 6) generation of information, community awareness and public educational programmes.

9.2 Constraints to Conservation and Sustainable Use of Biodiversity in Kiritimati Atoll

To develop a program of activities that will promote biodiversity conservation requires that constraints to conservation and sustainable use of biodiversity be identified and addressed.

Based on preliminary discussions with local communities in their **maneaba** (traditional meeting houses), with government representatives, and with representatives from the private sector in Kiritimati, and previously in South and North Tarawa, major current and future constraints to the conservation and sustainable use of biodiversity in Kiritimati Atoll seem to include:

1. **Inadequate resource-management mechanisms:** For example, local communities lack control over inshore marine resources, and existing environmental legislation, by-laws or responsibilities are often not implemented or enforced. There is a greater need for community control over and increased responsibility for adherence to, and enforcement of, existing and future regulations.
2. **Inadequate capacities within Government for biodiversity protection and**

resource management. The capacity of the Ministry of Line and Phoenix Development for effective biodiversity protection and resource conservation is severely limited. This is both in terms of budgetary resources and in skilled personnel. This constraint extends uniformly throughout the Ministry's various technical units namely fisheries, wildlife and agriculture units that have direct responsibilities for biodiversity protection and sustainable resource management.

3. **Loss of ethnobiological and environmental knowledge among the young:** Increasingly, the older generation is failing to pass on traditional environmental knowledge (e.g., the names, uses and management strategies for terrestrial and marine animals, plants and ecosystems) to the younger generation, a generation that has increasingly had an urban-biased education with inadequate environmental content and very limited discussion of traditional I-Kiribati links with land and sea. Complicating this is the fact that most of the recent settlers on Kiritimati are from other parts of Kiribati and are not familiar with the local environment.
4. **Coastal erosion and saltwater incursion:** These increasingly apparent forms of degradation may result from sea-level rise induced by global warming, distant volcanic eruptions or earthquakes and associated tsunamis (seismic sea waves), removal of coastal littoral vegetation, and overdraught of water from the freshwater lens.
5. **Interruption of lagoon circulation by causeway construction and other modern developments:** The construction of causeways between individual atoll islets has interrupted tidal flows in and out of Tarawa Lagoon. This restriction of flushing (water renewal) and nutrient cycling within the lagoon may have affected the spawning cycles and behaviour of a wide range of marine organisms (e.g., it may be responsible for the failure of bonefish to spawn in their traditional Kiritimati Atoll spawning grounds since the late 1980s). Although not currently a major problem on Kiritimati, the impacts of future developments (e.g. the expansion of wharf facilities, the construction of causeways between Cook Islet and Ronton or between other islets, etc.) on the circulation and ecology of Kiritimati lagoon and the system of hypersaline ponds should be carefully considered before such developments are allowed to proceed.
6. **Overexploitation of inshore fisheries resources:** There is evidence that lobsters, beche-de-mer, bonefish, some large demersal species, some shark species, coral, aquarium fish and other commercially-important target species are currently overexploited or degraded by commercial and subsistence fishermen, and by DWFNs fishing within the EEZ of the Northern Line Islands. This is due to a number of factors including the increasing population of Kiritimati, increasing commercialisation of these marine resources, and the use of faster, larger boats, scuba gear, small-mesh gillnets, long driftnets, very long longlines, and crowbars (**orooro** fishing) to frighten fish into nets. There is a need to address these problems as part of the KACAP through the development of a Marine Resources Management Plan.

7. **Lack of culturally, economically and ecologically valuable trees, plants and associated wildlife:** The poverty of the natural and introduced vegetation of Kiritimati is seen as a major constraint to sustainable habitation on the island. There is thus a need for the protection of existing useful plants and the planting and maintenance of a wide range of ecologically and culturally valuable plants as part of the KACAP.
8. **Declining indigenous bird and terrestrial animal populations due to habitat destruction, overexploitation or predation:** Sea birds and sea-bird eggs are seasonally overexploited in some parts of Kiritimati. There is also a danger of the elimination of disturbance of ground-nesting birds by rats and/or feral cats. terrestrial habitats are also destroyed by burning, vegetation clearance, and rooting of pigs — all processes that diminish a traditionally important food resource and a wildlife of resource of global scientific and ecotouristic importance.
9. **Absence or poor management of a system of marine and terrestrial reserves and sanctuaries:** There is a need to formalise a system of marine reserves and to strengthen and improve the management of the existing system of terrestrial wildlife reserves or parks in order to protect and sustainably use Kiritimati's terrestrial and marine resources..
10. **Water shortage and water quality:** The absence of surface water, the limited groundwater resource, an increasing demand for domestic and agricultural water, limited rainwater catchment capacity, poor maintenance and/or pollution of groundwater and rainwater all constrain development, especially agricultural development, in Kiritimati Atoll. The quality and quantity of water in the freshwater lens is seriously affected during extended droughts, which in turn seriously affect coconut production and make it difficult to grow more water-demanding plants, such as breadfruit, short-term vegetables and many other culturally valuable plants that grow naturally on wetter atolls.
11. **Poor soils and limited agricultural potential:** The extremely infertile soils of Kiritimati make conventional agriculture, as practiced on larger Pacific islands, and even wetter atolls, very problematic. Thus, despite over a century of experimenting with new food and cash crops in the atoll environment by the British, French, German, Japanese and American colonial administrations, and recent capital-intensive atoll agricultural research programs, few additions to the traditional atoll crops of coconut, pandanus, giant swamp taro, breadfruit, and banana have proven to be sustainable in the long run, particularly on drier atolls like Kiritimati.
12. **Extreme isolation and poor transportation and communication:** Although there are proven markets for fresh and processed finfish, lobster, mantis shrimp and a number of other marine products, and a very considerable market for sportfishing, scuba diving, birdwatching and ecotourism on Kiritimati, the absence of a reliable scheduled airline connection between Kiritimati and Hawaii, or even between Kiritimati and Tarawa, has been a very serious limiting factor on commercial development on Kiritimati.

13. **Inadequate small-scale tourism development:** There has been only limited promotion of Kiritimati Atoll as a tourist destination, by a number of overseas-based adventure tourism (e.g. sportfishing and birdwatching) operations, by the local Dive Kiribati owner, and by the Kiribati Visitors Bureau. There is also an almost total absence of promotional materials on ecotourism on Kiritimati Atoll. This reflects the limited ability of the Kiribati Visitors Bureau and local small-scale tourist operators to promote and to highlight the biodiversity of Kiritimati Atoll and to identify areas and activities of particular ecological, cultural or scenic interest to tourists. Also lacking are trained local tour guides and suitable accommodation and facilities for tourists.

9.3 Project Management

9.3.1 General - overall approach to project management

The capacity of the existing government institutions in Kiritimati Atoll to effectively address the requirements for biodiversity conservation and sustainable resource management is very limited. It needs to be strengthened significantly in terms of additional staff, skills transfer for existing staff and office equipment. The level of community support and commitment also needs to be strengthened. To achieve both, appropriate focus on training and other forms of institutional strengthening is necessary. Fostering community support requires a planning and CA management process that is participatory and transparent and wherein community members can claim a sense of project ownership. This support can be further cemented through activities that will generate for community members tangible benefits. Capacity building should therefore target the Lead Agency, other implementing agencies and as broad a cross section of the Kiritimati Atoll community as possible.

The management structure under the normal SPBCP project design requires the designation of a lead agency to act as the focal point and coordinator for the Project, and to provide the necessary technical expertise to support the full time Project staff. In the case of the Kiritimati Atoll CAP, the lead agency shall be the Ministry of Line and Phoenix Development. Within this Ministry are semi autonomous units responsible for various sectors namely Fisheries, Wildlife, Agriculture, Tourism and others. These units are administratively under the MLPD umbrella but are functionally responsible to their central sector ministries in Tarawa for strategic direction and technical management.

The Lead agency's various technical units namely the Wildlife, Fisheries, Tourism, Agriculture and others must work together in implementing the activities of the the Kiritimati Atoll CAP. The Project Office within the MLPD will coordinate all activities. The technical units of Wildlife, Fisheries, Agriculture, Education and others will have direct responsibilities and will be provided with the resources to implement those Project activities that are consistent with their technical mandates. To ensure that these units are effective in implementing their assigned activities, the Project will provide support and assistance through training, personnel, expert technical advice, consultancies, information and equipment.

9.3.2 Kiritimati Atoll CAP Coordinating Committee

An important part of the Project Management Structure is the KACAP Coordinating Committee. This Committee will be made up of representatives from the various community groups, private sector and the aforementioned agencies. The Committee's principal purpose is to serve as a formal mechanism for the participation in the planning and management of the Project of all stakeholders including community groups and private sector interests. The Committee will be the key advisor to the Lead Agency in project management by providing input in the identification and prioritisation of project activities, the allocation of project funds and in ensuring that approved activities are implemented effectively by the responsible agencies. The Committee will also ensure that the Project reflects the priorities and needs of the community at large.

The Lead Agency on its part is obligated to consult with the Committee in the formulation of annual and quarterly work plans and budgets and to ensure that these plans and budgets are endorsed and supported by the Committee. The Lead Agency is also required to ensure that all relevant Project information is made accessible to the Committee to enable it to perform its advisory function efficiently and without constraint.

The composition of the Kiritimati CACC includes high-ranking Kiritimati Atoll-based representatives of relevant local government agencies, private sector representatives and representatives from participating church communities. Provisions are made for the co-option of additional appropriate members (e.g. from the private sector) as the need arises. The suggested composition of the CACC is shown in Table 9.1.

Table 9.1. Composition of the proposed Kiritimati Atoll Conservation Area Coordinating Committee.

Patron:	Hon. Tim Taekiti, Minister of Line and Phoenix Development
Chair:	Depweh Kanono, Chairman, Land Planning Board
Secretary:	Mr Tapaeko Teunroko, CASO
Project Manager:	Teboranga Tioti, Assistant Secretary MLPD
Membership:	Tekinene, Chairperson, Katorika Youth Nakara, Chairperson, KPC Youth Anni, Chairperson, Itoiningaina Tabwekea Women Organization (WO) Teieta, Chairperson, Itoiningaina Ronton WO Tekaeke, Chairperson, Itoiningaina Banana WO Maritina, Chairperson, Itoiningaina Poland WO Mrs Tiotaake Bob, Chairperson, SDA Docas Ronton Mrs Eritabeta Tabwaia, Chairperson, SDA Youth Nei Bura Oriwe, Chairperson, RAK Poland WO Mr Intaake Maribo, Chairperson, RC Youth Poland M. Bobwai Biribi, Chairperson, KPC Poland Mr. Kaibeia Rakobu, Chairperson, RC Banana Kaintoa Tairo, OIC, Fisheries Baroko Kaiboboki, Chairperson, KPC Ronton Bita Tamiano, Chairperson, RC Ronton

Tabu Bakaia, Chairperson, KPC Tabwakea
Kiraren Tirate, Tourism Officer, MICT
Terubaina Kaeka, Chairperson, RAK Ronton (WO)
Moumou Arebonto, Chairperson, RAK Tabwakea
Akineti Teitiewa, Chairperson, RAK Banana
Tekabwaia Lotebwa, Chairperson, Pet Fish Association
Utimawa Bukaireiti, Project Officer, Wildlife (MLPD)
Bwentaake Euta, Social Welfare MLPD
Karoraina, Chairperson, Bahai Women Ronton
Temangoti Ioakim, Chairperson, RC Tabwakea
Boitabu Smith, Chairperson, Bahai Ronton
Brentia kaiea, Agricultural Officer, Agriculture
Tinganga, Chairperson, KPC Banana
Mrs Lavinia Teem, Representative, Kiritimati Is Business Association
Mr Bob Kabuati, Manager, Captain Cook Hotel.

Co-opted:

Director, Dive Kiribati
General Manager, Kiritimati Marine Export Ltd.
Other Appropriate Co-opted Members

9.3.3 Technical Sub-Committee

The technical nature of any Project activities requires that sound technical advice is available to the Lead Agency and the Project Coordinating Committee. The provision of this technical advice will be the responsibility of the Technical Sub-committee. Members of the Technical Sub-Committee are representatives from

- Agriculture,
- Environment Unit,
- Fisheries,
- Wildlife and the
- Kiritimati Land Board.

The sub-committee members who are also the key implementing units for the Project, will also use this forum to coordinate their own activities. The Technical Sub-Committee shall meet as considered necessary by the Chairperson of the CACC, who is also the chairperson of this subcommittee.

9.3.4 Lead Agency's Responsibilities

The Lead Agency - the Ministry of Line and Phoenix Development (MLPD - will be responsible for the overall management of the KACAP. A large part of this function is that of coordinating the various government agencies involved. This function also extends to coordination between government and non-governmental groups. It requires the lead Agency to liaise and inform all stakeholders on a timely basis of the Projects activities and progress.

The Lead Agency will also be the main link with SPBCP and other outside agencies that may fund activities under the project. It will be responsible for administering project funds, preparing and submitting quarterly reports and work plans to SPBCP, and providing logistical

support for the role assigned to the Coordinating Committee. The Lead Agency will report on all planned activities and the progress of the KACAP to the Coordinating Committee, whose endorsement of the plans, reports, request for quarterly funds will be required before they are to be forwarded to SPBCP.

9.3.5 Project Manager and other Project Personnel

A Project Manager appointed by the MLPD will be responsible for the Project Office and will have overall management of the KACAP. This person will be the conduit between the KACAP, the CACC and the SPBCP.

A Conservation Area Support Officer (CASO) fully funded by the Project but working for the MLPD, will assist the Project Manager in the day-to-day implementation of the KACAP activities. The CASO will report to the Project Manager and will work closely with the various implementing units and the Coordinating Committee (CACC). The CASO will be supported by two Conservation Officers, one to be recruited in the first year of the Project and the second in the second year.

Additional project personnel include 2 Conservation Officers (CO) and a Project Volunteer. The CO's will be assigned to the Wildlife Unit and the Agricultural Unit, the former to assist with the avifauna management activities and the latter with the management of the proposed nursery. A competent technical volunteer is also considered crucial to support the Project Manager and CASO particularly in the management of the CA's extensive avifauna diversity.

9.4 DETAILS OF PROJECT ACTIVITIES AND BUDGETS

9.4.1 Planning Approach

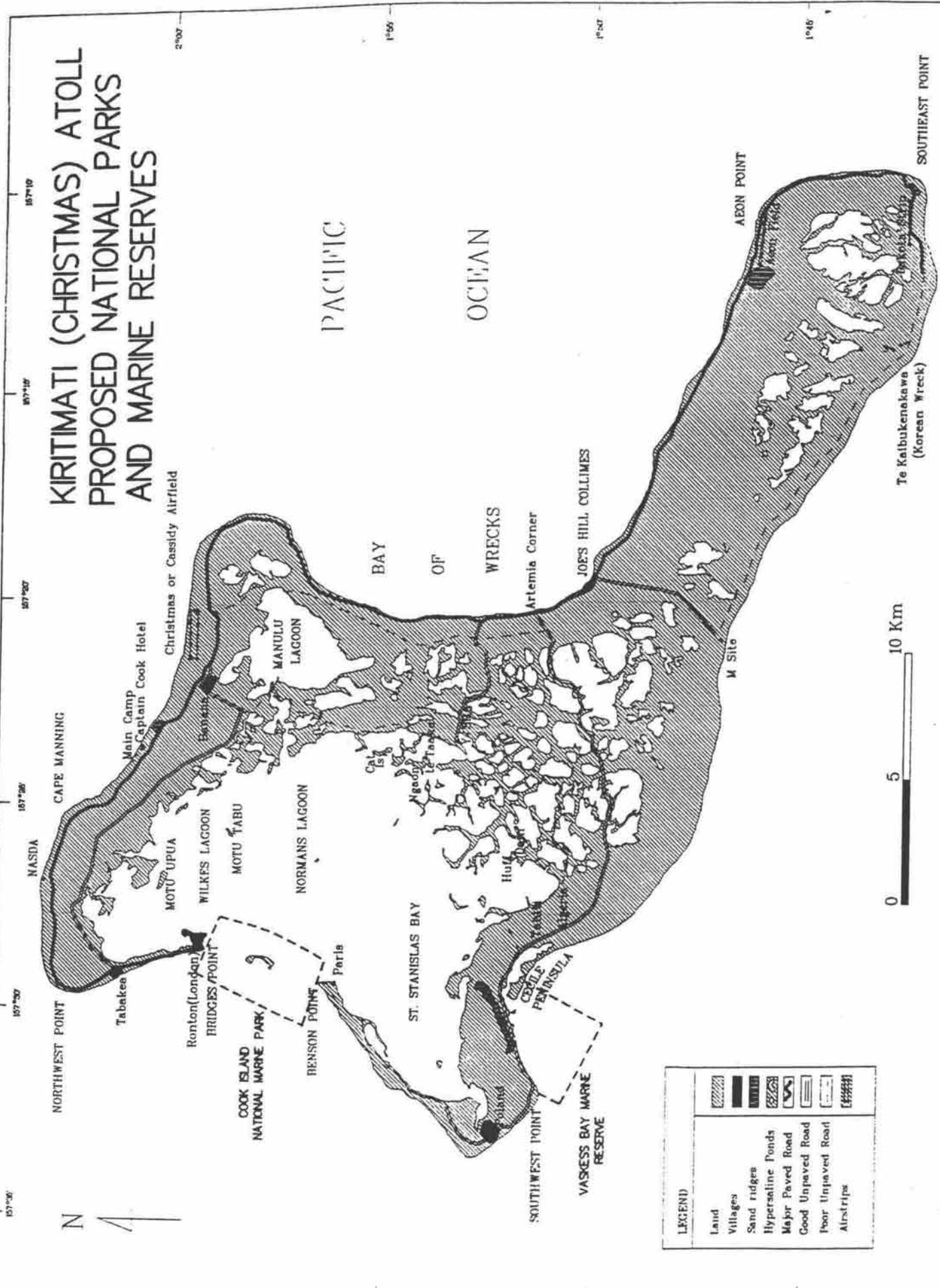
There is a strong emphasis on planning in the Project. This stems from a desire for a systematic and integrative approach to the management of the KACAP's biodiversity and the need for specific management actions to be based on solid scientific grounds. Thus whereas several options and approaches for pursuing a number of Project objectives may seem obvious and are discussed in the text, the priority areas for funding and implementation is in the gathering of information, the formulation of management action plans, awareness raising and information generation, and capacity building.

The details of specific actions for management are not preempted. Rather they will be determined and programmed for implementation during the management planning exercises. This process complements the current approach to adaptive management wherein the CACC and Lead Agency plays a key role in reviewing quarterly plans and identifying and reprioritising activities. This Project Document also seeks to facilitate the implementation of the plans' activities by making funding provisions in the proposed Budget for the key activities.

9.4.2 Project Activities

Given this background, five general activities are proposed for implementation by the KACAP, and for continued support throughout the three year funding period. These include:

KIRITIMATI (CHRISTMAS) ATOLL PROPOSED NATIONAL PARKS AND MARINE RESERVES



LEGEND	
[Hatched Box]	Land
[Dotted Box]	Villages
[Wavy Line Box]	Sand ridges
[Cross-hatched Box]	Hypersaline Ponds
[Thick Solid Line]	Major Paved Road
[Thin Solid Line]	Good Unpaved Road
[Dashed Line]	Poor Unpaved Road
[Hashed Box]	Airstrips

1. Establishment and maintenance of Cook Islet National Marine Park and a system of Conservation Areas and Protected Sites for avifauna and marine resources conservation.
2. Development and implementation of a Management Plan for the Cook Islet National Marine Park, an Avifauna Management Action Plan and technical assistance to the Fisheries Department in the formulation of the Marine Resources Management Plan.
3. Initiating sustainable development activities including the propagating and replanting of key economic plants species, and exploring and developing promising income generating activities such as ecotourism, handicrafts and others.
4. National and international CA promotion, public awareness and educational campaigns, and the production of educational and promotional materials on the KACA.
5. Building the capacity of the various agencies involved and the communities through the transfer of skills, information and knowledge.

Activities 1 and 2 are essential for the protection of the unique terrestrial and marine biodiversity inheritance of Kiritimati Atoll and are central to the successful maintenance of the island as a Conservation Area under SPBCP. Activity 3 is important for the enhancement of on-island incomes (cash and non-cash) and the improvement of the quality of life for long-term residents and new settlers of the island. It would also serve to increase the biodiversity and ecotourism potential of the island. Activity 4 is seen as necessary to improve local, regional and international awareness of the uniqueness of Kiritimati Atoll and to provide up-to-date information on the island's ecosystems and biodiversity as a basis for both biodiversity conservation and management and the promotion of ecotourism. Activity 5 aims at developing the necessary skills within the lead and implementing agencies and the community generally to implement and manage various project activities including privately operated income generating activities that complement the Project objectives. The longer term objective for Activity 5 is to progress the Project to a level wherein it can be effectively managed by the local agencies and the community after SPBCP support ceases.

These five areas of activities were identified as priority activities by all the Project stakeholders including the local Ministry of Line and Phoenix Development (MLPD), private sector interests and the local communities. With administrative and logistic support from the Lead Agency (Project Manager and CASO), the activities will be implemented, monitored and modified as necessary by the CACC.

9.5 Budget

The proposed budget is divided into: 1) Project administration and CACC management costs; 2) costs of the individual Project components; and, 3) Kiribati Government contribution.

Project administration costs include salaries, office operating costs, furniture, transportation hire and communications, the purchase of a Project motor cycle and its operating costs, and the support costs for the work of the CACC. Individual component costs reflect the estimated costs of individual activities and costs of technical assistance (consultant fees, per diems and travel). The total estimated cost of Phase 1 (3 years) of the Kiritimati Atoll Conservation Area Project (KACAP) is AUD271,729 or \$US 194,092.

The Kiribati Government contribution would include:

1. a commitment from the Ministry of Line and Phoenix to be the lead agency for the Project, and for the cooperation and support of other Kiritimati based agencies including the Fisheries, Wildlife, Tourism and Agriculture in project implementation.
2. the salary of one Assistant Secretary level officer of the MLPD who will be the Project Manager
3. use, depending on availability, of Kiritimati Atoll-based government boats and vehicles.
4. Office space for the CASO, a Project volunteer and other Project staff in Ronton, the administrative centre of Kiritimati Atoll.
5. the timely provision of adequate accommodation for the Project Volunteer, and
6. access to computers, e-mail, fax, telephone and photocopy services in Ronton.

Table 9.2 presents in detail the estimated Project Budget by components for the three (3) years of the Project. The estimated costs per year are Year 1 A\$91,034, Year 2 A\$102,050 and Year 3 A\$78,645 respectively.

The main variables in the budgets over the three years of the project include: 1) falling off of set-up costs after year 1 and cost of living increases in the personnel salaries; 2) initial emphasis of planning in year 1 and the shift to plans implementation thereafter 3) completion of biodiversity and baseline studies in year 1; and, 4) the reduced need for funding for education and public awareness as project activities become well-established and as other agencies (MLPD, the private sector, local communities themselves, and schools) take on responsibility.

The total estimated cost of the KACAP over its three-year duration would be A\$271,729 or US\$194,092 an amount that gives flexibility for any necessary modification of the project or the change of emphasis to other activities identified by the participating communities within the KACA.

Table 9.2 Proposed budget for 3 years of the Kiritimati Atoll Conservation Area Project

		1999	2000	2001	GRAND
#	Activity	TOTAL	TOTAL	TOTAL	TOTAL
1	Project Administration				
1.1	CASO Salary	\$ 8,584.00	\$ 10,300.00	\$ 10,300.00	\$ 29,184.00
1.2	Project Officer - Volunteer	\$ 8,500.00	\$ 15,000.00	\$ 16,000.00	\$ 39,500.00
1.3	2 Conservation Officers @2900/yr.	\$ 1,450.00	\$ 5,800.00	\$ 5,800.00	\$ 13,050.00
1.4	Office furniture (desk & 2 chairs)	\$ 400.00	\$ -	\$ -	\$ 400.00
1.5	Filing cabinet	\$ 300.00	\$ -	\$ -	\$ 300.00
1.6	Telephone and e-mail connection	\$ 500.00	\$ -	\$ -	\$ 500.00
1.7	Motor cycle	\$ 3,000.00	\$ -	\$ -	\$ 3,000.00
	<i>Operating Costs</i>				
1.8	Stationery	\$ 800.00	\$ 880.00	\$ 968.00	\$ 2,648.00
1.9	Transportation hire	\$ 2,500.00	\$ 2,750.00	\$ 3,025.00	\$ 8,275.00
1.10	Communications (fax, phone, e-mail)	\$ 400.00	\$ 440.00	\$ 484.00	\$ 1,324.00
1.11	Motor cycle operation & maintenance	\$ 800.00	\$ 880.00	\$ 968.00	\$ 2,648.00
	<i>CACC Meetings</i>				
1.12	Hire of venue	\$ 400.00	\$ 500.00	\$ 600.00	\$ 1,500.00
1.13	Meeting expenses	\$ 1,000.00	\$ 1,000.00	\$ 1,000.00	\$ 3,000.00
2	Awareness Raising/Information Production				
2.1	<i>Poster and essay competitions</i>				
	Prizes	\$ 600.00	\$ -	\$ -	\$ 600.00
2.2	<i>Radio Programmes</i>	\$ 800.00	\$ 500.00	\$ 500.00	\$ 1,800.00
2.3	<i>Production of posters, leaflets, maps etc.</i>				
	Production & printing of 2 Project posters	\$ 2,000.00	\$ -	\$ -	\$ 2,000.00
	Information leaflets of reserve areas & park	\$ 2,000.00	\$ -	\$ -	\$ 2,000.00
2.4	<i>Production of KACA Project video</i>				
	video production and copying	\$ -	\$ 15,000.00	\$ -	\$ 15,000.00
2.5	<i>Drama</i>	\$ 1,000.00	\$ 1,000.00	\$ -	\$ 2,000.00
3	CA Establishment & Management				
3.1	<i>Information gathering & Planning.</i>				
3.1.1	Diving gear for marine survey & monitoring	\$ 6,000.00	\$ -	\$ -	\$ 6,000.00
3.1.2	TA Avifauna surveys & management planning	\$ 15,000.00	\$ -	\$ -	\$ 15,000.00
3.1.3	TA Cook Is NMP surveys & management planning	\$ 13,000.00	\$ -	\$ -	\$ 13,000.00
3.1.4	TA for Marine Resource Management Plan	\$ 5,000.00	\$ -	\$ -	\$ 5,000.00
3.1.4	Community consultations for planning	\$ 3,000.00	\$ -	\$ -	\$ 3,000.00
3.2	<i>CA Plans Implementation</i>				
3.2.1	Provision for implementing Avifauna Plan's key activities	\$ -	\$ 10,000.00	\$ 10,000.00	\$ 20,000.00

3.2.2	Provisions for implementing NMP Plan's key activities	\$ -	\$ 9,000.00	\$ 9,000.00	\$ 18,000.00
3.2.6	Signs & markers for boundaries	\$ 5,000.00	\$ -	\$ -	\$ 5,000.00
3.2.7	Traps, cages etc for feral animal control		\$ 2,000.00	\$ 1,000.00	\$ 3,000.00
4	Sustainable Development				
4.1	<i>Income Generating Activities & Resources Development</i>				
4.1.1	nursery tools & supplies	\$ -	\$ 4,000.00	\$ 3,000.00	\$ 7,000.00
4.1.2	seedling/planting material propagation	\$ -	\$ 2,000.00	\$ 1,000.00	\$ 3,000.00
4.1.4	TA for feasibility studies into other potential income generating activities.	\$ -	\$ 15,000.00	\$ -	\$ 15,000.00
5	Capacity Building/Training				
5.1	Training for bird surveying/monitoring methods	\$ -	\$ -	\$ 6,000.00	\$ 6,000.00
5.2	Weaved handicraft making	\$ 3,000.00	\$ -	\$ -	\$ 3,000.00
5.3	Atoll agricultural methods	\$ -	\$ -	\$ 3,000.00	\$ 3,000.00
5.4	Small business management methods	\$ -	\$ -	\$ 6,000.00	\$ 6,000.00
5.5	SCUBA diving training	\$ 6,000.00	\$ -	\$ -	\$ 6,000.00
5.6	Sustainable fishing methods workshop	\$ -	\$ 2,000.00	\$ -	\$ 2,000.00
5.7	Workshop on small scale ecotourism ventures	\$ -	\$ 4,000.00	\$ -	\$ 4,000.00
		AS 91,034.00	AS 102,050.00	AS 78,645.00	AS 271,729.00
					(USD194,000.00)

9.6 Details of Project Activities

ACTIVITY 1. ESTABLISHMENT AND MAINTENANCE OF COOK ISLAND NATIONAL MARINE PARK AND A SYSTEM OF CONSERVATION AREAS AND PROTECTED SITES

The designation of Cook Island (Islet) as a National Marine Park and the establishment and maintenance of a system of conservation areas and protected sites is of the highest priority in the establishment of the KACA and for the conservation of biodiversity on Kiritimati. Although this is not an entirely new initiative, it is designed to give the network legal status and consolidate the current system of designated Wildlife Reserves and fisheries closed areas. It is also seen as the stepping stone to the identification and designation of other appropriate sites as protected areas, and will provide a strong and firm basis on which to build and improve community awareness of the importance of the protection of these areas as the foundation for the sustainable development and the promotion of ecotourism on the island.

1.1 NATURE OF ACTIVITY

The main objectives of this activity will include:

1. The development of appropriate legislation to enable the immediate designation of the area from Bridges (Ronton or London) Point to Benson (Paris) Point to a depth of 100 ft (30m), and including all of Cook Island (Islet), as a National Marine Park.
2. The consolidation and strengthening of the existing systems of Wildlife Reserves through intensive public awareness raising activities, strict enforcement and monitoring and proper boundary marking.
3. The identification and gazetting of important ecosystems or geographic features that could become part of a system of scenic viewpoints or areas of historic, ecotouristic, scientific or cultural importance.
4. The development and implementation of management action plans for the proposed marine park and Kiritimati's avifauna, including the setting up of management structures and procedures for their implementation.
5. Protection of native wildlife from introduced pests, pathogens and feral animals.

1.1.1 Designation of Cook Islet as a National Marine Park: The designation of Cook Island and the area extending from Bridges (Ronton or London) Point to Benson (Paris) Point as a National Marine Park and Conservation Area is seen as central to the conservation of biodiversity on Kiritimati Atoll. Discussions with local communities and scientists indicate that this would be the most cost-effective and ecologically-sound way of protecting the marine and terrestrial biodiversity of the area, as well as ensuring that there is a protected spawning ground

for as wide a range as possible of marine species of commercial and subsistence importance. This area also seems to offer the most potential as a multi-purpose ecotourism location.

Because of its location on the leeward side of the island, centered in the mouth of the lagoon, it offers the best all-weather snorkelling and scuba diving on the atoll. It also has perhaps the best representation of marine organisms found on Kiritimati. The other advantage is that Cook Island, Motu Tabu and to a lesser extent, Motu Upua, are the only bird colonies that are isolated from the mainland, and, thus, more easily protected from feral animal predation and easy access to resident human communities. If practicable and appropriate, both Motu Tabu and Motu Upua could be included in the proposed Cook Island National Marine Park system.

This activity will require a review of the existing legislation and the clarification of the appropriate legislative mechanism for making this possible. The Fisheries Unit of MLPD will work closely with the CACC and the Project Office in implementing this activity.

1.1.2 Consolidation and Strengthening of the Existing System of Wildlife Reserves.

There is already a quasi-legal network of bird sanctuaries designated with the blessing of Cabinet in the recent past. The Wildlife Unit had undertaken the necessary public notification steps in informing the public of the areas, have surveyed and marked the reserve boundaries and are conducting regular monitoring against illegal harvesting of resources. This network needs to be consolidated and strengthened further with a fully legal status, public support and recognition of its need for protection, and with a detailed management plan for continuing development based on sound information and built by a process of community participation and public consensus.

The Management plans should recognize the main issues of susceptibility of the fragile seabird populations to human disturbance and predation from wild, feral and domestic animals. It must also recognize and provide for the need for limited access to seabird populations because of their potential as an ecotouristic, educational and scientific resource, and, in some cases, as a subsistence food resource, that can contribute substantially to sustainable development on the island.

Suggestions of options to consider in the planning process for this activity are provided in Annex 1.

1.1.3 The identification and gazetting of important ecosystems or geographic features that would become part of a system of scenic viewpoints or areas of historic, ecotouristic, scientific or cultural importance.

As discussed in section 4.6, in addition to Cook Islet, the other large lagoon islets and the system of Wildlife Reserves, there are, on Kiritimati Atoll, other unique or scenic areas or ecosystems of considerable historic, ecotouristic, scientific or cultural importance that should be immediately identified, mapped, gazetted and protected. These include features such as Joe's Collimes sand dunes to the south of the Bay of Wrecks, numerous attractive beaches and coral ramparts, atoll grasslands and herblands, tree groves and individual trees, archaeological sites, the nuclear testing site, copra plantations and copra drying areas, Father Rougier's home site, the South Pacific Airways Hotel ruins, etc., all of which could be of significant ecotouristic,

educational or scientific interest. These areas need to be systematically identified, mapped, gazetted and managed.

1.1.4 Protection of Wildlife from Introduced Pests, Pathogens and Feral Animals

The wildlife and plantlife, particularly the birdlife and marine life, of Kiritimati could be seriously threatened by the introduction of alien species, particularly more competitive species from continental areas and larger island areas, such as Japan. Already, the introduced tilapia (*Oreochromis mossambica*) seriously threatens the sustainable commercial and subsistence production of the culturally, nutritionally and economically important milkfish in the hypersaline lakes of Kiritimati.

Other pests and pathogens that could be introduced, if appropriate precautions are not taken, include: 1) noxious weeds, insects and diseases that could affect plants, animals and humans; 2) competitive bird species, such as the Indian myna (*Acridotheres tristis*); 3) feral or free-ranging cats, dogs, goats and pigs or rats, snakes and other animals that could devastate the islands fauna and vegetation; and, 4) alien marine organisms that could devastate the rich marine fauna.

Of particular concern is the distinct possibility of the introduction of the brown tree snake (*Boiga irregularis*) from Guam where it has virtually wiped out all of the ground-nesting indigenous birds, bats, lizards and geckos on the island over the past 20 years (Rodda and Fritts 1996). With increased flights from Asia and Guam (e.g., Air Nauru has weekly flights through Guam) there is a high probability that the snake could be introduced into Kiritimati. There are already cases of snakes found alive on runways in Hawai'i, Texas and Okinawa, presumably off of flights from Guam or other areas infested by the snake.

Of serious concern on Kiritimati are domestic mammals, particularly those that stray from village sites and go feral (wild) and which attack birds, feed on their eggs or destroy habitats. Dogs, cats, pigs and rats have all periodically been serious problems, with a relatively successful eradication program having been implemented in the past on Kiritimati to control feral cats. It is only a matter of time before unchecked mammals will adversely effect the size, breeding status and long term viability of the bird colonies.

The final area of great concern is the potential for the introduction of serious marine pests or parasites that could affect the fish, shellfish or crustacean populations of Kiritimati, not to mention human health. There are now numerous examples of foreign organisms that have been introduced in the ballast water of ships that have devastated the indigenous biota in harbours and coastal areas around the world.

In short, if a major development, such as the proposed NASDA Space Station, goes ahead, there will undoubtedly be an increase in the number of planes and ships arriving in Kiritimati from Asia and other points of origin where there are potentially serious pests. There is, thus, an urgent need to strengthen quarantine regulations, procedures, facilities and human resources as an integral component of any major development project. There is also the need to restrict the introduction of domestic and wild animals and to continue to implement control programs of feral animals, particularly cats and rats. Pigs should also be properly penned or tethered and kept out of restricted

areas, and goats should not be allowed on the island, given their proven ability to severely degrade small-island environments and vegetation.

1.1.5 Strengthening of the conservation area management capability

For the successful development, maintenance and sustainable use of Cook Island National Marine Park, the system of Wildlife Reserves and ecosystems and features of historic, ecotouristic, scientific or cultural importance, there is a need for the strengthening of the conservation area management capability on Kiritimati. Technical capacity within the Wildlife and Fisheries Units needs to be bolstered significantly to assist with the data collection for planning purposes, as well as the implementation of required activities and long term biodiversity monitoring and reporting. Likewise, appropriate management structures and procedures should be looked at to manage the park effectively, recognizing its significant potential for ecotourism.

Protection of wildlife from introduced pests, pathogens and feral animals requires the collaboration of all agencies - Wildlife, Police, Fisheries, Education and the community at large. The Project through its Coordinating Committee should encourage this collaboration. The Project through its training activities should also be prepared to assist in the provision of appropriate training and awareness raising initiatives to address this issue decisively.

1.2 IMPLEMENTING AGENCIES

While the MLPD is the official lead agency with overall coordinating responsibility, other specialised technical of the Ministry will be assigned the implementing responsibility and should be appropriately strengthened to perform this function. These include the Wildlife Conservation Unit, Fisheries Unit and the Tourism Unit. The Agriculture and Heath Unit and the Police should also be involved in activities related to the control of feral animals and the strengthening of quarantine procedures. The Tarawa-based MESD, the Ministry of Natural Resources Development (MNRD) and Kiribati Visitor's Bureau will also have to be involved. The actual planning and implementation of the activities will be coordinated by the Project Manager supported by the CACC.

1.3 TIMING

The designation and establishment of Cook Islet as a National Marine Park and the strengthening of the system of wildlife reserves and conservation areas should begin immediately after the PPD has been finalised, ideally no later than June 1999. The exact timing of each activity will be determined by the CACC.

1.4 ESTIMATED COSTS

1. Establishment, upgrading and maintenance of Cook Island National Marine Park and

a system of Wildlife Reserves and areas of scenic, ecological, scientific, historical and cultural importance including technical assistance for biodiversity surveys of Cook Is	A\$ 8,000
2. Preparation of signs for sites and zones	\$3,000
3. Transport (boat and road)	\$1,000
4. Scuba diving gear for training and surveying	\$6,000
5. Technical assistance for developing Cook Is National Marine Park Management Plan (fees, travel, per diem)	\$5,000
6. Implementation of Cook Is National Marine Park management plan's key activities.	\$18,000
7. Technical assistance for developing the Kiritimati Atoll's Avifauna Management Action Plan.	\$15,000
8. Implementation of Kiritimati Atoll's Avifauna Management Action Plan's key Activities.	\$20,000
TOTAL	\$A41,000 (USD 29,285)

ACTIVITY 2: DEVELOPMENT AND ENFORCEMENT OF A MARINE RESOURCES MANAGEMENT PLAN

The development and enforcement of a "Marine Resources Management Plan" to ensure the sustainable use of Kiritimati's marine resources and protection of the marine environment is fundamental to the success of the KACAP. Kiritimati's greatest renewable natural resource is its marine biodiversity. Without it neither humans or birds would survive on the island. The unusually high marine biodiversity of the lagoon, surrounding reefs, the ocean, and the countless hypersaline ponds constitute a sustainable resource if managed appropriately. Marine foods are the main locally available protein source, and, along with coconut, the main locally available staple food on Kiritimati. The marine environment is also the focus of a range of important commercial enterprises. These include *Echeuma* seaweed mariculture, snorkelling and scuba dive operations, export of pet or aquarium fish, the limited export of dried and salted milkfish and beche-de-mer (holothurians), sport fishing, commercial fishing for limited local sale and air export (e.g., lobster and deepwater snapper) and commercial fishing by distant-water fishing nations (DWFNs) off Kiritimati in Kiribati's EEZ.

The long-term sustainability of all of these activities depends on the adoption of a management strategy to ensure that marine resources are used sustainably and protected from degradation due to destructive fishing practices, construction, boat anchorage and pollution. What appear to be almost limitless stocks of pelagic migratory fish, vast quantities of bonefish and milkfish in the lagoon and hypersaline ponds, and extremely abundant aggregates of edible giant

clams and reef fish on the fringing reefs are in reality healthy breeding populations that have not been overfished. Each marine species has its own breeding cycle influenced by numerous environmental factors. What they do have in common, however, is that they are susceptible to external pressures, particularly those placed on them by humans, and there are already signs of overharvesting of some species such as sharks and lobsters, the use of destructive fishing practices associated with local bonefish fishing by I-Kiribati, and destruction of coral by aquarium fish export companies. Such problems can only increase, if corrective measures are not taken.

2.1 NATURE OF ACTIVITY

The development and enforcement of a Marine Resources Management Plan to ensure the sustainable use of Kiritimati's marine resources and the marine environment is seen as a priority component of the KACAP and as a basis any future development or resettlement of Kiritimati. The Plan should provide the basis for a clear policy promoting the protection and sustainable use of the marine resources of Kiritimati, both by the local I-Kiribati population, resident non-I-Kiribati, and visitors to the island, including both sport and commercial fishermen (fishers). This will be particularly important with increased resettlement and the increases in non-Kiribati inhabitants that might be expected, especially if ecotourism increases and if the proposed NASDA Space Station is developed.

The development and acceptance of a Marine Resources Management Plan would include some of the following provisions:

1. A strengthening of the existing system of fisheries marine reserves.
2. Establishment and reinforcement of policies and regulations to promote the sustainable use of inshore and offshore marine resources.
3. Conduct of local participatory marine resource management workshops.

Fundamental to the success of this activity is the participation of local communities, including local private sector fishing, diving, water sports, ecotourism operators and distant-water fishing nations that fish under license in the EEZ off the Line Islands. Without their integral involvement, efforts to conserve endangered species, establish effective marine reserves, reduce fishing pressure on over-exploited species, or to produce high quality *Echeuma* seaweed cannot be successful. Because the KACAP is ultimately to be run and managed by local communities, the KACAP could be an ideal mechanism to initiate the process of increasing community based management of marine resources

Because current legislation allows open access to all areas below mean high tide, effective community management is very difficult. Consequently, the most serious concern of communities on Kiritimati Atoll is that, even if they conserve and manage their marine resources wisely, outsiders can move in and over-harvest. Local communities need some degree of management control over nearby in-shore marine resources.

Discussions on this issue with senior Government officials and local commercial interests in Kiritimati indicate that there is strong support for moves to enact legislation or use local by-laws under current legislation to establish some marine reserves and to more strictly enforce

appropriate fishing regulations. It also appears that existing legislation offers several possibilities for increasing local control and the implementation of by-laws (by local Island Councils or Unimwane) which give local communities control over specific resources or types of fishing, e.g., milkfish and bonefish fishing. Short-term outside technical expertise may, however, be required to support such efforts.

2.1.1 Establishment of Designated Marine Reserves or Marine Parks

The establishment of a system of designated marine reserves or non-fishing areas is reported by many scientists to be the surest way protecting breeding populations of marine organisms and ensuring sustainable use of marine resources. This contention is strongly supported by scientists studying fish stocks of Tarawa Lagoon in the main Gilbert group (BioSystems, 1994). During the PPD consultancy, village leaders, local fishermen, some commercial interests, and government representatives strongly supported the establishment of a number of designated marine reserves that could serve the dual purpose of protecting breeding stocks of Kiritimati's important vertebrate and invertebrate marine organisms, as well as serving as important scientific and ecotourism resources.

The areas that have been identified to be the most appropriate for preservation include:

1. The reefs and waters from Bridges (London/Ronton) Point to Benson (Paris) Point to a depth of 100 ft (30m), and including all of the reefs surrounding Cook Island (see Activity 1 above).
2. All reefs and waters from Southwest (Poland) Point to the mid-point of Vaskess Bay.
3. The current no-fishing area around Huff Dam.

Other areas could also be subsequently designated as marine reserves.

The rationale for the selection of these areas is as follows.

Bridges (Ronton) Point to Benson (Paris) Point: The area between Bridges (Ronton) Point and Benson (Paris) Point has, reportedly, the best representation of biological diversity of coral reef formations and vertebrate (e.g., finfish) and invertebrate (shellfish, lobsters, crabs, beche-de-mer) organisms on the island.

It is the only open-water access to the central lagoon and is, thus, critical in terms of the exchange of water and nutrients between the central lagoon and the deeper open ocean. Because it is on the leeward (off-wind) side of the atoll, there is significant upwelling and increased nutrient flow. With the incoming tide, deep ocean nutrients are brought to the surface in the form of spawning blooms ("soup") that benefit both lagoon and ocean ecosystems.

The currents and tidal flows coming in and out of the lagoon and moving south and north along the coasts and around the island also carry planktonic larvae and juvenile stages of a wide

range of finfish, shellfish, lobsters, crabs, beche-de-mer and corals to almost all other reefs and coastal areas on the island, thus enhancing the importance of the reserve as a nursery or spawning ground for the entire island.

Manta rays, dolphins, sharks and many other deepwater organisms also spawn in the lagoon and depend on the health of the areas around Cook Islet and the nutrients coming through the Bridges-Benson channel (pass).

The area immediately off Cook Islet is reportedly also one of the best all-weather snorkelling sites on the island. Its protection is of great importance to the future of both ecotourism and the promotion of recreational snorkelling and scuba diving as commercial enterprises.

Southwest (Poland) Point to the Mid-point of Vaskess Bay: The area from Southwest (Poland) Point to the mid-point of Vaskess Bay is also one of the most biologically diverse areas of Kiribati in terms of reef formations and marine organisms. It remains one of the most well-preserved and productive ecosystems and one of the few areas where sharks are still regularly seen.

Alongshore currents in the areas would also help to distribute planktonic and non-planktonic forms of a wide range of marine organisms.

Huff Dam Area: The current no-fishing area around Huff Dam is clear evidence that, where fishing is prohibited, fish stocks of a wide range of species, especially larger breeding stock will congregate and serve as breeding sites or spawning grounds that can ensure the protection of all species. Particularly conspicuous in the area are large populations of milkfish, bonefish and trevally, three of the commercially most important species for export, local sale and the sportfishing industry. The Huff Dam area is an inner lagoon site, and thus very important for the protection as a spawning ground for bonefish and other fish that are not generally found on open-ocean reefs.

These areas should be immediately designated marine reserves (non-fishing areas) and sign-posted accordingly. Local communities and fishermen should be deputised to enforce the prohibition of fishing in these areas and should have authority to report violations to Fisheries Officers, who have primary responsibility to the implementation and enforcement of the reserve status of these areas. The erection of signs would in three languages (I-Kiribati, English and Japanese) would facilitate community-based management of the CA as well as serving as a symbol and heightening public awareness.

Finally, the designation of these areas as reserves leaves sufficient other good fishing areas open to both subsistence and commercial fishing for the inhabitants of the island's main settlements. Specifically, the areas north of Bridges (Ronton) Point to Northwest Point and from Benson Point to Poland Point are good all-weather fishing areas, and the areas beyond Vaskess Bay toward the Bay of Wrecks and extending east from Northwest Point along the north coast would also be open areas when the conditions are favourable.

2.1.2 Establishment and Reinforcement of Policies and Regulations to Promote the Sustainable Use of Inshore and Offshore Marine Resources

This activity is designed to reinforce existing policies and regulations, and to implement appropriate new regulations or practices to promote sustainable marine resource use and to prohibit unsustainable practices. This would include:

1. Reinforcement of the existing and proposed system of non-fishing reserve areas (e.g., Huff Dam area) and catch-and-release (no-kill) areas.
2. Designation of restricted species or restricted use areas, including the enforcement of the current system of the use by selected groups or owners of the hypersaline milkfish ponds.
3. Enforcement of current and appropriate new regulations prohibiting unsustainable or dangerous marine resource-use practices.

Reinforcement of the existing and proposed system of non-fishing reserve areas and catch-and-release (no-kill) areas: An important part of any plan must be the enforcement of any system of marine reserves or non-fishing areas. This will have to be a combined effort between the government (Fisheries Officers), the Police, local subsistence and commercial fishers, and ideally foreign fishermen who fish in the waters of Kiritimati.

Designation of restricted species or restricted use areas: The designation of restricted species or restricted use areas is also seen as central to the sustainability of marine resource use on Kiritimati. This should include:

1. Enforcement of the current system of the use by selected groups or owners of the hypersaline milkfish ponds. With estimated annual yields of at least 100 metric tonnes per year, the hypersaline milkfish ponds are a critical subsistence and commercial resource if managed appropriately. At present the system where some ponds are designated for the exclusive use of resident Kiribati families, some for commercial harvest and some as government property would seem to be an effective way of managing this unique resource.
2. Enforcement of the catch-and-release areas for bonefish and the designation and enforcement of other areas where bonefish are protected and areas where I-Kiribati are allowed to catch bonefish for subsistence purposes. This should be enforced strictly as sport bonefish fishing is one of the main seasonal sources of income for the local population, as well as a source of bonefish fishers who could provide additional income to other ecotourist and diving operators on days when they are not fishing.
3. Designation of some species as endangered species and the placement of moratoria on their exploitation. For example, although the blacktop reef shark is very common, most of the larger reef and pelagic sharks, which were formerly common off Kiritimati's fringing reefs and a main attraction for overseas scuba divers, are now rarely seen. Even at Vassess Bay, where they used to be very common, they are now rarely seen. This seems to be the combined result of the relentless and unrecorded exploitation of sharks for their fins by

DWFNs (mainly longliners) fishing in the EEZ of the Line Islands, and the recent growth of sharkfin export by local commercial fishers.

4. The increasingly endangered status of sharks as top predators is a serious worldwide phenomenon, and can best be tackled if the Kiribati Government, with the assistance from the Forum Fisheries Agency (FFA) and SPREP place appropriate restrictions or moratoria on endangered sharks species. Locally, communities should discuss the issue immediately, while the Kiribati Government pursues the issue both nationally, in terms of regulating shark fishing by longline vessels, and in terms of putting the issue of sharks on the regional FFA and SPREP agendas. At present, despite the fact that the sale of sharkfins is a major source of income to longline vessels and their crews, Pacific governments and local communities receive little or no compensation for the depletion of this resource within their EEZs.

5. Restricting the taking of giant clams (*Tridacna* spp.), which are extremely abundant on some reefs in Kiritimati, to subsistence consumption by the local I-Kiribati population is also recommended as there is great potential for overexploitation of this resource by local exporters or future resident Asian communities (e.g. employees of the proposed NASDA Space Landing Site), for whom giant clam is an expensive delicacy. There are examples elsewhere in the region (e.g. Nauru and New Zealand) where recent immigrants from Asia have seriously overexploited previously underexploited marine resources.

6. Enforcement of current and appropriate new regulations prohibiting unsustainable or dangerous marine resource-use practices. This should include restrictions on the mesh-size and length of gillnets used within the Kiritimati lagoon, restrictions on the use of **orooro** (use of crowbars or other methods to frighten fish into gillnets). It could also include seasonal or size restrictions or limits on the number of individuals of a given species that can be taken. It could also include restrictions on the use of scuba or hookah gear for certain forms of fishing or in designated areas. The exact nature of the regulations and means of enforcement that would be the most appropriate will have to be decided upon as an ongoing activity by the Fisheries Section and other appropriate agencies and reinforced under the KACAP.

2.1.3 Participatory Marine Resource Management Workshops/Discussions.

KACA-level and community-level workshops/discussions on the problems, prospects, strategies and benefits of the development and acceptance of a Marine Resources Management Plan and of community-based marine resource management will be necessary to ensure the successful development and enforcement of a Marine Resources Management Plan. Community-level management of marine resources is a priority program (3.6.6) under the "Development and Protection of the Resource Base" in the Kiribati national Environmental Management Strategy. In the case of Kiritimati, the "local community" is seen as including local village communities as well as government agencies and the private commercial sector.

These workshops and discussions should include appropriate high-level representation from the Fisheries Division (local Fisheries Officers and probably representatives from headquarters on South Tarawa), local marine export operators (e.g., exporters of fresh and processed fish,

aquarium fish, beche-de-mer, sharkfin and seaweed), local sportfishing and dive operators (e.g., bonefish fishing, deepsea fishing and scuba and snorkel tour operators), and representative of local fishers organisations from the villages on the island. If appropriate, local representatives from these groups could be designated as a Marine Resources Management Working Group, which could be made responsible for the development, implementation and revision of the marine Resources Management Plan, and possibly the conduct of community-level workshops or discussions.

The main objectives of the workshops/discussions would be to discuss the issues related to: 1) the identification and designation, by local communities in consultation with appropriate persons, of an agreed upon system of marine reserves or parks; 2) agreement on the system of non-fishing areas, catch-and-release zones, and open areas, including the designation of use regimes for the hypersaline milkfish ponds and other appropriate area; 3) identification of rare or endangered fish or organisms that are in need of protection or which should receive some sort of protected status; and 4) prohibited or unsustainable fishing practices or technologies, the reasons for the institution and enforcement of regulations restricting their use, and the importance of adhering to such regulations. Hopefully, the outcome of the discussions would be a provisional Marine Resources Management Plan that could be tested, monitored, discussed and improved by local communities and implemented and modified by a Marine Resources Management Working Group.

2.2 LEAD AGENCIES

The development of a Marine Resource Management Plan is already reported to be a priority activity with the Ministry of Natural Resources Development taking the lead. Given this situation, KACAP will play a supportive role. Activities that KACAP will undertake in this role include the marine surveys of the areas proposed for the Cook Is National Marine Park, some capacity building for the Fisheries Unit, and building community awareness and support for the sustainable use and conservation of marine resources generally. KACAP will also work closely with the MNRD to ensure that the planning process is community based and is fully participatory. KACAP's Coordinating Committee provides the mechanism for participatory planning and it is envisaged that this committee can serve as a key avenue through which community views and concerns can be expressed.

2.3 TIMING

The proposed support activities of KACAP will commence as soon as the PPD is approved. Subsequent activities to modify legislation or to implement by-laws could also begin concurrently in consultation with appropriate persons or government agencies.

Discussions regarding the identification and designation, by local communities in consultation with appropriate persons, of a limited system of community based or KACA-controlled marine reserves or parks could also commence immediately.

KACA's involvement in community resource management planning workshops will need to be coordinated properly with the Department of Marine Resources efforts in this area.

2.4 ESTIMATED COSTS

1. Kiritimati Atoll and community workshops/discussion on marine resources management. \$3,000
2. Technical assistance for the formulation of a marine resource management plan. \$10,000
3. Technical assistance for marine surveys (funded under Cook Is marine surveys)
4. Boundary markers and signs to designate marine reserves and restricted-use zones \$2,000
5. Feral animal control (baits, traps & cages) \$3,000

TOTAL

A\$18,000
US\$12,857

ACTIVITY 3: SUSTAINABLE DEVELOPMENT: PROTECTION AND ENHANCEMENT OF BIODIVERSITY RESOURCES AND ECOTOURISM

Protection and Enhancement of Biodiversity Resources

The native and introduced flora of Kiritimati Atoll are both very poor due to the dry climate and extremely poor soils. An important Activity of the KACAP will be the planting and protection of trees and other useful plants in and around villages on Kiritimati, both for their environmental services and value (e.g. shade, human and fauna habitat enhancement, soil and coastline stabilisation, nitrogen fixation etc.) but also for their economic value as a source of raw material for income generation activity such as handicraft from carving (Casurina) and weaving (Pandanus)..

Included as part of this activity is the promotion of mixed "organic" food gardening farming that does not depend on commercial fertilisers and pesticides. Such an activity could provide long-term ecological, economic and cultural benefits to the people of Kiritimati, among them protection from groundwater pollution resulting from the use of inorganic fertilisers on low-lying limestone islands.

The village and houseyard gardens contain a range of important food trees and crops and other culturally and ecologically valuable plants, most of which have been introduced to Kiritimati from the wetter Line Islands, Teraina (Washington Island) and Tabuaeran (Fanning Island), the main Gilbert Group, or even Hawai'i. Important trees in village gardens include coconut palms, te

ni (*Cocos nucifera*), edible pandanus, **te kaina** (*Pandanus tectorius*), breadfruit, **te mai** (*Artocarpus altilis* and *A. mariannensis*), tropical almond, **te kunikun** (*Terminalia catappa*), native fig, **te bero** (*Ficus tinctoria*), **te itai** (*Calophyllum inophyllum*), **te kanawa** (*Cordia subcordata*), **te uri** (*Guetarda speciosa*), **te non** (*Morinda citrifolia*), **te kiaiai** (*Hibiscus tiliaceus*), plus frangipani, **te meria** (*Plumeria* spp.), sebesten plum (*Cordia sebestina*), hibiscus, **te roti** (*Hibiscus rosa-sinensis*), lantana, **te kaiboia** (*Lantana camara*), hedge panax, **te toara** (*Polyscias* spp.) and a small range of other ornamentals.

There has also been the active official promotion of the establishment of small houseyard vegetable gardens by the Health and Agricultural Officers. The main plants found in these gardens include Chinese cabbage, pumpkins, amaranth spinach (*Amaranthus* spp.), hibiscus spinach (*Abelmoschus manihot*), chili peppers, tomatoes, egg plants, rock melon, cucumbers, sweet potato, cassava, rock melon or cantaloupe, papaya and the drumstick or horseradish tree (*Moringa oleifera*).

Almost all plants in villages and houseyard gardens are culturally and economically very important for making habitation possible on Kiritimati. The increased planting of trees, a wide range of other plants, and the maintenance of small food gardens is, thus, an integral component of the KACAP.

Ecotourism

The rich avifauna and marine resources of the Kiritimati CAP offer a wide range of opportunities for tourism development. Some of these, such as scuba diving, snorkelling activities and sport fishing, are already widely marketed and is providing the basis for a burgeoning tourism industry. The proposed setting up of a Cook Islet National Marine Park and the strengthening of avifauna management further promises additional tour products that can be offered through proper marketing to the same tourist market.

The hordes of tourists visiting the atoll for sport-fishing provides a ready market for handicraft and other souvenir items and products such as cultural entertainment and short day tours to places of cultural and historical significance. These possibilities are significant in their potential for community involvement.

For these opportunities to be fully exploited, pre-feasibility and feasibility studies need to be conducted with promising options developed. Whatever options are selected, the need to build local capacity to fully utilise these opportunities is envisaged. Training in areas such as in tour guiding, small enterprises management, traditional handicraft making and others will be necessary.

2.1 NATURE OF ACTIVITY

Priority activities to enhance village biodiversity include:

1. The active discouragement of tree removal and the protection and replanting of appropriate species (See Appendix 3).

2. The preparation, by all villages and communities on Kiritimati, of lists of "endangered" or culturally important species that could constitute protected species and which could be assigned priority status for protection, propagation, replanting and introduction in houseyard or urban gardens.
3. Replanting and rehabilitation of culturally important tree species, and important varieties of important food and multipurpose plants such as pandanus, coconut, breadfruit, bananas, native figs (**te bero**), papaya, and other appropriate fruit and cultural trees in villages, around taro pits, and in appropriate inland and coastal sites.
4. The active planting of pandanus varieties and other handicraft plants for sale as raw or partially processed materials or for the production of marketable handicrafts. Particularly important is the propagation and planting of endangered and especially high-value pandanus cultivars, many of which are rare or in short supply.
5. Protection and planting of appropriate nitrogen-fixing plants, with particular emphasis placed on the intensified planting of indigenous legumes, such as **te kaimatu** (*Sophora tomentosa*), **te kitoko** (*Vigna marina* and *Canavalia cathartica*), and **te burukam** or **te katurina** (*Casuarina equisetifolia*), plants with which the people of Kiritimati are familiar.
6. Planting and improvement of living hedges/fencing around, or bordering roads on all town allotments.
7. Strengthening the capacity of the Agricultural and Health Officers on Kiritimati Atoll to provide appropriate planting material (not available locally). This will revolve around the establishment of a central nursery for the propagation and distribution of trees and other desired plants in all of the island's main villages and, where possible, at all schools.
9. Workshops on the post-transplanting care of plants that have been distributed and/or planted. The workshops will also focus on organic farming, the dangers of chemical farming in low-lying islands, and other environmental and health issues.

Activities to investigate and develop other income generating activities:

1. Prefeasibility studies to canvass the entire range of possible income generating options with potential for further investigation and development.
2. Feasibility studies and development of promising income generating activities.

3.2 LEAD AGENCIES

The MLPD will work closely with the Agricultural Unit in enhancing terrestrial biodiversity including the establishment of a tree nursery, distribution and replanting of trees. This needs to be coordinated properly through the CACC with local women's, youths and church groups, and local schools who will organize replanting schemes at the community level. The Project will

also assign one of its Conservation Officers to work closely with the Agriculture Unit in operating the nursery.

Community members (i.e. women's organizations, youth and various church groups, schools) are an important part of any replanting activity. Planting schemes involving these groups, properly designed with accompanying incentives will not only contribute to the enhancement of the terrestrial biodiversity but with promoting and raising the profile of the Project. Lists of trees which communities could select for nursery propagation and/or planting in and around villages are provided in Appendix 3. MLPD will also need to facilitate the bringing in of some appropriate planting materials from other islands in Kiribati and possibly from overseas. The Agricultural division of MNRD in Tarawa could play a key role in limited plant introduction.

Activities such as ecotourism will require the involvement of the Visitors Bureau. The Project Manager will lead in coordinating the proposed feasibility studies in close consultation with the Bureau, existing tourist operations and the hotel management, as well as the existing tour operators.

3.3 TIMING

The establishment of a demonstration Project nursery and the collection and propagation of target species should in the second year of the Project (2000) and will continue throughout the project. Assistance from MLPD in site selection and establishment can also start immediately, with more specialised assistance with the propagation of species unfamiliar, or unavailable to local communities beginning in Year 2.

3.4 ESTIMATED COSTS

The main costs of the village biodiversity enhancement activity will be related to the establishment and maintenance of the nursery and the distribution to communities of selected species by MNRD. These costs are shown below:

1. Demonstration nursery establishment (materials, tools, transport, logistical support, etc.)	\$7,000
2. Propagation of seedlings/planting materials by MNRD	\$3,000
3. Conservation Officer (Nursery) @ 2,900/yr for 2 years	\$5,800
4. Prefeasibility and feasibility studies for income generating activities and ecotourism.	\$15,000
TOTAL	A\$20,810 (US\$14,865)

ACTIVITY 4. PUBLIC AWARENESS AND PRODUCTION OF EDUCATIONAL AND PROMOTIONAL MATERIALS

Conservation initiatives have a better chance of success when their rationale and objectives are understood by the general public, resource users and owners, the business community and decision makers. Education and public awareness is seen as fundamental to the success of the KACAP and Activities 1 to 3.

4.1 NATURE OF ACTIVITY

The specific components of this activity include:

1. A schools essay and poster competition highlighting the special biodiversity features of Kiritimati Atoll Conservation Area Project and the importance of conserving this biodiversity for the sustainable development of Kiritimati Atoll.
2. A broadly-based on-going community public awareness program revolving around project news, interviews with Project staff, CACC members and others using the newly established Radio Kiritimati.
3. Production of a *Birds of Kiritimati Atoll* poster and a Project poster highlighting the main attributes of the Kiritimati Atoll Conservation Area Project
4. Production of a general brochure or booklet on the Kiritimati Atoll Conservation Area.
5. The production of plays (drama) in the vernacular on the need for biodiversity conservation on Kiritimati.
6. Production of a Kiritimati Atoll Conservation Area Project video..

All of these activities together are design to raise the profile of the Project and community awareness of its objectives and activities, the international and scientific importance of the atoll's biodiversity, the importance of sound resource management to the sustainable development for the people of Kiritimati and the Republic of Kiribati. The Project video will also be used to promote the special biodiversity features of Kiritimati Atoll abroad and will, like the other information products proposed, play a key role in marketing Kiritimati Atoll to the international tourism market.

Broad-based Community Public Awareness Program: The community awareness campaign will focus on: 1) the ecological, economic and cultural importance of biodiversity and biodiversity conservation as a foundation for sustainable development; 2) constraints to biodiversity conservation, and activities that destroy or degrade biodiversity; 3) the ecological and biological rationale for environmental legislation, biodiversity conservation, and the establishment of terrestrial and marine reserves; 4) activities that promote the sustainable use of

biodiversity; and 5) the role of the KACAP in the promotion of biodiversity conservation and sustainable development on Kiritimati.

Specific objectives and target audiences for the program include the sensitisation of decision makers and community leaders to the key issues related to legislation and regulation of sustainable use of biodiversity in Kiribati. This would be coordinated and conducted by MLPD and the CACC, and would include meetings with appropriate department and agency heads, the Kiritimati Atoll Island Council, leaders of women's, church and school groups, and representatives from the private commercial sector who have a role to play in the development and maintenance of the KACA.

Increased community awareness of the role of biodiversity conservation and the KACAP as a foundation for sustainable development is also a priority. This will focus on strengthening the resource users' resolve to promote the protection and sustainable use of their marine and terrestrial biodiversity. Means of doing so could include meetings with local communities, the distribution of brochures or leaflets (see below), radio programs produced in the newly established Radio Kiritimati station, and the local production of two stage plays on the need for biodiversity conservation on Kiritimati (see below), one stressing the importance of the protection of Kiritimati's unique terrestrial environment and birdlife and one stressing the importance and fragility of Kiritimati's marine resources and the importance of using them sustainably.

Production of posters (Birds of Kiritimati Atoll and Kiritimati Atoll Conservation Area Project):

The schools poster competition winning entry will be produced into a Project poster to be printed and widely distributed to promote the Project. The KACAP will also collaborate with the Wildlife Unit to produce a *Birds of Kiritimati* poster to help raise national awareness of the importance of protecting birds and their habitats in community awareness programmes, in schools and with tourists.

Production of a Brochure or Booklet on Kiritimati:

The production of a general brochure or small booklet with appropriate historical, geographical information and outlining the main ecotouristic attractions and activities that are available to visitors on Kiritimati is seen as important to the success of the KACAP. This would include a list of possible short- and longer-term tours, fishing activities, scenic viewpoints, beaches, etc., especially those that highlight the atoll's biodiversity inheritance. The brochure/booklet should be no longer than eight to ten panels or pages, should include a small reference map, and should be reproducible using simple photocopying for widespread distribution to and by local communities, government agencies and private agencies involved in the promotion of ecotourism and other relevant activities. Consideration should also be given to producing the brochure/booklet in I-Kiribati, English and Japanese.

Production of Plays on Biodiversity Conservation on Kiritimati:

Two stage plays will be produced to highlight the need for biodiversity conservation on Kiritimati. One will focus on the importance of protecting Kiritimati's unique terrestrial environment and birdlife and the other will stress the importance of Kiritimati's marine resources and the importance of using them sustainably. The plays could be performed to

accompany local project workshops in local community meeting houses (*maneaba*), schools and other appropriate venues for local audiences, as a means of attracting interest and community participation. It is also possible that they will perform at local hotels or in villages for tourists as a source of income.

Production of a Project Video

The production of a Project video is seen as crucial to promoting the conservation of Kiritimati Atoll's unique biodiversity worldwide. The video is to be distributed throughout the region and will form an important part of promotional efforts for ecotourism and fund raising from international donors. The video would explain the Project's objectives and philosophy, the unique biodiversity features of Kiritimati Atoll, and will discuss the crucial issues of sustainable development faced by the communities. It is intended that the video will be produced in English and I-Kiribati, for overseas and local uses in schools and communities.

4.2 LEAD AGENCIES

The lead agency will be MLPD in cooperation with the Kiribati Visitors Bureau. The SPBCP will be responsible for recruiting the appropriate parties/contractors to produce the video and who will work with the Project Office to write the script and take film footage. Cooperation with the CACC and appropriate government personnel (e.g., from the Wildlife, Fisheries, Agricultural and Tourism sections) will be crucial.

The recently formed Kiritimati-based Drama Group" which has already produced excellent plays in the Kiribati language on EU funded anti-family abuse campaign will be contracted to produce two plays on nature conservation for the Project.

4.3 TIMING

The public awareness campaign will begin immediately after Project approval and will continue throughout the project.

The Essay and Poster competition, the production of posters and Project leaflets will commence immediately with draft copies to be distributed as part of the Kiribati National Environment Week in June 1999.

The production of the first play on the unique terrestrial environment and birdlife of Kiritimati, will begin by the end of 1999. The second play will be produced in 2000.

The planning for and preparation of a 30 minute video on the importance of marine and terrestrial resources in the KACA and the importance of preserving traditional knowledge about biodiversity and its use will begin in early 2000. This will be used in schools as well as by other agencies to inform the public and policy makers about the KACA and the importance of biodiversity conservation.

4.4 ESTIMATED COSTS

The estimated costs of this component are as follows:

1. Essay and Poster Competition	\$600
2. Radio Programmes	\$1,800
3. Production of posters and leaflets	\$2,000
4. Drama Production (fees, transport costs etc..)	\$2,000
5. Production of CA video (early Year 2)	\$15,000
TOTAL	A\$21,400 (US\$15,285)

5. CAPACITY BUILDING

Building the capacity of the Lead Agency, the community and the collaborating agencies to effectively implement the activities of the Project is an important component of the KACAP. Training will accompany all component activities of the Project and will be implemented locally using local experts in the majority of cases. Training of collaborating agencies in technical areas such as surveying methods etc may require the recruitment of outside experts from time to time. The following training activities are based on those proposed by collaborating agencies and the community through the consultations undertaken in the preparation of this Project Document.

5.1 TIMING

Training schedule will spread the three year duration of the Project. Training in Year 1 will focus on technical skills such as bird surveying methods that the collaborating agencies will need to assist with information gathering that is essential to the formulation of detail management plans. Other training workshops will be spread out in year 2 and 3.

The following table is indicative of the yearly programme of training proposed for KACAP:

#	Training	Year 1999	Year 2000	Year 2001
1	Training in birds surveying methods			
2	Tour Guide Training			
3	Weaved handicraft Making workshop			
4	Atoll agricultural methods workshop			
5	Small business management methods			
6	SCUBA Diving Training (Fisheries)			
7	Sustainable Fishing methods workshop			
8	Workshop on small scale ecotourism ventures			

5.2 LEAD AGENCY

Coordinating the training activities will be the responsibility of the Project Manager and CASO. This will involve generating the necessary publicity, identifying and selecting training participants, and organizing the logistics such as venue hire, transportation etc..

SPBCP will assist with the recruitment and contracting of outside expert trainers should this be necessary. In training specific to collaborating agencies such as the Fisheries and Wildlife Units, close collaboration with these units will be necessary.

5.3 ESTIMATED COSTS

1	Training in Bird Surveying Methods	A\$5,000
2	Tour Guide Training for Bird Watching	\$6,000
3	Weaved handicraft making working	\$3,000
4	Atoll Agriculture Methods	\$3,000
5	Small business management methods	\$6,000
6	SCUBA Diving training	\$6,000
7	Sustainable Fishing Methods Workshop	\$2,000
8	Workshop on the management of small businesses	\$4,000

TOTAL

A\$35,000
(US\$25,000)

Proposed Work Schedule

The proposed Work schedule for the implementation of the suggested activities (9.4) is presented in Table form below.

INDICATIVE WORK PLAN: KIRITIMATI ATOLL CONSERVATION AREA PROJECT

#	Activity	Responsible Agencies	Year 1				Year 2				Year 3			
			1	2	3	4	1	2	3	4	1	2	3	4
	CA Administration													
	Formalise Lead Agency	MLPD	■											
	Finalise arrangement for the transfer of Project funds	MLPD	■											
	Set up the CACC	LA	■											
	Recruit the Project Staff - CASO	CACC	■											
	Recruit Conservation Officers			■										
	Set up Project Office	LA	■											
	Recruit Project Volunteer	SPBCP		■	■									
	CA Management													
	Constitute CACC and appoint CACC officers		■											
	Quarterly CACC Management Meetings	LA	■	■	■	■	■	■	■	■	■	■	■	■
	Awareness Raising/Educational Activities													
	Community consultations for work plan	LA		■										
	Awareness raising workshops for community groups and schools	LA			■	■	■	■	■	■	■	■	■	■
	Poster competition & school essay competitions	LA		■	■	■								
	Production of information materials: posters, leaflets, maps etc..	LA			■	■	■	■	■	■				
	Production of CA Video	LA,C	■	■										

Radio publicity and programmes	LA																			
CA MANAGEMENT																				
Establish and maintain Cook Islet Marine Park																				
Propose for Cabinet approval new legal designation of Cook Isl as a National Marine Park and its extended boundaries.	LA																			
Mark new Cook Is Marine Park boundaries	F, LA																			
Publicise widely (radio and community workshops) Cook Is' new legal status	LA																			
Conduct surveys of key bird spp. and their habitats on Cook Isl.	W,C																			
Conduct biodiversity surveys of surrounding marine environments.	W,F,C																			
Develop Cook Islet MP Management Plan	W,F,C																			
Publicise Management Plan for review.	W,F,LA																			
Finalise Plan and commence implementation.	C,W,F,LA																			
Other Wildlife and Marine Reserves																				
Consolidate status of other existing wildlife and fisheries closed areas.	W, F, LA																			
Complete boundary marking for remaining 4 Wildlife CAs.	W																			
Identify, designate and mark temporary closed areas for sooty terns before each breeding season.	W,LA																			
Raise public awareness of temporary sooty tern CAs and their management.	LA																			
Monitor populations of key bird species	W																			
Feral Animals control programme	W																			
Intergrated Resource Management Planning																				
Review 1983 Wildlife Management Plan and 1993 Integrated Development Plan for Kiritimati Island.	W, LA/C																			
Assess status of existing wildlife and fisheries closed areas.	F, LA/C																			
Collect socio-economic data for planning and baselines.	LA																			
Undertake community consultations for planning.	W,F,LA,C																			
Update intergrated plan and recommend to Government for endorsement.	W,F,C,LA																			
Update Wildlife Management Plan and implement priority activities.	C,W	1	2	3	4	1	2	3	4	1	2	3	4							
Support the Fisheries Div. in the development of the Marine Resource Management Plan.	LA																			
CA Sustainable Development																				
<i>Protection and Enhancement of Terrestrial Biodiversity</i>																				
Establish demonstration nursery & propagate seedlings	A, LA																			
Distribute seedlings/planting material and launch tree planting drive	A, LA																			
Secure as reserve remaining Pisonia forest stands.																				
Capacity Building/Training																				
Training for PM and CASO in project procedures.	SPBCP																			
Tour guide for bird watching	W,F, LA																			
Training on bird surveying and monitoring methods.	C, LA																			
Workshop on handicraft weaving skills	LA																			
Workshop on Atoll agricultural methods	A, LA																			
SCUBA Diving training for Fisheries Div.	C,LA																			
Workshop on sustainable fishing practices	F																			
Workshop on small scale ecotourism ventures	LA																			

- Key Bird Species for surveys - sooty tern, wedge-tailed shearwater and Christmas Island Warbler
- Each activity is described with the implementing agency(ies) identified and the timeline defined. Estimated costs are indicated in the budget discussed earlier.
- The Work Plan is provisional and flexible although given the limited life of the Project, it is assumed that implementation will proceed with the minimum of delays. Other specific activities to be generated by the various management plans to be developed and the feasibility studies of potential income generating activities are expected to be added where feasible.

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**Annex 1: Suggested criteria and classification system for Kiritimati Atolls
Seabird populations:**

Existing sea bird rookeries for the island's 18 resident species cover every major habitat region on Kiritimati, ranging from areas adjacent to villages to more remote sites on the small islets (motus) in the central lagoon (e.g., Cook Island and Motu Tabu). However, none are inaccessible, and it is recommended that all important seabird rookeries become part of the system of protected "wildlife reserves" that fall under a number of categories of "protection status". The categories of protection status could include: no-contact zones, limited contact zones, open-restricted zones, and open non-restricted zones. It is stressed that a given protected area (e.g., Cook Island National Marine Park) may have areas that fall into one or all of these categories depending on the nature of the terrain and the seasonal status of the resident bird populations of a given area.

The suggested criteria and classification system for "protection status" would be:

- A. No contact zones:** These would be the most highly restricted areas where entry is restricted to authorised scientific study or to Wildlife Conservation Service personnel. Sub-classes may be considered in the "A" category. Category A areas would include fragile nesting grounds (such as shearwater burrows in soft sand, areas where birds are currently nesting, or areas where chicks are moving about on the ground). These would essentially be "no trespass" zones.
- B. Limited contact zones:** These would be areas where trained guides would be required to accompany small groups of "ecotourists" or scientists through an area for observation or photographic purposes only. Nothing may be touched or taken. Consideration should be given to the construction of "walks" (designated paths) or "boardwalks" that delineate prescribed paths for observation or photographing of different sea bird nesting sites and species. The construction of boardwalks is an excellent means of elevating observers and restricting their ground movement in ecologically sensitive areas. Their use could be particularly important in uncompacted sandy areas where there are wedgetailed shearwater (*Puffinus pacificus*, *te tanguiuoua*) nests. This species digs burrows in unconsolidated sandy areas where the dominant vegetation is often low lying *Lepturus-Tribulus-Boerhavia* herb mats. Any walking on these burrows causes them to collapse which could lead to egg destruction and chick mortality. It is suggested that two experimental boardwalks, one on Cook Island and one on Motu Tabu, be constructed during Phase I of the project in wedgetailed shearwater nesting sites on both islets, possibly on the northwest central part of Cook Island and on the northern peninsula of Motu Tabu.
- Until such time as designated paths or boardwalks can be put in place, it is recommended that these category B areas be posted, and remain as no trespass zones in the interior of sites such as Cook Island and Motu Tabu, with observation of birds allowed only from the perimeter of these islands.
- C. Open-restricted status:** It must be acknowledged that, regardless of current and future conservation policies, some seabirds and their eggs will probably be consumed by the "traditional" residents of Kiritimati. Both local community leaders

and local government officials believe that it is more realistic and practicable to accept this fact and formulate policies based on :

1. the designation of some seabird rookeries as restricted exploitation areas;
2. the designation of selected village representatives to be responsible for controlling a limited seasonal harvest of eggs of specified species; and
3. monitoring the ecology and bird populations of these areas to ensure that harvest levels are sustainable.

D. Open-no status: There are some sites that might need to be considered expendable if pressures arose to develop them. In order to identify such areas, there is a need for further studies of bird populations on Kiritimati and of the suitability of different sites for appropriate development activities. Based on such studies, initial selection/evaluation criteria could include:

1. correlation of seabird breeding patterns - courtship timing and practices, nest site selection and construction, egg laying and incubation, partner (pair) bonding and interchanges, chick rearing and feeding patterns and fledgling departures, and tolerances/resistances to external stimuli;
2. relative accessibility and appropriateness of sites as ecotourism destinations, current and future population concentrations, and proposed or potential developments (e.g., the possible development of a NASDA Space Landing Site near Aeon Field);
3. overall attractiveness of a site in a scenic or aesthetic sense; and,
4. The scientific value of a site on an IUCN standard. Based on international standards there are many sites on Kiritimati that could be recognised by the International Ornithological Union (IOU) for the: a) rare species breeding there, b) abundance/concentration of marine avifauna, c) accessibility for legitimate scientific research, and, d) uniqueness and cultural value to the I-Kiribati/Kiritimati people.

Annex 2: Persons consulted in Kiritimati during Project Preparation Consultancy.

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Appendix 3. Terms of reference for the Conservation Areas Support Officer (Kiritimati).

The Conservation Area Support Officer shall be an employee of the Ministry of Line and Phoenix Development (MLPD). He shall be responsible directly to the Project Manager KACAP and provide support to the Project in the day-to-day administration and management of the KKACAP.

The specific terms of reference or responsibilities of the CASO shall be to:

1. In consultation with the Project Manager, the Conservation Area Coordinating Committee (CACC) and the local communities implement the Work Plan of the KACAP.
2. Ensures that all necessary support and logistics are provided for all meetings of the CACC and to act as the CACC Secretary in the absence of the Project Manager.
3. Establish and maintain a Kiritimati Conservation Areas Projects office (desk) within the MLPD in Ronton.
4. Assist the Project Manager with the the day-to-day administration and management of the KACAP.
5. Coordinate closely with other collaborating agencies in particular the Wildlife, Fisheries, Agriculture and the Tourism Office to ensure the timely implementation of Project activities in which these agencies play key roles.
6. Collect, catalogue (keep inventories) and maintain appropriate reference and educational materials in the KACAP Office in Ronton and for use by the CACC and local communities.
7. Conduct participatory planning meetings with members of the CACC and participating communities as required.
8. Distribute/disseminate information and materials related to KACA activities.
9. In conjunction with the CACC and the local communities monitor activities and plan future activities of the KACAP.
10. Prepare and submit quarterly progress reports on the KACAP to the Project Manager and CACC for consideration and for forwarding to SPBCP.
11. Ensure that SPBCP reporting and financial procedures are adhered to.

Appendix 4: Food and multipurpose species of priority status for protection, propagation and planting in and around villages and settlements on Kiritimati Atoll.

FOOD AND MULTIPURPOSE PLANTS

- te babai, giant swamp taro (*Cyrtosperma chamissonis*)
- te bamakin, te baukin, pumpkin (*Cucurbita pepo*)
- te banana, te umuum, plantains (*Musa* cultivars)
- te bero, native fig (*Ficus tinctoria*)(all varieties)
- te buka (*Pisonia grandis*)
- te kabiti n Taina, Chinese cabbage (*Brassica chinensis*, *Brassica* x "Saladeer")
- te kaina, pandanus (*Pandanus tectorius*)
- te kaitioka, sugarcane (*Saccharum officinarum*)
- te kuawa, guava (*Psidium guajava*)
- te kumara, sweet potato (*Ipomoea batatas*)
- te kunikun, tropical almond (*Terminalia catappa*)
- te mai, breadfruit (*Artocarpus altilis* and *A. mariannensis*)
- te meren, rock melon, cantaloupe (*Cucumis melo* var.)
- to mootaa, amaranth spinach (*Amaranthus tricolor*)
- te mwemwera, te babaia, papaya, pawpaw (*Carica papaya*)
- te nambere, hibiscus spinach (*Abelmoschus manihot*)
- te ni, coconut (*Cocos nucifera*)(special cultivars)
- te oraora, te tabonibae, ladyfinger banana (*Musa* AAB Group)
- te raim, lime (*Citrus aurantifolia*)
- te taram, horseradish or drumstick tree (*Moringa oleifera*)
- spinach tree, chaya (*Cnidoscolus chayamansa*)

OTHER USEFUL PLANTS

- te akanta, bougainvillea (*Bougainvillea* spp.)
- te ango (*Premna serratifolia*)
- te bumatoritori, giant milkweed (*Calotropis gigantea*)
- te burukam, te katurina, casuarina (*Casuarina equisetifolia*)
- te inato (*Clerodendrum inerme*)
- te itai (*Calophyllum inophyllum*)
- te kaibake, tobacco (*Nicotiana tabacum*)
- te kaiboia (*Dodonaea viscosa*)
- te kaibuaka (*Lantana camara*)
- te kaitetua (*Leucaena leucocephala*)
- te kanawa (*Cordia subcordata*)
- te katuru, te kaitiru (*Ixora casei*)
- te kaura (*Sida fallax*)
- te kiaiai (*Hibiscus tiliaceus*)
- te kiaou (*Triumfetta procumbens*)
- te kitoko (*Vigna marina*)
- te meria, frangipani (*Plumeria obtusa*)

te meria, frangipani (*Plumeria rubra*)
neikarairai yellow bells (*Tecoma stans*)
te ngea (*Pemphis acidula*)
te non, Indian mulberry (*Morinda citrifolia*)
te orion, oleander (*Nerium oleander*)
te ren (*Tournefortia argentea*)
te roti, common hibiscus (*Hibiscus rosa-sinensis*)
te tiare, Tahitian gardenia (*Gardenia taitensis*)
te toara, hedge panax (*Polyscias guilfoylei*)
te ukin (*Terminalia samoensis*)
te uri (*Guettarda speciosa*)
sebestan plum (*Cordia sebestina*)

Annex 5: Checklist of bird species reportedly breeding on Kiririmati Atoll and their status during July 1996 (KEY: 1) A = abundant, C = common, U = uncommon, R = rare, - = not seen, 2) CI = Cook Islet, MC = Main Camp, MT = Motu Tabu, SE = southeast peninsula, SL = saline lagoon area).

COMMON NAME (English)	SCIENTIFIC NAME	IKIRIBATI NAME	Breeding Observed	Adults	Nests	Eggs	sm. ch.	lg. ch.	Red plin gs	Population Estimates	Locale Visited
Phoenix petrel	<i>Pterodroma alba</i>	te ru ru	YES	C						5000 # 25%	MT CK
wedge-tailed shearwater	<i>Puffinus pacificus</i>	te tangitanga	YES	C						4000 # 25%	MT CK SLA
Chestnut shearwater	<i>Puffinus pacificus</i>	te tinubu	YES	C						3000 # 25%	MT CK
Audubon's shearwater	<i>Puffinus pacificus</i>	te nna	NO	-							
white throated storm petrel	<i>Nesofregata aibinibatis</i>	te hwehwe ni marawa	NO	-							
red tailed tropic bird	<i>Phaethon rubricauda</i>	te taake	YES	C						5500 # 25%	MT CK SLA
blue faced booby	<i>Sula dactylatra</i>	te mouakona	YES	C						850 # 15%	SE
brown booby	<i>Sula leucogaster</i>	te kibul	NO	U						100 # 25%	ROOSTING BIRDS CK
red footed booby	<i>Sula</i>	te kofa	YES	C						5000 # 15%	SLA
great frigate bird	<i>Fregata minor</i>	te eitei	YES	C						6000 # 15%	SLA
lesser frigate bird	<i>Fregata ariel</i>	te eitei	YES	C						1000 # 25%	SLA
sooty tern	<i>Sterna fuscata</i>	te kecu	YES	A						6 MILLION # 15%	MT CK MC SE
grey backed tern	<i>Sterna lunata</i>	te tarangongo	NO	U						NOT ENOUGH INFO	ROOSTING BIRDS CK MT
crested tern	<i>Sterna bergii</i>	te kara kara	NO	C						NOT ENOUGH INFO	ROOSTING BIRDS CK MT
bluegrey noddy tern	<i>Procelsterna cerulea</i>	te rauuan	YES	C						1500 # 25%	MT CK
brown/common noddy tern	<i>Anous stolidus</i>	te io	YES	C						3500 # 25%	MT CK
black/Hawaiian noddy tern	<i>Anous minutus</i>	te mangkiri	YES	A						8000 # 25%	MT CK
white / fairy tern	<i>Gygis alba</i>	te matawa	YES	C						4500 # 25%	MT CK
Line Island warbler	<i>Acrocephalus acquinocialis</i>	te hofohofio	NO	U						NOT ENOUGH INFO	MC SE
scarlet breasted lorikeet	<i>Vini kuhlii</i>	te kura	NO	-							