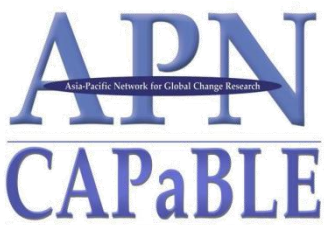




GLOBAL CHANGE AND CORAL REEF MANAGEMENT CAPACITY IN THE PACIFIC: ENGAGING SCIENTISTS AND POLICY MAKERS IN FIJI, SAMOA, TONGA AND TUVALU



General Background Dossier

Institute of Marine Resources: Technical Report 02/2012



School of Marine Studies
Institute of Marine Resources

Global Change and Coral Reef Management Capacity in the Pacific:
Engaging Scientists and Policy Makers in Fiji, Samoa, Tuvalu and Tonga:
General background dossier

Institute of Marine Resources
School of Marine Studies
Faculty of Science, Technology and Environment
University of the South Pacific

2010

Project Reference Number: CBA2010-15NSY-South

This publication should be cited as:

South, G.R., Chand, P., Morris, C. & Bala, S. 2012. *Global Change and Coral Reef Management Capacity in the Pacific: Engaging Scientists and Policy Makers in Fiji, Samoa, Tuvalu and Tonga: General background dossier*. Suva, Fiji: Institute of Marine Resources, School of Marine Studies, FSTE, USP. IMR Technical Report 02/2012. 133pp.

©Institute of Marine Resources, USP.

Published by Institute of Marine Resources,
School of Marine Studies, FSTE, USP,
Private Mail Bag, Suva, Fiji.

ISBN: 978-982-9143-01-3

Cover photographs from left to right:

Lovell, E., 2008, *Porites cylindrical* coral off Suva waters, Fiji

Morris, C., 2008, Prawn harvest at Navua Farm, Fiji.

Morris, C., 2009, Tilapia harvest at Navua Farm, Fiji.

Miller, C., 2010, Spinner dolphin off Moon Reef, Dawasamu, Fiji.

Morris, C., 2011, *Caulerpa* at Tongan Market

Layout and Design: Dikoila A. Valemei

Printed by: University of the South Pacific

© Institute of Marine Resources

All rights reserved. This publication may be reproduced in whole or in part and in any form for educational or nonprofit purposes without the permission of the copyright holders provided that due acknowledgement of the source is given. This publication may not be copied, or distributed electronically, for resale or other commercial purposes without prior permission, in writing, from the Institute of Marine Resources.

ACKNOWLEDGEMENTS

The Global Change and Capacity Management in the Pacific Project (CBA2009-FP11-South) would not have been possible without the financial support provided by the Asia-Pacific Network for Global Change Research (APN).

The Institute of Marine Resources gratefully acknowledges our partners, the Pacific Center for Environment and Sustainable Development and START Oceania at the University of the South Pacific (USP).

In addition, our gratitude goes to the Governments of Fiji, Tonga, Samoa and Tuvalu, the USP centers in Tonga and Samoa and the Secretariat of the Pacific Regional Environment Programme for their logistical support and encouragement.

LIST OF ACRONYMS

AFD	Agence Francaise de Developpment
AOSIS	Alliance of Small Island States
BPoA	Barbados Programme of Action
CBD	Convention on Biological Diversity
CCC	Convention of Climate Change
CCE	Community Capacity Enhancement
CI	Conservation International
CFMS	Coastal Fisheries Management Section
CITES	Convention on International Trade of Endangered Species in Wild Fauna and Flora
CNRS	Centre National de la Recherché Scientifique
COP	Conference of the Parties
COT	Crown of Thorn
CRISP	Coral Reef Initiative for the Pacific
CROP	Council of Regional Organisations in the Pacific
CTI	Coral Triangle Initiative
EEZ	Exclusive Economic Zones
EIA	Environment Impact Assessment
EMA	Environment Management Act
FFA	Forum Fisheries Agency
FLMMA	Fiji Locally Managed Marine Area
FSM	Fiji School of Medicine
FSPI	Foundation of the Peoples of the South Pacific International
IRD	Institut de recherche pour le développement
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Production
GHG	Greenhouse Gas
GTZ	German Technical Cooperation
IAS	Institute of Applied Sciences
ICM	Integrated Coastal Management
IMR	Institute of Marine Resources
IOI	International Ocean Institute
IUCN	International Union for Nature Conservation
KSTP	Kinoya Sewage Treatment Plant
LMMA	Locally Managed Marine Area
LRFFT	Live Reef Food Fish Trade
MES	Mamanuca Environment Society
MESCAL	Mangroves Ecosystems for Climate Change and Livelihood in the Pacific
MMA	Marine Managed Area
MPA	Marine Protected Area
NBSAP	National Biodiversity Strategy and Action Plan
NEMS	National Environment Management Strategy

NGO	Non Government Organisation
NOAA	National Oceanic and Atmospheric Administration
NRM	Natural Resource Management
ODS	Ozone Depleting Substance
PACE-SD	Pacific Centre for Environment and Sustainable Development
PCB	Polychlorinated Biphenyls
PCDF	Partners in Community Development Fiji
PCEG	Pacific Centre for Environment Governance
PIROF-ISA	Pacific Islands Regional Ocean Framework- Integrated Strategy Action
PREEN	Pacific Resource and Environmental Economics Network
REDD	Reducing Emissions from Deforestation and Forest Degradation
SBTTA	Subsidiary Body on Scientific, Technical, and Technology Advice
SIDS	Small Islands Developing States
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of Pacific Communities
SPREP	South Pacific Regional Environment Programme
SST	Sea Surface Temperature
TBT	Tri-butyl Tin
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNF	United Nations Foundation
UNFCCC	United Nations Framework Convention on Climate Change
UNGASS	United Nations General Assembly
USP	University of the South Pacific
WCS	Wildlife Conservation Society
WPC	Waste and Pollution Control
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION.....	2
1.1 Purpose	2
1.2 Project Rationale.....	2
2. OVERVIEW – CORAL REEF ECOSYSTEMS	2
2.1 Coral Reef Resources.....	2
2.2 Distribution of Coral Reefs	3
2.3 Coral Reef Bio-diversity	5
2.4 Significance of Coral Reefs.....	6
3. THREATS TO REEF ECOSYSTEMS.....	6
3.1 Global Climate Change.....	7
3.2 Overfishing	8
3.3 Pollution	9
3.4 Natural Disasters and Disease Outbreaks.....	9
4. CONVENTIONS, TREATIES AND AGREEMENTS.....	9
4.1 International Conventions	9
4.1.1 Ramsar Convention.....	9
4.1.2 World Heritage Convention	10
4.1.3 United Nations Convention on the Law of the Sea III (UNCLOS III).....	10
4.1.4 United Nations Conference on Environment and Development (UNCED).....	11
4.1.5 Agenda 21	12
4.1.6 Barbados Programme of Action (BPoA).....	13
4.1.7 Convention of Biological Diversity (CBD)	13
4.1.8 World Summit on Sustainable Development (WSSD)	13
4.1.9 United Nations Framework Convention on Climate Change (UNFCCC).....	15
4.1.10 The Alliance of Small Island States (AOSIS).....	16
4.1.11 Conv. on Int. Trade in Endangered Species of Wild Fauna & Flora (CITES)....	17
4.2 Regional Actions and Strategies	17
4.2.1 Pacific Islands Regional Ocean Policy	17
4.2.2 Apia Convention	18
4.2.3 Noumea (SPREP) Convention	18
4.2.5 National Environmental Management Strategies (NEMS).....	19
4.2.6 Pacific Adaptation to Climate Change (PACC) Project.....	19
5. COUNTRY PROFILE: FIJI.....	20
5.1 Introduction.....	20
5.2 Background	20
5.2.1 Coastal Resources of Fiji.....	20
5.3 Ecosystem Management Initiatives by NGOs in Fiji.....	24
5.3.1 World Wildlife Fund for Nature (WWF) - South Pacific.....	24
5.3.2 Wildlife Conservation Society (WCS) - Fiji	25
5.3.3 Locally-Managed Marine Area (LMMA) Network	25

5.3.4 Institute of Applied Science (IAS) - University of the South Pacific	25
5.3.6 Mamanuca Environment Society (MES).....	26
5.3.7 Partners in Community Development Fiji (PCDF).....	26
5.3.9 The Foundation of the Peoples of the South Pacific International (FSPI)	27
5.3.10 Pacific Islands Applied Geoscience Commission (SOPAC).....	27
5.3.11 Secretariat of the Pacific Community (SPC)	27
5.3.12 International Union for Conservation of Nature (IUCN)	28
5.3.13 Secretariat of Pacific Regional Environment Programme (SPREP)	29
5.3.14 Coral Reef Initiatives for the Pacific (CRISP).....	29
5.3.15 Institute of Marine Resources (IMR)	29
5.3.16 Pacific Center for Environment and Sustainable Development (PACE-SD)....	30
5.3.17 International Ocean Institute (IOI).....	30
5.4 National Laws, Policies and Plans	31
5.4.1 Fisheries Act	31
5.4.2 Marine Spaces Act.....	31
5.4.3 Environment Management Act.....	32
5.4.4 Fiji National Biodiversity Strategic and Action Plan (NBSAP)	33
5.4.5 Fiji's part in International Treaties and Conventions	34
5.5 Gaps in Coastal Legislation and Policies	34
5.6 Recommendations	37
5.6.1 Fisheries	37
5.6.2 Marine Managed Areas	38
5.6.3 Multi-sectoral, Multi-stakeholder Consultations	38
REFERENCES	38
6. COUNTRY PROFILE: SAMOA	43
6.1 Introduction.....	43
6.2 Background	43
6.2.1 Coastal Resources of Samoa	43
6.2.2 Economic Value of Reef Systems in Samoa.....	44
6.2.3 Major threats to Samoa reefs.....	45
6.3 Ecosystem Management Initiatives by NGOs in Samoa	47
6.3.1 O le Si'osi'omaga Society Incorporated (OLSSI)	47
6.3.2 The Foundation of the Peoples of the South Pacific International (FSPI)	47
6.3.3 Secretariat of the Pacific Community (SPC)	48
6.3.4 International Union for Conservation of Nature (IUCN)	48
6.3.5 Secretariat of the Regional Environment Programme (SPREP)	49
6.3.6 Matuaileoo Environment Trust Inc. (METI).....	49
6.3.7 Faasao Savai'i Society (FSS)	50
6.3.8 Samoa Umbrella for Non Governmental Organization (SUNGO).....	50
6.3.9 United Nations Environment Programme (UNEP).....	50
6.3.10 United Nations Development Programme.....	51
6.3.11 Conservation International	52
6.3.12 Pacific Islands Applied Geoscience Commission (SOPAC).....	52
6.4 National Laws, Policies and Action Plans.....	53

6.4.1 Fisheries Act	53
6.4.2 Lands, Surveys and Environment Act	54
6.4.3 National Parks and Reserve Act	55
6.4.4 Government (Fisheries Division) Fisheries Management Strategy	56
6.4.5 Min. of Natural Resources and Environment Policy on Climate Change	57
5.4.6 Min. of Natural Resources and Environment Policy on Biological Diversity	57
6.4.7 Samoa's National Biodiversity Strategy and Action Plan (NBSAP)	59
6.4.8 Min. of Natural Resources and Environment Management Plan 2008-2011..	60
6.4.9 Samoa's Part in International Treaties and Conventions	60
6.5 Gaps in Coastal legislation and Policies	60
6.6 Recommendations	63
6.6.1 Fisheries	63
6.6.2 Marine Managed Areas	63
6.6.3 Global Change	64
6.6.4 Multi-sectoral, Multi-stakeholder Consultation	64
References	64
7. COUNTRY PROFILE: TONGA	70
7.1 Introduction	70
7.2 Background	70
7.2.1 Coastal Resources of Tonga	70
7.2.2 Economic Value of Reef Systems in Tonga	72
7.2.3 Major threats to Tonga's reefs	72
5.3 Ecosystem Management Initiatives by NGOs in Tonga	73
5.3.1 Civil Society Forum of Tonga (CSFT)	73
5.3.2 Tonga Community Development Trust (TCDT)	74
7.3.3 Vava'u Environmental Protection Association	74
7.3.4 Langafonua a Fafine Tonga (National Women's Council)	74
7.3.5 PAN Pacific & South-East Asia Women's Association of Tonga (PPSEAWA)	75
7.3.6 Tonga National Youth Congress	75
7.3.7 Australian AID Programme	75
7.3.8 The Foundation of the Peoples of the South Pacific International (FSPI)	76
7.3.9 International Union for Conservation of Nature (IUCN)	77
7.3.10 Secretariat of the Regional Environment Programme (SPREP)	77
7.3.11 Pacific Islands Applied Geoscience Commission (SOPAC)	78
7.3.12 United Nations Environment Programme (UNEP)	78
7.3.13 United Nations Development Programme	79
7.4 National Laws, Policies and Action Plans	80
7.4.1 Parks and Reserves Act	80
7.4.2 Fisheries Management Act (2002)	81
7.4.3 Environment Impact Assessment Act (2003)	83
7.4.4 Marine Pollution Prevention Act (2002)	83
7.4.5 Waste Management Act (2005)	84
7.4.6 Inter-departmental Environment Committee (IDEC)	84
7.4.7 National Capacity Building Action Plan for Env't. Mgmt 2008-2013(draft)	84

7.4.8 Strategic Development Plan 8 (2006/7, 2008/9) Tonga (SPD 8)	85
7.4.9 National Biodiversity Strategy and Action Plan (NBSAP).....	86
7.5 Tonga’s Commitment to International Treaties and Conventions.....	87
7.6 Gaps in Coastal Legislation and Policies	88
5.7 Recommendation	89
7.7.1 Fisheries	89
7.7.2 Marine Managed Areas	90
7.7.3 Climate Change.....	90
7.7.4 Multi-sectoral and Multi-stakeholder Consultation	90
References.....	90
8. COUNTRY PROFILE: TUVALU.....	95
8.1 Introduction.....	95
8.2 Background	95
8.2.1 Coastal Resources of Tuvalu	95
8.2.2 Economic Value of Reef Systems in Tuvalu	96
8.2.3 Major threats to Tuvalu reefs	97
8.3 Ecosystem Management Initiatives by NGOs in Tuvalu	98
8.3.1 Tuvalu Association of Non Government Organizations (TANGO).....	98
8.3.2 The Luaseuta Foundation.....	98
8.3.3 Tuvalu Ship Registry.....	99
8.3.4 Alofa Tuvalu	99
8.3.5 Tuvalu National Council of Women (TNCW).....	99
8.3.6 Island Care.....	99
8.3.7 Australian AID Programme	100
8.3.8 New Zealand AID Programme.....	100
8.3.9 The Foundation of the Peoples of the South Pacific International (FSPI)	100
8.3.10 Secretariat of the Pacific Community (SPC)	101
8.3.11 International Union for Conservation of Nature (IUCN)	102
8.3.12 Secretariat of the Regional Environment Programme (SPREP)	103
8.3.13 United Nations Environment Programme (UNEP)	103
8.3.14 United Nations Development Programme.....	104
8.4 National Laws, Policies and Action Plans.....	106
8.4.1 National Fishing Corporation of Tuvalu Act.....	106
8.4.2 Environment Protection Act.....	107
8.4.3 Marine Resources Act	109
8.4.4 Marine Zone (Declaration) Act.....	112
8.4.5 Prohibited Area Act.....	112
8.4.6 Marine Pollution Act	112
8.4.7 Conservation Areas Act.....	113
8.4.8 Wildlife Conservation Act.....	114
8.4.9 Ozone Layer Protection Act.....	115
8.4.10 National Strategy for Sustainable Development 2005-2015 (NSSD).....	115
8.4.11 National Adaption Programme of Action	116
8.4.12 Tuvalu National Biodiversity Strategic Action Plan (NBSAP)	117

<i>8.5 Tuvalu’s Commitment to International Treaties and Conventions</i>	117
<i>8.6 Gaps in Coastal Legislation and Policies</i>	118
<i>8.7 Recommendation</i>	119
<i>8.7.1 Fisheries</i>	119
<i>8.7.2 Marine Managed Areas</i>	119
<i>8.7.3 Climate Change</i>	119
<i>8.7.4 Multi-sectoral and Multi-stakeholder Consultation</i>	120
<i>References</i>	120

EXECUTIVE SUMMARY

Sustaining healthy coral reefs is vital to the livelihoods of the people of the Pacific Islands. Global change is having increasing impacts on Pacific coral reefs, leading to increased vulnerability of coastal communities (Reefs at Risk Revisited, 2011. World Resources Institute). Integrating global change into policies across various national government sectors and then, translating this into actions that lead to sustainable management of coastal ecosystems is an enormous challenge. The project sought to address this through face-to-face dialogue between reef experts and government personnel responsible for coral reef management policies. It aimed to strengthen science-policy interaction and linkages and empower policy-makers to make informed decisions. The project targeted four countries all heavily dependent on their coral reefs: Fiji, Samoa, Tonga and Tuvalu.

Using the most recent information available on the sustainable management of coral reefs, the project brought Pacific Leaders together with scientists and experts so that they could be apprised of the impacts of global change and of those factors that are affecting the health of their coral reefs. For each country this detailed national dossier was prepared by the project team in consultation with the countries, leading into two-day workshops. The dossier includes a series of issues (including gaps) pertinent to each country which were used in the development of national coral reef plans. About a year later, countries were re-visited to review and measure the progress achieved on recommendations on fisheries, marine managed areas, global change and multi-sectoral, multi stakeholder consultations. Although progress varied in the four countries, it was evident that collaboration between relevant government departments needed to be improved and that there was a need for the establishment and implementation of management systems that will be on-going and self financing given the resources available.

Workshops were held between June and August 2010, in which a total of some 130 senior officials from Fiji, Samoa, Tuvalu and Tonga attended. The workshops identified priority actions for coral reef management. It was found that all four countries had in place, or are developing, appropriate policies for the sustainable management of their coral reefs, taking into account the anticipated impacts of global change. All lacked, however, an overarching policy and the necessary human resources and expertise required for implementation. This situation highlights the dilemma faced by the small Pacific countries responsible for the custodianship of the unique biodiversity of their reefs. In follow-up discussions two countries (Samoa and Tuvalu), requested our assistance in the development of their National Ocean Policies which would provide the needed over-arching policy and national commitment to sustainable coral reef management. The Institute of Marine Resources has the expertise to do this but would require the necessary funding.

The project provided a model for interaction between scientists and policy makers that could be readily extended to other Pacific Island countries or, for that matter, to other island states where the sustainable management of coral reefs is of vital importance for the conservation of valuable reef resources, and for maintaining the livelihoods of people.

1. INTRODUCTION

1.1 Project Rationale

Healthy coral reefs are vital to the sustainability of peoples' livelihoods in the Pacific Islands. Global change has increasing impacts on Pacific coral reefs, including sea level rise, increased sea surface temperature, ocean acidification, and natural phenomena like cyclones, leading to increased vulnerability of coastal communities. Integrating this knowledge of global change across various national government sectors, then translating this into policies that lead to sustainable management of coastal ecosystems remains a challenge. This will be addressed through face-to-face dialogue between reef experts familiar with the science of climate change, and government personnel responsible for the development of appropriate policies focusing on the sustainable management of coral reefs.

1.2 Purpose of this report

The need for the sustainable management of coral reefs is widely stated in all regional and national policies in the Pacific. It is also reflected in UNCED, the CBD and Barbados. The lack of adequate policy development and implementation required for the sustainable management of coral reefs and their resources has been reiterated (UNEP *et al.* 2004), and its importance is reflected in the Pacific Islands Regional Ocean Policy (South and Low 2008; South 2008; Veitayaki *et al.* 2004), which is meant to be a blue print for Pacific Island Countries. In consultation with the four countries, this detailed national dossier has been prepared to provide a basis for discussion during the workshops. It highlights pertinent issues, including gaps, for each country.

2. OVERVIEW – CORAL REEF ECOSYSTEMS

2.1 Coral Reef Resources

Coral reefs are a critical resource for millions of people. Coastal populations have relied on coral reefs as a source of food for millennia (Spalding *et al.* 2001). The stretches of coral reefs along various coastlines have acted as a protective barrier in times of natural disasters such as tropical storms. A significant amount of sediment input on the beaches of tropical regions is supplied by coral reefs. In cases of atoll islands, the reefs provide a rocky platform on which people live (Spalding *et al.* 2001). In recent times coral reefs have become a popular destination for tourists who seek tropical shores for adventure and diving activities. The tourist industry also provides a source of income and employment for some of the world's most impoverished nations (Spalding *et al.* 2001).

2.2 Distribution of Coral Reefs

Coral reefs are restricted to a broad belt, roughly confined to the tropics (approximately 25°N to 25°S), circling most of the globe. Within this region they are unevenly distributed, with large reef areas confined to remote island regions and offshore areas far from major land masses. Overall perspective on the area of coral reefs in the world indicates an estimate of 284 300 square kilometers of coral reefs worldwide (Table 1). Spalding *et al.* (2001), indicates the Pacific region to have the highest estimate of coral reef coverage by area, 115 900 square kilometers.

Table 1: Estimates of global reef area calculated from the reef maps. (Source: Spalding *et al.* 2001)

Region	Area (km ²)	% of world total
Atlantic and Caribbean	21 600	7.6
Caribbean	20 000	7.0
Atlantic	1 600	0.6
Indo-Pacific	261 200	91.9
Red Sea and Gulf of Aden	17 400	6.1
Arabian Gulf and Arabian Sea	4 200	1.5
Indian Ocean	32 000	11.3
Southeast Asia	91 700	32.3
Pacific	115 900	40.8
Eastern Pacific	1 600	0.6

The figures in Table 1 have been rounded to the nearest 100 square kilometers, and the percentage figures to one decimal place. The calculations were made by first simplifying the global coverage down to 1 kilometer grid, each grid cell being marked as reef or non-reef. The reef area was calculated as the total of 1 square kilometer cells with reef. This method was used in order to avoid the problems associated with using maps prepared at multiple scales. The exaggerated figures for total areas (the figures are greater than what is actually shown on the maps), can be justified on the grounds that the maps only show reef flat to reef crest areas, while the true reefs extend beyond these areas (Spalding *et al.* 2001).

Coral reefs are commonly categorized into three major reef types; fringing reefs, barrier reefs and atolls. The type of coral reef is governed by particular hydrological and geological conditions in tropical seas (Nybakken and Bertness 2005). The structure of a fringing reef includes a shallow platform out to a sharply defined edge, the reef crest, beyond which is a steeply shelving reef front dropping down to the sea floor. Barrier reefs are defined as older reef structures rising up from a deeper base at some distance from the shore, with a lagoon separating them from the coast. Atolls are circular reef formations enclosing a wide lagoon and are typically found in oceanic locations, away from the continental shelf (Spalding *et al.* 2001).

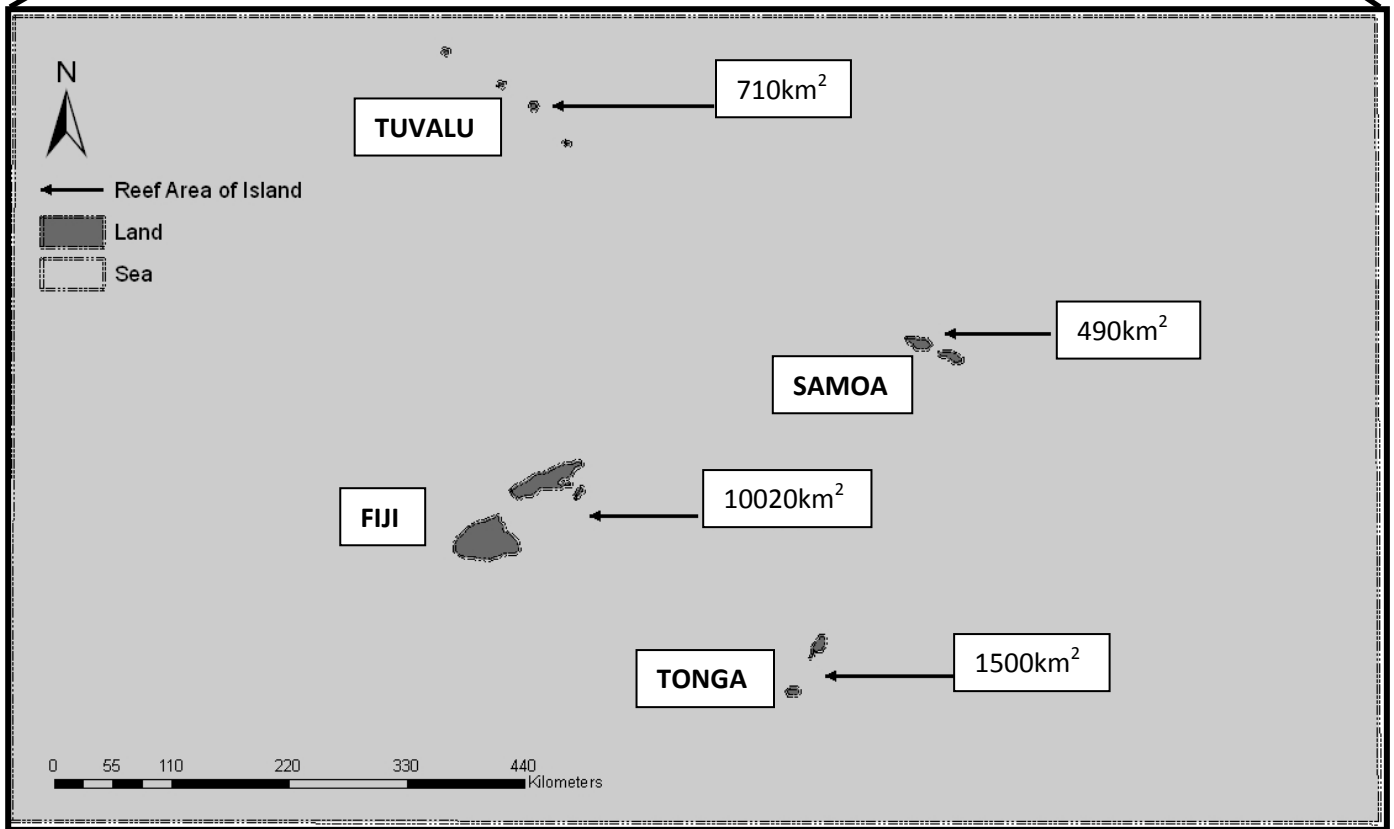
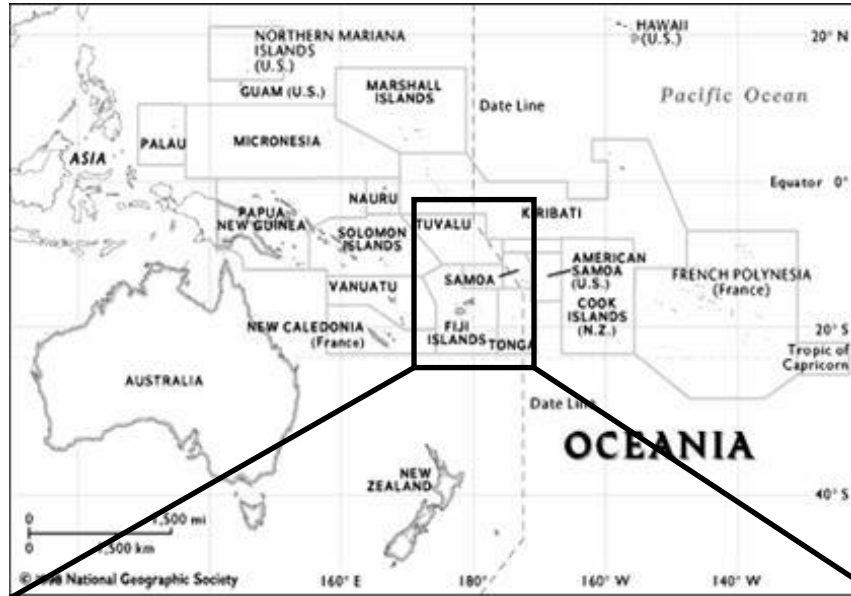


Figure 1: The location of Fiji, Samoa, Tonga and Tuvalu in Oceania. The arrows indicate the approximate reef area of each country.

2.3 Coral Reef Bio-diversity

Coral reefs are among the most biologically diverse ecosystems in the world. Although tropical rainforests contain more species than coral reefs, reefs contain more phyla than rainforests. Phyla are large groupings of organisms that are thought to be related. Covering less than 0.2% of the ocean floor, coral reefs contain perhaps a quarter of all marine species. New studies indicate that biodiversity on coral reefs may be even higher. Despite their limited area, coral reefs may be home to up to 25% of the fish catch of developing countries or 10% of the total amount of fish caught globally for human consumption as food. Reefs are also extremely valuable as breakwaters and draws for tourism (www.marinebiology.org).

Table 2: Regional patterns of species diversity in coral reefs and related ecosystems: the clear pattern of maximum diversity in the Indo-Pacific region is shown in all species groups.

Taxonomic Group	Indo-West Pacific	Eastern Pacific	Western Atlantic	Eastern Atlantic
Scleractinian corals ¹	719	34	62	
Alcyonarian corals	690+	0	6	
Sponges (general)	244		117	
Gastropods:				
Cypraeidae	178	24	6	9
Conus	316	30	57	22
Bivalves	2000	564	378	427
Crustaceans:				
Stomatopods	249	50	77	30
Caridean shrimps	91	28	41*	
Echinoderms	1200	208	148	
Fish	4000 (2304 – Fiji)**	650	1400	450
Butterfly fish and angelfish ²	175	8	15	7
Seagrasses ³	34	7	9	2
Mangroves ⁴	59	13	11	7

*All Atlantic. Source: Paulay (1997) except: 1. Veron (2000), 2. Allen et al. (1999), 3. WCMC database – figures include species with warm temperate distributions, 4. Spalding et al. (1997). Adapted from: Spalding et al. 2001.

**From the fish checklist prepared by Seeto and Baldwin (2010).

The two groups of higher plants associated with the coral reef ecosystem are seagrasses and mangroves. They form distinct ecosystems that are closely linked with the coral reef environment. However, in contrast with the coral reefs, the habitats associated with these species have low species diversity (Spalding et al. 2001). Many species of seagrasses are frequently found to be associated with the soft sediments of reef flat and lagoon areas. Apart from complementing the primary production in the reef ecosystem, seagrasses also act as nursery grounds for some of the juveniles of the species inhabiting coral reefs, feeding grounds for turtles, and they help consolidate the sediment environment. An opportunistic association exists between mangroves and coral reefs. The calm waters behind fringing and barrier reefs,

river mouths create the soft sediment and sheltered environment required for mangroves. Mangroves have the ability to bind silt and mud, which reduces the level of siltation in offshore areas and enables reefs to flourish. The movement of fish species between the mangrove and coral reef habitats is considerable, however, this appears to be opportunistic rather than essential (Spalding *et al.* 2001). The reef system is created by corals which belong to the class Anthozoa, phylum Cnidaria. Table 2 also presents other organisms found in the coral reef ecosystem, and their diversity.

2.4 Significance of Coral Reefs

The coral reef systems are diverse and complex and the human understanding of the complexity and reef interactions is limited. Humans themselves, in many areas, can be considered part of the coral reef system. Reefs are a source of food, protection and leisure. By acting as a barrier, reefs protect the coastlines and also create new land. Coastal populations have depended on reefs for food since pre-history (Spalding *et al.* 1997). Since the traditional times, fisheries have diversified considerably and reef fish, mollusks and crustaceans are now a major part of several commercial fisheries. In recent times, reefs have also been utilized in the tourism industry as places for recreation. The global estimate of the net benefit per year of the world's coral reefs is US\$29.8 billion. Out of this \$9.6 billion is associated with tourism and recreation, US\$9.0 billion is associated with coastal protection, US\$5.7 billion is associated with fisheries and US\$5.5 billion is associated with biodiversity (Conservation International 2008; Cesar *et al.* 2003).

3. THREATS TO REEF ECOSYSTEMS

For thousands of years, humans have been using the coral reefs for recreational purposes and as a source of food and other products. An increase in human population and their dependence onto reefs are damaging reefs at unpredictable rates (Hodgson 1999). "Estimates assembled through the expert opinion of 372 coral reef scientists and managers from 96 countries are that the world has effectively lost 19% of the original area of coral reefs; 15% are seriously threatened with loss within 10-20 years; and 20% are under threat of loss in 20-40 years" (Wilkinson 2008). A long term study (1996-2003) in PNG indicated that fish biodiversity abundance is directly proportional to coral cover. Survey results of eight separate reefs showed coral cover declined from 66% in 1996 to as low as 7% in 2002. Over 75% of reef fish declined in abundance due to habitat degradation, however the effects are even greater in species which has a greater dependence on living coral as juvenile recruitment sites (Jones *et al.* 2004).

Most people heavily depend on coral reefs and their resources for their livelihood especially in the Pacific island countries. This over dependence on coral reef ecosystems can have adverse effects to the continuance of a balanced ecosystem. Some of the major threats that affect the reef ecosystem are: Global climate change, overfishing, pollution, coastal development and biological threats.

3.1 Global Climate Change

There have been growing concerns about the global change in climate over the past few decades. Palaeoclimatologists have proven that earth's surface temperature has risen sharply in the past 200 years (Nunn 2007). Human activities have been identified as a major culprit in increasing green house gas emissions which are believed to have caused the rise of earth's surface temperature. Greenhouse gases in the atmosphere consist of carbon dioxide, water vapor and various trace gasses. These gases have the ability to absorb part of the sun's radiation while the residue is lost in space. When in its natural abundance, these greenhouse gases assist in maintaining earth's global surface temperature to 15°C, which is essential for life on earth (Campbell 2000). When these greenhouse gases increase in concentration beyond the acceptable limit (e.g. from 1970 to 2000, the CO₂ concentration rose by about 1.5ppm each year, but since 2000 the annual rise has leapt to an average 2.1ppm), it further increases the average global surface temperature (including sea surface temperature) which then starts to have drastic effects on life on earth.

Water temperature on reef areas have risen globally with the largest increase being in the Indian Ocean, which resulted in massive coral bleaching in 1998 (Wilkinson 2008). A rise in surface water temperature will cause the corals to stress and spit out their symbiotic zooxanthalle, causing massive bleaching of corals. With massive bleaching of corals, the whole of the complex coral reef ecosystem will be disturbed. This rise in water temperature will also cause thermal expansion, which is believed to be partially responsible for the rise in sea level. The other factors that are believed to be contributing to this rise are the melting of mountain glaciers (www.climatechange.org). Sea level rise is one of the further effects of climate change. During the 21st century, sea level is expected to continue rising, reaching levels as high as 88cm by Y2100 (Nunn 2007). Since corals depend on light to maintain their biological functions, a rise in sea level will result in coral not getting enough light at certain depths, which lead to coral death/bleaching (Hoegh-Guldberg 1999). Coral reefs will have to compensate for this rise in water level, by keeping up their growth to levels where they continue to receive sufficient sunlight.

In addition to sea temperature and level rise, ocean acidification is also predicted with the increase of carbon dioxide in the atmosphere, which will have adverse effects on the marine ecosystems. Oceans, along with terrestrial plants absorb CO₂ from the atmosphere. In the past 200 years, the increase in CO₂ in the atmosphere had led to an increase in amount of dissolved CO₂ in the ocean, which in turn increases carbonic acid concentration in the ocean (Solomon *et al.* 2007). "The most direct impacts of ocean acidification will be on marine ecosystems. A decrease in ocean pH would affect marine life by lowering the amount of calcium carbonate (the substance created when CO₂ is initially dissolved) in the water. Calcium carbonate is the substance used by many marine organisms (including coral, shellfish, crustaceans, and mollusks) to build their skeleton and shells. If the pH drops by the expected 0.5 during this century, the resulting effect would be a 60% drop in available calcium carbonate. Such a decrease would put the productivity and even the survival of thousands of marine species at risk" (www.climatechange.org).

3.2 Overfishing

Overfishing is defined as fishing at a rate faster than the reproductive rate of any marine organism. Overexploiting reef resources is one of the principal threats to its ecosystem stability (Newton *et al.* 2007). An exponential increase in the world's population has led to a directly proportional increase in demand for fisheries resources for food. Long-term unsustainable fishing may cause major direct and indirect effects on community structure of fishes and other reef organisms. It can result in a reduction in species diversity, and/or endangerment or extinction of target species, also affecting other species (not directly fished) in the process (Roberts 1995). Roberts (1995) further points out that "loss of keystone species, such as predators of echinoderms, through fishing, can lead to major effects on reef processes, such as accretion of calcium carbonate. Ultimately, sustained heavy fishing may lead to loss of entire functional groups of species, resulting in impairment of the potentially important ecosystem functions provided by those groups."

Some simple examples of results of overfishing of particular marine organisms are: a) increase in crown-of-thorns star fish due to overfishing of its major predator, triton shellfish (sciencera.com); b) overfishing of herbivorous fish can lead to over growth of macro algae on reefs (Scheffer *et al.* 2005), results in coral death due to not enough light penetration and space competition; c) Overfishing of filter feeding oyster in Chesapeake Bay, disrupted the balance of microalgae and oxygen content, which resulted the area becoming a "dead zone" that stretches for hundreds of square miles (see-the-sea.org).

The live reef food fish trade (LRFFT) often targets spawning aggregations of selected high value species, leaving a population with relatively reduced spawning stock, thus resulting in recruitment limitation (Pomeroy *et al.* 2004). A study conducted in Borneo showed a significant exponential decline in the population of reef fishes targeted by LRFFT (Scales *et al.* 2007). Furthermore marine ornamental and curio trade may also have negative effects on the reef ecosystem if not done sustainably. A review by Ziemann (2001) indicates that much stock of marine ornamental fish has been severely depleted. For example, abundance of eight marine ornamental fish species has declined in Hawaii, along with declines in butterfly fish in Sri-Lanka and anemone fish in Kenya (Ziemann 2001). These luxury wildlife trades (marine aquarium trade and food fish trade) are a major concern. High prices, together with strong demand, ensure incentives for constant heavy exploitation. Fishing efforts are being increased to cater for the high market demand, which leads to fish stocks being severely depleted. Overfishing is often accompanied by people's initiatives to increase catch by using destructive fishing methods. Bombs and cyanide are known to be used to catch fish and since this method is not selective, many other organisms are killed or stunned in the process. Destruction left after the cyanide fishing usually results in habitat/ coral loss.

The reef ecosystem is complex and there is a need to better understand the functional ecosystem processes and effects of biodiversity loss on these functions (Roberts 1995).

3.3 Pollution

Primary sources of coral reef pollution are land based (www.noaa.gov). Developments on land that are near coastal areas can alter the landscape and increase the level of runoff from land (Wilkinson 2004). “Runoff often carries large quantities of sediment from land-clearing, high levels of nutrients from agricultural areas and sewage outflows, and pollutants such as petroleum products and pesticides” (From: www.noaa.gov). Sediment runoff from land ends up on the reefs, smothers the corals, minimizing light penetration, and interferes with its ability to feed and reproduce. Thick sediment runoff can cause massive coral death due to disease, bio-erosion and eventually burying (Wilkinson 2004).

Nutrient runoff from agricultural lands results in high nutrient loading on the reef ecosystem. With excess nutrients in the water, marine micro and macro-algae, which otherwise exist in reasonable quantity, tend to overgrow (eutrophication) and disturb the balance of the reef ecosystem. Light dependent corals will not get enough light and will die. This will favor growth of other competitors, mainly those which tend to bore into and weaken the coral skeleton, for example, sponges, molluscs, worms and burrowing algae (Wilkinson 2004). Sewage runoff also contributes to the increase in inorganic nutrients in the water and may also increase water turbidity and pathogen introduction. “For example, *Aspergillus sydowii* has been associated with a disease in sea fans, and *Serratia marcescens*, has been linked to white pox, another coral disease.” (www.noaa.org). Household waste debris and chemical/pesticide runoff can alter the water chemistry and affect normal growth of corals and other marine organisms.

3.4 Natural Disasters and Disease Outbreaks

Increased frequency of natural disasters (hurricanes, earthquakes, tsunami etc) threatens reefs around the world, for example, the 2004 Indian Ocean mega thrust earthquake and tsunami caused considerable damage to coral reefs and ecosystems around the area (Wilkinson 2008). Coral disease outbreaks (bacterial, viral, fungal) also deteriorate reef health. “Coral diseases and syndromes generally occur in response to biotic stresses such as bacteria, fungi and viruses, and/or abiotic stresses such as increased sea water temperatures, ultraviolet radiation, sedimentation and pollutants” (<http://coris.noaa.gov>). The frequency of natural disasters and disease outbreaks may increase due to global climate change and pollution.

4. CONVENTIONS, TREATIES AND AGREEMENTS

4.1 International Conventions

4.1.1 Ramsar Convention

“The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources”

(www.ramsar.org). “Negotiated through the 1960s by countries and non-governmental organizations that were concerned at the increasing loss and degradation of wetland habitat for migratory water birds, the treaty was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. It is the only global environmental treaty that deals with a particular ecosystem and the Convention's member countries cover all geographic regions of the planet” (www.ramsar.org). The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world" (www.ramsar.org).

4.1.2 World Heritage Convention

“The World Heritage Convention was adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) General Conference at its 17th session in Paris on 16 November 1972. The Convention came into force in 1975” (whc.unesco.org).

The Convention is known to be a global instrument for the protection of world’s cultural and natural heritage. The Convention aims to promote cooperation among nations to protect heritage around the world that has outstanding universal value and to conserve all listed world heritage at all time (whc.unesco.org). Under this Convention, the marine and wetland environments are underrepresented, where there were only 28 coastal or marine sites out of a total of 144 sites by the year 2006 (Techera and Troniak 2009), however by 2010 this number increased to 49 (whc.unesco.org). Australia’s Great Barrier Reef was declared as a world heritage site in 1981. This reef is believed to have the world’s largest collection of coral reefs (400 types of corals; 1500 species of fish; 4000 types of mollusk). New Caledonia’s lagoons: “Reef Diversity and Associated Ecosystems” was also one of the declared (2008) world heritage coral reef sites (whc.unesco.org).

4.1.3 United Nations Convention on the Law of the Sea III (UNCLOS III)

The third United Nations Convention on the Law of the Sea (UNCLOS III) was signed in Montego Bay on the 10th of December 1982. The UNCLOS III came into effect in 1994; a year after Guyana became the 60th state to sign the treaty. To date, 158 countries and the European Community have joined the Convention. The Law of the Sea Convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for

Under Article 2 of the Convention, the Contacting Parties are obliged to designate suitable wetlands within its territory for inclusion in a list “Wetlands of International Importance.” The wetland reserve can include any area of marine water which does not exceed six meters at low tide. The coastal zones adjacent to wetlands can be included in the wetland area. Article 3 (1) states that designated wetlands should have comprehensive conservation strategic action plans. Even if a wetland is not included in the list, Contacting Parties are encouraged to promote the conservation of wetland areas by establishing nature reserves. If a Contacting Party deletes or restricts the boundaries of a wetland included in the list, it should compensate by creating additional reserves (Article 4:1). According to Article 4 (3), the exchange of data and publication regarding wetlands and their fauna and flora is encouraged. A Conference of the Contacting Parties is held in order to discuss the effectiveness of the wetlands in the list and related issues (Article 6). The bureau duties of the Convention are carried out by the International Union of Conservation of Nature and Natural Resources (Article 8).

A Natural Heritage under the World Heritage Convention can be declared for physical and biological formations including the habitats of threatened species of animals with outstanding universal value from an aesthetic, scientific and conservation point of view (Article 2). Each State Party to the Convention must recognize and ensure the need of transmission of the natural and cultural heritage to the future generation by taking appropriate legal, scientific, technical, administrative and financial measures necessary for identification, protection, conservation, presentation and rehabilitation of the heritage (Article 4). While undertaking effective and active measures to conserve the natural heritage, each State Party is to adopt a general policy, set up services for protection and conservation of the heritage, and develop scientific and technical studies through research which would aid in sustainable management of the heritage (Article 5).

The request for funds for rehabilitation of the heritage after damage by natural disasters is given priority by the World Heritage Committee (Article 21:2). The World Heritage Fund also provides financial assistance for research, training and supply of equipment for the protection, conservation, presentation and rehabilitation of the heritage (Article 22, 23). It is the duty of the State Party to educate and inform the public on the significance of the heritage to strengthen appreciation and respect by their peoples of the heritage (Article 27). Each State Party is required to submit a report on the legislative and administrative provisions which have been adopted for the application of this Convention (Article 29).

businesses, the environment, and the management of marine natural resources (en.wikipedia.org).

The UNCLOS III was negotiated to have a uniform and widely accepted system of control over the world's ocean and its resources. Under this Convention nations have legitimate rights and privileges, and responsibility over different ocean area features within 200 nautical miles (370 km) off their coastal baselines. The seas beyond this 200 nautical miles are the High Seas. Designed to meet the challenges of increased competition to acquire the ocean's resources, the Law of the Sea Conventions is the most comprehensive, political and legislative work undertaken by the United Nations (Craven 1982; Veitayaki 1995). The Law of the Sea describes 17 parts and 9 annexes which contain provisions determining the limits of national jurisdiction over ocean space, access to the seas, navigation, protection and preservation of the marine environment, exploitation of marine resources and conservation, scientific research, sea-bed mining and the exploitation of other non-living resources and the settlement of disputes (United Nations 1983: xxiv; Veitayaki 1995). In addition, the Convention also establishes new international bodies to govern the attainment of specific objectives under the Convention.

4.1.4 United Nations Conference on Environment and Development (UNCED)

The United Nations Conference on Environment and Development (UNCED), (also known as the Rio Summit, Rio Conference, Earth Summit), was a major United Nations conference held in Rio de Janeiro from 3-14 June, 1992. A total of 172 governments participated, with 108 sending their heads of state or government. There were approximately 2,400 representatives of non-governmental organizations (NGOs) who attended, with 17,000 people at the parallel NGO "Global Forum" who had Consultative Status (en.wikipedia.org). Five major Agreements on global environmental issues were signed during this conference:

- Rio Declaration on Environment and Development
- Agenda 21
- Convention in Biological Diversity (CBD)
- Forest Principals and
- Framework Convention on Climate Change (UNFCCC).

The Framework Convention on Climate Change and the Convention

on Biological Diversity, were formal treaties whose provisions are binding on the parties. The other three UNCED Agreements were non-binding statements on the relationship between sustainable environmental practices and the pursuit of social and socioeconomic development. Agenda 21 is a wide-ranging assessment of social and economic sectors with goals for improving environmental and developmental impact of each. The Rio Declaration summarizes consensus principles of sustainable development, and the Statement on Forest Principles pledges parties to more sustainable use of forest resources (www.ciesin.org).

4.1.5 Agenda 21

Agenda 21 is a United Nations programme, the full text of which was revealed at the United Nations Conference on Environment and Development on June 14, 1992. It is a blueprint of action to be taken globally, nationally and locally by organizations of the UN, governments, and major groups in areas where humans directly affect the environment. The 40 chapters of Agenda 21 are divided into 4 main sections: Section I – social and economic dimensions, Section II – conservation and management of resources for development, Section III – strengthening the role of major groups and Section IV – means of implementation (en.wikipedia.org).

Rio +5 was a special session held by the General Assembly of the UN, in 1997, to appraise five years of progress on the implementation of Agenda 21. It was decided by the Assembly that progress was ‘uneven’ and key trends were identified including increasing globalization, widening inequalities in income and a continued deterioration of the global environment. A new General Assembly resolution promised further action. At the World Summit on Sustainable Development (WSSD), the Johannesburg Plan of Implementation affirmed UN commitment to ‘full implementation’ of Agenda 21.

The Commission on Sustainable Development acts as a high level forum on sustainable development and has acted as preparatory committee for summits and sessions on the implementation of Agenda 21. The United Nations Division for Sustainable Development acts as the secretariat to the Commission and works ‘within the context of’ Agenda 21. Implementation by member states remains essentially voluntary (en.wikipedia.org).

Chapter 17 of Agenda 21 outlines the “protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources” (Rio de Janeiro, 3-14 June 1992). Agenda 21 provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources. Marine and coastal area management development is required at the national, sub-regional, regional and global levels. These need to be integrated in content and precautionary and anticipatory in ambit as outlined in the programs of Chapter 17 (Agenda 21): (a) integrated management and sustainable development of coastal areas, including exclusive economic zones; (b) marine environment protection; (c) sustainable use and conservation of marine living resources of the high seas; (d) sustainable use and conservation of marine living resources under national jurisdiction; (e) addressing critical uncertainties for the management of the marine environment and climate change; (f) strengthening international, including regional, cooperation and coordination; and (g) sustainable development of small islands. The implementation of the activities under these programs by the developing countries shall commensurate with their individual technological and financial capacities and priorities (Rio de Janeiro, 3-14 June 1992).

4.1.6 Barbados Programme of Action (BPoA)

The Barbados Programme of Action (BPoA) was adopted in the first Global Conference on Sustainable Development of Small Island Developing States (SIDS) which took place from the 25th of April to the 6th of May, 1994. The BPoA and the Declaration of Barbados listed 15 priority areas for specific action. These areas included climate change and sea-level rise; natural and environmental disasters; management of wastes; coastal and marine resources; freshwater resources; land resources; energy resources; tourism resources; biodiversity resources; national institutions and administrative capacity; regional institutions and technical cooperation; transport and communication; science and technology; human resource development and implementation, monitoring and review. In support of the Small Islands Developing States (SIDS), BPoA set forth specific actions and measures to be taken at the national, regional and international levels. Agenda 21 was translated into a programme of action for a group of countries for the first time by the Barbados Global Conference (www.un.org).

The Barbados Programme of Action +5 (BPoA +5), took place from 27-28 September, 1999 at the 22nd Special Session of the United Nations General Assembly (UNGASS) on Small Island Developing States (SIDS). This session adopted a State of Progress and Initiatives for the Future Implementation of the Programme of Action for the sustainable development of SIDS which identified six priority problem areas in need of urgent attention over the next five years: climate change, natural and environmental disasters and climate variability, freshwater resources, coastal and marine resources, energy and tourism (www.un.org).

The Barbados Programme of Action +10 (BpoA +10): Mauritius Strategy of Implementation, was the ten year review of the BPoA and took place in Port-Louis, Mauritius in January, 2005. The International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of SIDS was convened in January 2005, in Port-Louis, Mauritius. The meeting was attended by 18 Presidents, Vice-Presidents and Prime Ministers, some 60 ministers and nearly 2000 delegates, civil society representatives and journalists from 114 countries, and by 15 UN or multilateral agencies. The meeting showed “a renewed interest and commitment on the part of the entire international community for the issues of concern to these states - from environmental vulnerabilities to small economies, remoteness from world markets, high energy costs and waste management problems” declared by the UN Secretary General. Two outcomes of the meeting were a pro-active Strategy to further implement this programme of action, called Mauritius Strategy and The Mauritius Declaration (www.un.org).

4.1.7 Convention of Biological Diversity (CBD)

The Convention on Biological Diversity was inspired by the world community's growing commitment to sustainable development (www.cbd.int). The Convention aims to promote sustainable and equal use of all biological resources of the world. It came into force in December, 1993 and a total of 193 countries are party to this Convention. “The Convention on Biological Diversity provides a global legal framework for action on biodiversity. It brings together the Parties in the Conference of the Parties (COP) which is the Convention’s governing

The Contracting Parties of the Convention on Biological Diversity must be aware of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of its components. The Convention reaffirms that States are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner (Article 1, 10). The Contracting Parties must also be aware of the general lack of knowledge and information regarding biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures (Article 6:b). The Convention emphasizes that the fundamental requirement for conservation of biological diversity is *in-situ* conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings (Article 8). For the purpose of complementing the *in-situ* measurements, each State should adopt measures for *ex-situ* measurements (Article 9). The Convention recognizes the close and traditional dependence of the indigenous and local communities on the biological resources and the need to acknowledge the traditional knowledge on conservation of biological diversity and the sustainable use of its components. Each Contracting Party should also encourage cooperation between the government authorities and its private sector to develop methods for sustainable use of their biological resources (Article 10). The Parties must recognize the special need for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components in developing countries (Article 12). Article 13 of the CBD promotes public awareness and education on sustainable management of natural resources. The development of appropriate procedures for Environment Impact Assessments (EIA) is encouraged to avoid adverse impacts of developments on the natural resources (Article 7, 14). Other issues which may relate to the conservation of coral reefs covered by the CBD include; exchange of information (Article 17) and technical and scientific cooperation (Article 18). Each Contracting Party is required to provide reports on the measures undertaken for the implementation of the provisions of this Convention (Article 26) (Convention on biological diversity, Concluded at Rio de Janeiro on 5 June 1992).

body that meets every two years, or as needed, to review progress in the implementation of the Convention, to adopt programmes of work, to achieve its objectives, and provide policy guidance” (www.cbd.int). The COP is assisted by the Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA), which is made up of government representatives with expertise in relevant fields, as well as observers for non-Party governments, the scientific community, and other relevant organizations” (www.cbd.int).

4.1.8 World Summit on Sustainable Development (WSSD)

After a ten year cycle since the historic UN Conference on Environment and Development (UNCED) in Rio de Janeiro 1992, the UN held another conference to address sustainable development, which was known as the World Summit on Sustainable Development (www.worldsummit2002.org). The UNCED discussed “solutions for global problems such as poverty, war or the growing gap between industrialized and developing countries. In the centre was also the question of how to relieve the global environmental system through the introduction to the paradigm of sustainable development. UNCED emphasizes “economic and

social progress depends critically on the preservation of the natural resource base with effective measures to prevent environmental degradation” (www.worldsummit2002.org).

Following this, the “World Summit on Sustainable Development (WSSD), unofficially known as Rio+10, was a UN summit gathering at the highest level. World governments, UN agencies, Civil Society organizations, multilateral financial institutions and business gathered to assess global change since the UNCED. The official agenda of the World Summit was to review the achievements that have been made since the Rio Summit. Governments intended to debate what participating countries had done so far to implement the Rio action plan “Agenda 21” if they had ratified the Conventions e.g. to prevent biodiversity loss and what obstacles had been encountered; and if they had adopted national sustainable development strategies as was agreed they would by 2002” (www.worldsummit2002.org).

4.1.9 United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC is an international treaty that was produced at the UN Conference on Environment and Development (UNCED) in 1992. The signatories of this Convention acknowledge the growing change in the world’s climate and its effects on life on earth. The overall objective of the treaty was to address the issues of global climate change and the concentration of greenhouse gases, and make efforts to assist in stabilizing of these gases at an acceptable level (<http://unfccc.int>). As of December 2009, the Convention had 192 parties.

Each Party under this Protocol has to “individually or jointly ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012” (Articles 2, 3). The Protocol also aims to enhance and protect the sinks and reservoirs of greenhouse gases; taking into account its commitments under relevant international agreements (Article 2). The Parties included in Annex I of the Protocol would strive to implement policies and measures in such a way as to minimize adverse effects, including adverse effects of climate change, especially on developing country Parties (Article 3:3) (Kyoto Protocol to the United Nations Framework Convention on Climate Change).

Under the UNFCCC the Convention on climate change (CCC) and the Kyoto protocol was developed. The CCC “sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. Under the Convention, governments: gather and share information on greenhouse gas emissions, national policies and best practices; launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of climate change” (<http://unfccc.int>). This Convention became effective in March 1994.

“The Kyoto Protocol is an international Agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against the 1990

The Parties to the United Nations Framework Convention on Climate Change (UNFCCC) must acknowledge the adverse effects of global warming on the natural ecosystems and human kind due to the increasing atmospheric concentrations of greenhouse gases. One of the major objectives of the UNFCCC is to reduce the level of greenhouse gases in the atmosphere to a level that allows ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (Article 2, 3: 4, 5). The Parties must be “aware of the role and importance in terrestrial and marine ecosystems of sinks and reservoirs of greenhouse gases” (Article 3, 4). The Parties should cooperate in preparing for adaptation to the impacts of climate change by developing and elaborating appropriate and integrated plans for coastal zone management. To promote and cooperate with scientific, technological, socio economic and other research, to further the understanding of climate change, in order to reduce or eliminate the remaining uncertainties regarding causes, effects, magnitude and timing of climate change (Article 4:1). According to Article 6 of the Convention, education, training and public awareness programs on climate change should be conducted at a national, regional and sub-regional level. The Convention acknowledges “the global nature of climate change and calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capacities and their social and economic conditions” (United Nations Framework Convention on Climate Change, United Nations 1992).

levels over the five-year period 2008-2012.” The Protocol came in force in February 2005 (<http://unfccc.int>).

4.1.10 The Alliance of Small Island States (AOSIS)

The Alliance of Small States (AOSIS) is a coalition of small island low-lying coastal countries which are facing similar development challenges and environmental concerns, specifically, the effects of global climate change. It functions as a negotiating voice for Small Island Developing States (SIDS) within the United Nations system. AOSIS has 42 member and observer States (including Fiji) from all oceans and regions of the world: Africa, Caribbean, Indian Ocean, Mediterranean, Pacific and South China Sea. A total of 37 are members of the United Nations, approximately 28% of developing countries, and 20% of the UN's total membership. Together, SIDS communities constitute some 5% of the global population (www.sidnet.org).

The major human-induced climate change issues identified by AOSIS members include sea level rise, more frequent and extreme weather events, ocean acidification, coral bleaching, coastal erosion and changing precipitation patterns. AOSIS works at reducing all greenhouse gas emissions and in giving financial and technical support to vulnerable countries to aid them in their efforts to adapt to adverse impacts of climate change. AOSIS firmly supports the Rio Declaration and the UNFCCC and its Kyoto Protocol (AOSIS Declaration on Climate Change, 2009, www.sidnet.org).

4.1.11 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement between states, which aims to ensure that international trade in specimen of wild animals, plants and any product that is derived from them does not threaten their survival (www.cites.org).

The international wildlife “trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered but, the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future”(www.cites.org).

“CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species” (www.cites.org).

All species under CITIES are listed under three Appendices, depending on the degree of protection needed. Appendix I include species threatened with extinction; Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival and Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. There are 15 fish species listed under appendix I and 71 fish species listed under Appendix II (www.cites.org).

4.2 Regional Actions and Strategies

4.2.1 Pacific Islands Regional Ocean Policy

This Policy “was approved by Pacific Island leaders in 2002. It underscores the importance of the ocean to Pacific Island nations and communities and serves to unify a number of existing regional initiatives that address issues relevant to management and development of ocean and coastal resources and environments. The Policy’s goal is to ensure the future sustainable use of the ocean and its resources, by both Pacific Island communities and their external partners”(www.spc.int).

The implementation strategy known as Pacific Islands Regional Ocean Framework- Integrated Strategy Action (PIROF-ISA) builds on the principles of the Policy and sets a flexible

implementation framework that can be used by the partners. The five principles central to the goal of the Policy is: improving the understanding of the oceans; sustainably developing and managing the use of ocean resources; maintaining the health of the ocean; promoting the peaceful use of oceans; and creating partnership and promote cooperation.

CROP is a committee consisting of Pacific Island intergovernmental organizations, namely Forum Fisheries Agency (FFA), Forum Secretariat, and Secretariat of the Pacific Community (SPC), South Pacific Regional Environment Program (SPREP), South Pacific Tourism Organization (SPTO), University of the South Pacific (USP), Pacific Island Development Programme, Fiji School of Medicine (FSM), and South Pacific Board for Education Assessment. The Council has working groups which address a number of issues, the marine sector being one of them. The marine sector working group coordinates the implementation of the Pacific Island Regional Ocean Policy.

4.2.2 Apia Convention

The main purpose of the Convention is to encourage marine protected area establishment. This Convention was the first to demonstrate substantial concerns for the environment in the South Pacific. The Convention came in force from June 1990 and Fiji is a party to this. The Convention aims to safeguard representative samples of: natural ecosystems of the South Pacific region; superlative scenery; striking geological formation and regions and objects of aesthetic interest or historic, cultural or scientific value. The Convention encourages its parties to establish national parks and national reserves to conserve biodiversity (SPREP 1995).

4.2.3 Noumea (SPREP) Convention

The Noumea or SPREP Convention is a Convention to ensure proper protection of the natural resources and environment of the South Pacific Region and related protocol. It provides a broad framework for cooperation in preventing and regulating pollution of the marine and coastal environments. The Convention was open for signature at Noumea, New Caledonia, on 24 November, 1986 and came into force on 22 August, 1990. The Convention area includes all marine environments enclosed by the Exclusive Economic Zones (EEZ) of the 22 Pacific Island Countries and territories, including New Zealand and Australia's East coast and Islands, areas of high seas enclosed on all sites by these zones and other nominated areas of the Pacific Ocean under the jurisdiction of any party (www.sprep.org).

In addition, the Convention implements the UNEP Regional Seas Programme in the Pacific region which in turn promotes the WSSD Plan of Implementation targets for the establishment of marine and coastal protected area networks by 2012.

4.2.4 Other Regional Fisheries Treaties

Under the UNCLOS framework, several regional fisheries treaties elaborated on the conservation and management of offshore tuna fishery. These include:

- *The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean*, which covers Yellowfin, Bigeye, Skipjack and the Southern Albacore tuna fisheries.
- *The Wellington Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific*. This agreement requires state parties to bar their nationals and registered vessels from using driftnets in fishing activities.

4.2.5 National Environmental Management Strategies (NEMS)

The National Environment Management Strategies (NEMS) began in April 1991 and concluded in April 1994. NEMS was setup prior to UNCED by the PIC governments or consultants hired by governments. At the time NEMS were drafted, most of the countries involved did not have an Environment Department. The NEMS programme was initiated to address the basic environmental issues for the Cook Islands, Federated States of Micronesia, Kiribati, Marshall Islands, Niue, Solomon Islands, Tuvalu and Samoa. The NEMS programme aided in the development of environmental strategies of individual countries based on the country's unique economic, physical, cultural and social situation. The environmental strategies were coordinated in-country by a task force, comprising senior representatives from government departments, NGOs and the private sector. Environmental reports associated with the NEMS programme have been produced for Cook Islands, Kiribati, Federated States of Micronesia, Nauru, Niue, Palau, Marshall Islands, Solomon Islands, Tokelau, Tonga, Tuvalu and Samoa. Tonga already had an Environmental Plan, and similar projects were undertaken in recent years in Fiji, Vanuatu and Papua New Guinea with bilateral funding. Implementing the NEMS will involve relevant Environment Departments or Sections working closely with other governments' departments, NGOs, community groups and the private sector (www.fao.org).

4.2.6 Pacific Adaptation to Climate Change (PACC) Project

The PACC project is funded by the Global Environment Facility (GEF) with the United Nations Development Programme (UNDP) as its implementing agency and the Secretariat of the Pacific Regional Environment Programme (SPREP) as an implementing partner. The project timeline is from 2008 to 2012 (www.sprep.org). The Project is designed to promote climate change adaptation as a key pre-requisite to sustainable development in Pacific Island Countries. The PACC project covers 13 Pacific islands countries and helps develop three key areas that will build resilience to climate change in Pacific countries: food production and food security, coastal management and water resource management. Adaptation projects will be implemented nationally, and were selected after an intensive consultative process with the implementing agencies" (www.sprep.org). "Under the project, Fiji, Palau, Papua New Guinea and the Solomon Islands will focus on food production and food security. The Cook Islands, Federated States of Micronesia, Samoa and Vanuatu are developing Coastal Management capacity and Nauru, Niue, Republic of Marshall Islands, Tonga and Tuvalu are looking to strengthen their water resource management (www.sprep.org).

5. COUNTRY PROFILE: FIJI

5.1 Introduction

Fiji Islands, an archipelagic state, is located in the south-west Pacific Ocean, comprising more than 322 islands. The total land area covers approximately 18,000km² spread over 1.3 million km² of South Pacific Ocean. Thus more than 98% of Fijian territory is ocean. The majority of the Fiji Islands are volcanic in origin, although the group contains no active volcanoes. These islands are characterized by high central mountain ranges, with several large rivers leading down to coastal plains, then beaches and mangrove swamps surrounded by shallow water and coral reefs. The population of 827,900 is comprised of approximately 56% Indigenous Fijians and 36% of Indian origin with other Pacific Islanders making up a few percent. About 80% of Fiji's population live in coastal areas and are at least partially dependent upon fish and marine resources for subsistence (Techera and Troniak 2009). In 2008, the Fijian gross domestic production was worth USD 3.53 billion.

The waters of the Fiji Islands contain 3.12% of the world's coral reefs. This includes *Cakaulevu*, the Great Sea Reef, which is the third largest coral reef in the world. Marine life includes over 390 known species of coral and 2000 species of fish of which 41 are endemic (Seeto and Baldwin 2010). Fijian waters are the spawning ground for many species including the endangered hump head wrasse and bump head parrot fish. Six of the world's seven species of sea turtle inhabit Fijian waters (Techera and Troniak 2009).

5.2 Background

5.2.1 Coastal Resources of Fiji

Coastal areas play an important role in the Fijian society and are essential in national development as a whole. A number of urban centers and a majority of the local villages are situated along the coastal areas, along with much of the population, agriculture, industry and commerce. The income generated from tourism and fisheries is dependent on the condition and productivity of critical ecosystems and shoreline features such as coral reefs, beaches, sea grass beds and mangroves (Environment Report 2009). The coastal populations of Fiji depend on the coral reefs for the bulk of their protein. Subsistence catches from the reef total to approximately 17 000 tons per year; these catches include fish, shellfish, sea cucumbers, sea urchins and octopus (Spalding *et al.* 2001).

Reef Area and Types of Coral Reefs

Coral reefs cover an area of 10 020 square kilometers of the Fiji archipelago (Environment Report 2009; Spalding *et al.* 2001), representing 9.0% of the coral reefs of the Pacific and 3.5% of the total area of coral reefs in the world (Environment Report 2009). All islands of Fiji are associated with coral reefs. Fiji has approximately 1000 reef systems which are of many types,



including fringing, barrier and platform reefs. The largest continuous fringing reef of Fiji is along the southern coast of Viti Levu, stretching over 100 kilometers. There are two types of barrier reefs evident in Fiji. Oceanic ribbon reefs enclose lagoons or areas of normal sea and are entirely oceanic, such as the Great Sea Reef. This is the longest barrier reef of Fiji; it is 200 kilometers long and runs along the shelf edge from the Yasawas (west of Viti Levu), eastwards in a near continuous chain which gradually converges towards the coastline of Vanua Levu. The other type of barrier reefs is separated from the mainland by a relatively narrow lagoon such as off Suva. The Great Astrolabe Reef (Kadavu) is also one on Fiji's famous reef systems which consist of two barrier reefs and a lagoon structure (www.pcrf.org). A complex array of platform reefs exists along the northern coasts of both Viti Levu and Vanua Levu (Environment Report 2009; Spalding *et al.* 2001). A map illustrating the reef systems of Fiji is presented in Figure 2.

Coral Reef Biodiversity

The coral reef diversity of Fiji is high, as is expected due to its location in relation to the Indo-Pacific center of diversity (Table 2). Most of the studies of the reefs in Fiji are carried out by the non-government organizations, the research section of the Fisheries Department and the University of the South Pacific. The species identified in the coral reef ecosystem of Fiji include: about 342 species of scleractinian corals and 12 species of non-scleractinian corals, over 475 species of mollusk (including 253 nudibranchs and 102 bivalves), about 60 species of ascidians, and 576 algal species with 28 yet to be described (Lovell and McLardy 2008; South 2009; Spalding *et al.* 2001). A total of 2304 fish species has been identified, of which 2031 species have been confirmed whilst 275 species are still doubtful. There are 41 species endemic to Fiji, of which 33 are marine (Seeto and Baldwin 2010).

Economic Value of Reef Systems in Fiji

The marine environment of Fiji, (fisheries in particular) plays a central social and economic role for the nation. Of specific significance to local communities are the inshore waters and coastal zones. Historically, the main source of protein for local people has been marine food collected and caught from traditional fishing grounds (*qoliqoli*), with the excess harvest being sold (Techera and Troniak 2009). The marine resources (including fisheries), in addition to household needs, make a significant contribution to the national economy. Small scale artisanal and subsistence fisheries contribute to the national income. Overall, the fisheries sector contributes F\$91.9 million per annum to the national economy (2.7% of Gross Domestic Production (GDP)), which is the third largest natural resource. In addition, approximately twice the contribution of the GDP of the fisheries sector originates from the tourism industry which is dependent on a healthy marine environment (Techera and Troniak 2009).

Income from coral reef systems is through the inshore commercial fisheries (including aquarium trade) and subsistence fisheries. About 4 886 metric tonnes of domestic catch landings of reef finfish was recorded in 2008 valued at FJD24.7 million. For invertebrates, it was approximately 2 724 metric tonnes valued at FJD9.3 million. In addition there are over 800 villages in Fiji

Case Study 1: Coral Bleaching Events in Fiji

Coral bleaching due to high sea surface temperature (SST) was experienced in Fiji in 2000 and 2002 and to a lesser extent in 2005.

A nine year (1999-2007) biological monitoring of coral reefs across Fiji Islands showed that Fiji's reefs suffered mass coral bleaching events (Lovell and Sykes 2008). High SST resulted in coral bleaching in 2000 and 2002 with hard coral mortality estimates of 40-80%. The SST in both years remained above the long-term summertime average of 28.3°C for over three months (Lovell and Sykes 2008).

In 2000, mass bleaching of corals was observed in Fiji during the intense La Nina (Cumming *et al.* 2001). Cumming *et al.* (2001) surveyed 19 reefs locations within eight geographical regions in Fiji between mid April to July 2000. Bleaching was observed in all regions (except in Northern Vanua Levu), where 64% of Scleractinian corals were bleached. Bleaching was intense in Southern and Eastern sites lower bleaching incident was observed in some Western and one Northern site. SST exceeded the maximum summertime temperature for five months and peaked at 30-30.5°C. Fiji's bleaching threshold appears to be between 29.5-30°C (Cumming *et al.* 2001); however according to, National Oceanic and Atmospheric Administration (NOAA) Needs satellite information, Fiji's bleaching threshold is 29.2°C (Lovell and Sykes 2008).

Most reefs were observed to recover from mass bleaching events within five years and this indicates that Fiji's reefs may have high levels of resiliency (Lovell and Sykes 2008); however this resiliency may not continue if sea surface temperatures increase rapidly.

Case Study 2: Pollution in Ports and Industrial areas of Fiji

In 1996, the first data on chemical pollution in Fiji was documented. A study by Morrison *et al.* reported on the concentrations of a range of organochlorine (pesticide and related residues) compounds in sediments and shellfish in estuarine and coastal areas of Fiji. A significant number of organochlorines (20 pesticide related species and PCBs) were detected. Higher concentrations were detected in the two major port areas, Suva and Lautoka with Suva having the highest chemical pollution. This may be due to high commercial and port activities and a nearby rubbish dump site (Morrison *et al.* 1996).

Davis *et al.* (1999) investigated the levels of contamination from tri-butyl tin (TBT) in the Suva Peninsula. The study showed that levels were extremely high in bivalves and sediments. TBT is found in antifouling paints that are used by large commercial vessels. TBT leaches out from vessels and accumulates in some organisms and sediments, in other words these Act as geochemical sinks and are a threat to local invertebrate fishery (Davis *et al.* 1999).

Gangaiya *et al.* (2001) studied the level of heavy metal contamination in the Lami estuary which is located downstream of an industrial zone. The Lami estuary is used extensively for fishing and other recreational activities. "Sediment samples from twenty-nine sites within the area were analyzed...within the estuary, significant enrichment is evident, with heavy metal concentrations exceeding some of those from other known contaminated sites in the country. Copper contamination appears to be restricted to a few sites but contamination with lead and zinc seems to be spreading to areas further away from the shore. Metal distribution patterns clearly indicate adjacent factories to be the main source of contamination" (Gangaiya *et al.* 2001). Results prove that highly contaminated sites do exist in Fiji.

whose customary marine owners rely heavily on the reef for subsistence living. Fiji's subsistence fisheries landings is approximately 17500 metric tonnes valued at FJD54 million (Fisheries Annual Report 2008).

The tourism industry is heavily dependent on coral reefs. Fiji provides access to some of the best dive and snorkel sites which is a major attraction for tourists. Coral reefs are the source of the sediments which form Fiji's white sandy beaches, another attraction for tourists. In 2008, a total of 585 031 tourist arrivals were recorded by the Fiji Bureau of Statistics and this figure has increased approximately by 26% since 2003.

Major threats to Fiji reefs

Lovell and Sykes (2004 & 2008) have identified major threats to Fiji reefs through a series of continuous monitoring under the Global Coral Reef Monitoring Network for the South West Pacific Node. Overfishing, habitat destruction, pollution, coastal development, land based impacts of agriculture and tourism have been identified as having the greatest impacts on inshore reefs. Coral bleaching due to climate change was also experienced mainly in 2000, 2002 and to a smaller extent in 2005 (Case Study 1). Increased crown-of-thorns starfish, carnivorous snail density and coral disease have also been observed following the bleaching events.

Contaminants from major port areas are also a threat to nearby reefs. Major vessels discard ballast water in port areas, increasing the risk of introducing invasive organisms. Chemically polluted water can also reach nearby reefs and affect the reef ecosystem; some local studies have detected areas with heavy pollution (Case Study 2). Large amounts of household waste can be observed in major port areas of Fiji, believed to have washed down from the improper rubbish disposal of nearby urban areas (Lovell and Sykes 2008).

Sedimentation and nutrient enrichment threats are evident near populated and developed areas, such as the Coral Coast of Viti Levu, Laucala Bay (Case Study 3), and the Mamanuca and Yasawa Islands. Eutrophication is mainly observed in the Mamanuca and Yasawa islands and is believed to be due to the combined effects of nutrient enrichment (also through sewage), sedimentation and overfishing of herbivorous fish. On the northern and western

side of Fiji, this pollution is attributed to large-scale agricultural activities which contribute to runoff of fertilizer, sediments, pesticides and other chemicals to the nearby water ways which find its way to the reefs (Lovell and Sykes 2008).

Overfishing and its threats are being acknowledged in Fiji and some villages have noticed rare-to-no sighting of certain fish and invertebrates (Lovell and Sykes 2008) however, this has not been scientifically verified.

Reefs in confined shallow water environments and storm paths are susceptible to major damages. Cyclones which crossed Fiji in 2001, 2003, 2004 and 2009 caused damages in some areas however, the reefs usually recovered within a few years (Lovell and Sykes 2008).

5.3 Ecosystem Management Initiatives by Non-government Organizations in Fiji

The following paragraphs outline the major initiatives undertaken by NGOs in Fiji to address the issues related to global change and sustainable use of coral reefs:

5.3.1 World Wildlife Fund for Nature (WWF) - South Pacific

In its efforts to address the issues of climate change and its possible impacts on Pacific Island people and resources, WWF is involved in awareness campaigns that urge people to take action towards becoming resilient to the adverse impacts of climate change. Awareness videos, booklets and post cards are being used to pass information to school children, civil society and government departments. In another project, WWF in collaboration with the Fiji Government and other stakeholders are working to restore mangroves in a bid to increase the resilience of coral reefs to climate change. WWF also works with conservation managers to increase the resilience of Pacific Island ecosystems against the impacts of climate change. The WWF team in partnership with WWF Indonesia Friends undertakes climate change and impact assessments especially coral reef monitoring on Kabara Fiji. Community members of Kabara are also being trained in coral reef monitoring, which later will assist in assessing the extent of bleaching (www.wwfpacific.org.fj).

Case Study 3: Nutrient Enrichment in Coral Coast and Laucala Bay, Fiji

Water quality study (Mosley and Aalbersberg 2003) in sea and river water along the Coral Coast suggest that several sites along the coast have potentially damaging levels of nutrients (nitrate and phosphate), which can be detrimental to nearby coral reef health. The study showed mean levels of nitrate and phosphate as $1.69\mu\text{M}$ and $0.21\mu\text{M}$ respectively while the recommended level is $> 1.0\mu\text{M}$ nitrate and $>0.1\mu\text{M}$ phosphate. The nutrient enrichment coupled with overfishing of herbivorous fish has been identified as possible reasons for macro-algal growth along areas of Coral Coast. Nutrient levels were higher near hotels and populated areas and generally higher in river waters than seawater. Nutrient enrichment is a concern because local communities depend heavily on reefs for tourist attraction and food. A prolonged effect of elevated nutrient levels will degrade the nearby coral reefs as coral won't be able to over grow macro algae. The study emphasizes that immediate actions (by communities and government) need to be taken to address issues of land-based sources of wastes/nutrients before they enter the marine environment. Prolonged effects of nutrient enrichment will eventually kill off the coral reef ecosystem (Mosley and Aalbersberg 2003).

Another study by Singh *et al.* 2009, investigated the nutrient levels in Suva's Laucala Bay area. Data was compared with "before and after" improvements at the Kinoya Sewage Treatment Plant (KSTP). Results of the study showed that the bay still had high levels of nitrates (x2) and phosphates (x10). After the KSTP improvements, nutrient effluents have been reduced. However this is not reflected in the waters of the Bay, indicating alternate sources of nutrients. Inputs from other point and non-point sources need to be quantified and controlled to protect the biodiversity of the marine ecosystems within the vicinity of the Laucala Bay area (Singh *et al.* 2009).

WWF is also trying to work closely with the Coral Triangle Initiative to identify new approaches to lobbying governments, regional organizations and private sector decision makers, based on clear socio-economic arguments, to influence policy and trigger changes in behavior for sustainable ocean governance. WWF South Pacific Programme through its policy team advocates the lessons learnt from the field to influence policy changes at the national, regional and international level. Activities include support for the development of National Biodiversity Strategies and Action Plans (NBSAP) in several Pacific island countries, Climate Change, and the establishment of sanctuaries for endangered and threatened ecosystems such as whales, and marine ecosystems (www.wwfpacific.org.fj).

5.3.2 Wildlife Conservation Society (WCS) - Fiji

WCS is working with villages in the Kubulau district to establish an ecosystem-based approach to coral reef conservation. Within the Kubulau qoliqoli (the traditional sea tenure area owned and managed to a large extent by Kubulau villages), WCS and its partners have conducted basic ecological and socioeconomic assessments, worked with the communities to map fishing patterns and needs, and developed Fiji's first marine protected area network. Selected and designed to form an interconnected system, the network's 20 individual marine protected areas work together with 11 small areas that are open to fishing occasionally and 8 that are closed entirely (www.wcs.org).

5.3.3 Locally-Managed Marine Area (LMMA) Network

The LMMA Network is a group of practitioners involved in various marine conservation projects around the globe. The network seeks to reach its vision by networking practitioners (both individuals and organizations) and researchers who are committed to sharing experiences and information on determining the conditions under which locally-managed marine areas can contribute to conservation (www.lmmanetwork.org).

The Fiji LMMA (FLMMA) Network is the first country-level network to operate independently of the overall Network. FLMMA has the most project sites in the overall Network. The LMMA approach has brought back to life fading traditional management practices and has been formally adopted by the state government, which is in the process of officially transferring ownership of coastal areas and resources back to traditional land-owning clans (www.lmmanetwork.org).

5.3.4 Institute of Applied Science (IAS) - University of the South Pacific

IAS' Integrated Coastal Management program (ICM) is a management process that involves different stakeholders (government, community, science, difference sectors, NGOs) and different levels of government working together to prepare and implement a plan for the development, protection and utilization of coastal resources. IAS, with assistance from various government departments, is currently implementing a project on integrated coastal management (ICM) in Fiji. The initiative focuses on various issues including waste management

and coastal water quality, marine resources management, village governance, alternative income generation and coastal development planning. The Coral Coast area is the pilot site to demonstrate how stakeholders can work together to make decisions and develop localized plans. A national ICM committee has also been established to advise, learn and discuss policy level issues from the pilot site. The project also seeks to assist national government departments in implementing sustainable tourism and addressing waste management” (<http://ias.fste.usp.ac.fj>).

The Institute is also an active member of the Asia-Pacific Locally Managed Marine Area (LMMA) Network through the Fiji LMMA, which is involved in various community based marine conservation projects (<http://ias.fste.usp.ac.fj>).

5.3.6 Mamanuca Environment Society (MES)

The Mamanuca Environment Society is engaged in the promotion/ awareness of the need to protect the marine and terrestrial resources of the Mamanuca Region and assists, through partnerships with local communities, tourism operators, government and non-government organizations, in the environmentally sustainable development of these resources for the benefit of present and future generations (<http://mesfiji.org>).

The Society’s mission is to better inform all stakeholders, be they MES members or surrounding communities, of the environmental issues that face the region and country as a whole. MES highlights through stakeholder environmental awareness and protection communication, the relevant steps and strategies needed to ensure sustainable tourism and community livelihood. MES also runs a reef awareness program whereby staff and tourists are educated on simple marine biology and best practices. Reef check surveys are conducted to assess reef health and status. MES is also involved in other projects such as turtle conservation, water analysis, waste management, Crown-of-Thorns (COT) control and clam and coral restoration (<http://mesfiji.org>).

5.3.7 Partners in Community Development Fiji (PCDF)

PCDFs mission is to empower and assist communities to make informed decisions for their own future development. Their projects fall under Community Capacity Enhancement (CCE) and Natural Resource Management (NRM). Under the NRM program, PCDF has two major projects that involve supporting the sustainable management of marine and coastal resources: 1) *Cakaubulabula (Living Reefs) Project* supports the conservation and sustainable management of marine and coastal resources by communities, resorts and marine industries in the areas most utilized and impacted by the tourism and coral-reef based industries of Fiji, resulting in increased fish catches, enhanced tourism, and enhanced reef-based industries. Currently four villages in Yasawa, seven villages in Nacula and 10 villages in Moturiki are involved; 2) *Community Based Protection of Coral Reefs and Healthy Reefs Project* addresses root causes of marine degradation and rural poverty by supporting sustainable livelihood initiatives as incentives to conservation and currently involves eight villages from Serua and 10 villages from

Moturiki; 3) *Cuvu Community Environmental Initiative* aims to find and apply permanent solutions to long-standing environmental, socio-political and cultural problems which negatively impact tourism at the Shangri-La Fijian Resort (donors). (www.pcdf.org.fj/).

5.3.9 The Foundation of the Peoples of the South Pacific International (FSPI)

FSPI is the regional secretariat for a network of 20 independent community-based organisations working in the Pacific to foster self-reliance and sustainable development. It is one of the largest, most experienced civil society organisations in the Pacific, with Network Partners in Fiji, Kiribati, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu, Vanuatu and Timor-Leste, and metropolitan partners in Australia and the United States (www.fspi.org.fj).

FSPI's Communities and Coasts Program helps communities build on these strengths towards self-reliance, in combination with new knowledge and institutions. The Communities and Coasts Programme currently has programmes in Vanuatu, Solomon Islands, Kiribati, Tuvalu and Fiji to assist communities, government and NGOs to improve their own resource management practices and processes (www.fspi.org.fj).

5.3.10 Pacific Islands Applied Geoscience Commission (SOPAC)

The Ocean and Islands Programme of the Pacific Islands Applied Geoscience Commission (SOPAC) is an integrated programme focused on research, development and management of non-living resources in ocean and island systems addressing issues relating to seabed resources, energy, and maritime boundary delimitation and monitoring of ocean processes. The term ecosystem, in this case, is consistent with the Regional Ocean Policy, the Johannesburg Action Plan for Sustainable Development and the Convention on Biodiversity. An ecosystem-based approach includes all physical, chemical and biological attributes together with living and non-living resources. SOPAC is focused on the physical and chemical attributes of ecosystems and their non-living resources assessment (www.sopac.org).

5.3.11 Secretariat of the Pacific Community (SPC)

The Secretariat of the Pacific Community (SPC) has a Reef Fisheries Observatory under their Marine Programme. The SPC Reef Fisheries Observatory provides information to the SPC members and to all parties involved in Pacific Island reef resource management. This section of SPC disseminates information to local communities and international donors interested in the sustainability of the various reef fisheries in the Pacific. The section also aids the Pacific Island governments which require advice on the management of local fishery resources under their jurisdiction. A subsection under the SPC Coastal Fisheries Programme known as the Coastal Fisheries Management Section (CFMS) was established to provide regional support services. The CFMS assists the Pacific Islanders in identifying the status and optimizing the long-term social and economic value of small-scale fisheries and aquatic resources in Pacific waters (www.spc.int).

SPC is also involved in regional climate change programmes. SPC is working closely with the Fiji Forestry and Environment Department to implement the REDD-plus policy (reducing emissions from deforestation and forest degradation). The SPC/German Technical Cooperation (GTZ) Pacific-German Regional Programme on Adaptation to Climate Change in the Pacific Island Region commenced in January 2009 and is funded by the German Federal Ministry for Economic Cooperation and Development. The project is based with the SPC Land Resources Division in Suva, Fiji with activities in Fiji, Vanuatu, and Tonga (www.spc.int). The programme aims to assist SPC member countries in coping with the adverse effects of climate change however, this programme mainly focuses on land-based resources.

5.3.12 International Union for Conservation of Nature (IUCN)

IUCN is involved in three related projects: 1) Pacific Ocean 2020 Challenge: rescuing an ocean in crisis; 2) Mangrove Ecosystems for Climate Change and Livelihood in the Pacific (MESCAL); and 3) Pacific Centre for Environmental Governance (PCEG).

The 2020 challenge seeks to focus global attention, build new partnership and generate the necessary commitments and resources required to “develop and implement a long-term comprehensive and cohesive strategy and action plan to curb the impacts on the Pacific Oceans ecosystems and the resulting negative impacts on the Pacific Ocean region and the globe” (IUCN 2010 concept paper).

The MESCAL project started in December 2009 and involves five Pacific island countries: **Fiji**, Samoa, Solomon Islands, Tonga and Vanuatu. The primary goal of MESCAL “is to help reverse recent trends in the loss of mangroves, increase resilience of the people of the Pacific to climate change and provide natural insurance against the effects of climate change and extreme events. The project will help participating countries invest in stakeholder based management of mangroves and associated ecosystems by developing sound evidence-based policies, plans and practices and targeted capacity development of government, NGO, and community members as appropriate in mangrove conservation practices and rehabilitation. This interdisciplinary applied research and development project will also involve IUCN’s collaborating partners, such as the University of the South Pacific, WorldFish Center (WFC), Pacific Regional Environmental Programme (SPREP), and many government agencies and NGOs in the participating countries” (IUCN 2009).

PCEG, under IUCN Oceania, is a “virtual centre of excellence in environmental governance focusing on environmental law, environmental policy, environmental economics and leadership and learning. PCEG aims to strengthen enabling environments of laws, policies, formal and traditional institutions and decision-making processes for effective, efficient, equitable, transparent and accountable decisions within local and national political, socio-economic, and environmental context” (<http://www.iucn.org>). IUCN Oceania also has a Pacific Resource and Environmental Economics Network (PREEN). The inadequate consideration of economics issues in natural resource management is due to lack of capacity in that area. In response to this, IUCN organized a meeting with practicing resource economists in 2007 and formed PREEN,

whose purpose is to provide support and share ideas to progress economic analysis for sustainable resource management in the Pacific (<http://www.iucn.org>).

5.3.13 Secretariat of Pacific Regional Environment Programme (SPREP)

SPREP was established by the governments and administrators of the Pacific Island Countries, and is responsible for managing and protecting the environment and natural resources of the Pacific region. The initiative of Pacific Communities to establish SPREP shows their dedication towards sustainable development, especially in accordance with the outcomes of WSSD implementation plan, the Millennium Development Goals and Declaration, the Barbados Plan of Action and Agenda 21 (<http://www.sprep.org>). SPREP's Climate Change Vulnerability and Sea-level Rise project works in line with WSSD and UNFCC goals. SPREP is working on five focal areas under this programme: 1) strengthening meteorological services (project: PIGCOS), 2) Understanding climate change variability and sea-level rise (project: ARMS), 3) Vulnerability, adaptation and mitigation (project: CBDAMPIC and PIGGAREP), 4) Ozone depleting substance (project: ODS) and 5) Policy development on climate change (www.sprep.org).

5.3.14 Coral Reef Initiatives for the Pacific (CRISP)

“The Initiative for the Protection and Sustainable Development of Coral Reefs in the South Pacific (CRISP) was initiated by France in 2002. The Agence Française de Développement (French Development Agency – AFD) designed the technical content of the project, which comprises three main components to be supervised by four lead agencies (CI, CNRS, IRD, UNF), coordinating the work of 17 operators in 15 island countries and territories of the South Pacific. Component One addresses the definition of an eco-regional strategy for reef biodiversity conservation, the setting up of MPAs and support for existing ones and the development of tools for integrated coastal management (including watershed management, land tenure, socio-economic and sociology). Component Two encompasses knowledge development, monitoring, rehabilitation and economic use of reef ecosystems. Component Three specifically targets communication, knowledge collection and sharing and coordination of the whole project” (CRISP 2005).

“CRISP aims to develop a vision for the future of coral reefs and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally” (www.crisponline.net). In Fiji the local partners were PCDF, FSPI, USP and FLMMA. Reports of all studies done can be found on the CRISP website: <http://www.crisponline.net/>

5.3.15 Institute of Marine Resources (IMR)

IMR provides scientific and technical skills, and capacity-building, marine resource assessments, coral reef monitoring/ database maintenance, and socio-economic analysis for fisheries and aquaculture. IMR aims to increase the regional capacity to sustainably develop its marine

resources through applied research, training and teaching. Research and development projects focus on marine ecology, aquaculture and biodiversity issues (www.usp.ac.fj).

Much of IMR's work is externally-funded research and consultancies on the region's marine environment and its resources. Current activities centre on coral reef monitoring, marine biodiversity assessment, aquaculture management and cetacean research. The Institute also coordinates the South-West Pacific node of the Global Coral Reef Monitoring Network (GCRMN).

5.3.16 Pacific Center for Environment and Sustainable Development (PACE-SD)

The Pacific Center for Environment and Sustainable Development (PACE-SD) works with international and regional governments and non-government organizations to promote environmentally sustainable developments. Since 2001, PACE-SD has been involved in various Pacific environmental issues. The inception of PACE-SD was part of the University of the South Pacific's (USP) recognition of a collaborative approach to education, research, consultancy and capacity building in Pacific Island region. The recent projects associated with climate change issues in the Pacific region undertaken by PACE-SD include: modeling climate change impacts on Viti Levu (Fiji) and Aitotaki (Cook Islands) and community adaptation projects on 9 villages in Fiji (<http://ias.usp.ac.fj>).

5.3.17 International Ocean Institute (IOI)

The International Ocean Institute (IOI) is an international knowledge-based institute, and was founded in 1972. IOI is devoted to the sustainable governance of the oceans. It has 25 operational centers around the world and its activities involve capacity development, research, policy analysis, advocacy, dissemination of information, training and education, project implementation and promotion of peaceful use of oceans (www.ioinst.org).

"The IOI-Pacific Islands (IOI-PI) is one of the 25 Operational Centres and it is based at the University of the South Pacific (USP), Suva, Fiji Islands. It operates under a Memorandum of Agreement with the University and with the Government of Fiji, as an independent international NGO. IOI-Pacific Islands is a cooperative venture with the University of the South Pacific, through its Division of Marine Studies" (www.usp.ac.fj/ioi/) and activities of this Centre involves other USP member countries. IOI Pacific Islands is involved in specific programs such as; 1) "Women and the Sea" initiative, where IOI supports the community's initiatives toward resource management under LMMA; 2) "Articulating Sustainable Development in Gau Island" work involves research and development on sustainable rural development in Gau; 3) "Training Courses" whereby IOI trains communities on issues such as MPA managements, economics for community based projects, responsible fisheries and coastal management (www.usp.ac.fj/ioi/).

5.4 National Laws, Polices and Plans

5.4.1 Fisheries Act

The Fiji Fisheries Act, which is currently under review, is the key legislation that regulates marine activities in Fiji waters. This Act outlines the criteria to sustainably manage marine resources by placing restrictions on the catches and fishing areas as well as policing fishing licenses. The management and enforcement of the Fisheries Act is carried out by the Ministry of Fisheries and Forests' Fisheries Department.

Under the Fisheries Act, a license is needed to take fish from the Fiji waters, unless fishing for subsistence needs. The fishing vessels operated by the licensed fishermen are required to be registered. In efforts to ensure that the licensing conditions are followed, licensed officers are entitled to sight the license, the fishing gear and the catch of fishermen. Fish wardens can also be appointed by Ministers to detect and prevent offences under the Fisheries Act.

The inshore fishing grounds of Fiji are divided amongst the local clans (*mataqali*). Each clan has sole proprietorship to their fishing grounds and no other person can fish in their fishing area without permission from the head of the clan and Commissioner of the Division. The Fisheries Act recognizes the traditional or customary fishing rights of indigenous Fijians so an indigenous Fijian does not require a license when fishing in his traditional or customary fishing area (*i-qoliqoli*). Regulations on the fishing methods, including gear specifications and size, weight, areas, season and species limitations, can be made by a Fisheries Minister. (*For penalties on offences related to fishing activities, refer to Section 10 – 12 of the Fisheries Act*)

According to Section 10 of the Fisheries Act, fishermen using destructive methods for fishing are liable to severe penalties. However, under Section 11 of the Fisheries Act, a Minister has the authority to issue a permit to use an appropriate fishing method, including explosives.

For the purpose of conservation, size and take limits have been placed on marine fish and invertebrates; fish, crabs, turtles, trochus, davui and giant helmet shell. Taking shells and selling, offering and exporting of davui, giant helmet shells and turtle shells and its derivatives are prohibited. There are also export restrictions on giant clam meat, bêche-de-mer and fish. However, under Regulation 27 (Part VI, Section 9) of the Fisheries Act, written exemptions can be made on the above, by the Permanent Secretary for Agriculture and Fisheries or any person appointed by him.

5.4.2 Marine Spaces Act

“The Act sets out the boundaries and rights pertaining to internal waters, archipelagic waters, territorial seas, exclusive economic zone, and the continental shelf in relation to Fiji’s rights. The Act enables regulations pertaining to the management of fisheries to be determined by the Minister, including: allowable catches by Fijian and foreign vessels; licensing of fishing vessels; and appointment of Fisheries Officers. The Act also details penalties for misconduct under the

Act's regulations including the loss of fishing license and fines, however, it does not provide for regulations of inshore fisheries with the licensing regulations and subsequent enforcement regulations applying only to EEZ" (Environment Report 2009).

5.4.3 Environment Management Act

The Environment Management Act (EMA) is based on the principles of sustainable use and development of natural resources. It recognizes the significance of the preservation of coastal zones, wetlands, lakes and rivers, the protection of outstanding natural features, the relationship of indigenous Fijians with their ancestral lands and waters and the protection of human life and health. The EMA also aims to manage waste disposal and pollution and to establish a National Environment Council for matters related to natural resource management.

"The Act has introduced new processes including waste management and pollution controls and Environment Impact Assessments (EIA) as well as the introduction of requirements to plan for natural resource use and to report upon the status of the environment" (Environment Report 2009).

The Department of Environment administers Environment Impact Assessments (EIA) in cases of developments affecting environmental resources and arousing public concern. The Department is required to have a resource management unit which carries out surveys/inspections and collates geographic and natural resource information for the purpose of establishing the Natural Resource Inventory.

The Act also requires the establishment of an Environment Management Committee, which ensures proper management of environments by local businesses and public in general. For the purpose of environmental audits, the natural resources associated with the relative organizations are required to be recorded as natural resources accounting designed for quantification in financial terms.

"Under the new Environmental Impact Assessment (EIA) procedures, unless exempt, any development proposals considered to have the potential for significant environmental or resource management impacts must now undergo and be assessed using an EIA process. These development proposals may also be subject to approvals under the Town Planning Act. Responsibility for the undertaking of the EIAs has been tasked to the Department of Environment's EIA Administrator. The department is responsible for examining and processing every development proposal that is referred to it by the approving authority." (Policy, Law and Institutional Capacity Report 2009).

"The Act's new EIA processes also cover a number of other areas including logging, agriculture and pollution, all of which have potential impacts on coastal and marine resources. For example, under the Act a proposal for a commercial logging or sawmill operation must now be approved through the EIA process prior to any approvals of logging permits. Likewise, certain agricultural activities may also be subject to the EIA process. Livestock waste requiring a permit

under the Act is of particular importance in Fiji as pig waste from small village piggeries is a key health and coastal water quality issue” (Policy, Law and Institutional Capacity Report 2009).

“The Act also provides for the control of pollution through the issuing of permits under Section 5. Where a discharge forms part of a new development proposal, it is likely that the whole proposal including the discharge will be subject to the EIA process. The WPC Administrator (the prime decision maker in respect of pollution under the EMA), now has the power to grant a discharge of waste or pollutant permit with conditions and take action if a permit or condition of a permit has been breached. A system of permits is also proposed under the Act, and these will be required for any facilities involved in the handling, storage or use of hazardous substances; and the production and/or discharge of any waste, pollutants or hazardous substances. There is also provision for the development of a National Chemical Profile, and the setting of environmental standards, which could include limits for chemical contaminants in air, water and soil” (Policy, Law and Institutional Capacity Report 2009).

“To strengthen the legislative powers under the Act, a variety of enforcement measures are also set out, including the specific powers of Officers to take samples and other evidence and to issue enforcement or cessation notices. The penalties under the Act have also been strengthened with penalties for non-compliance with the Act ranging from up to \$100,000 and/or a 5-year prison sentence for individuals, and up to ten times those limits for a body corporate” (Policy, Law and Institutional Capacity Report 2009).

5.4.4 Fiji National Biodiversity Strategic and Action Plan (NBSAP)

In compliance with obligations of the Convention on Biodiversity, the Department of Environment in collaboration with key government and non-government stakeholders, have developed a National Biodiversity Strategic Action Plan (NBSAP) for Fiji which was published in 2007. The goal of Fiji’s NBSAP is to “conserve and sustainably use Fiji’s terrestrial, freshwater and marine biodiversity and to maintain the ecological processes and systems which are the foundation of national and local development”.

The NBSAP was developed in the context of existing reports including, Fiji State of Environment (GOF, 1992), The National Environment Strategy (GOF, 1993), Sustainable Development Bill (1997) and Revised Sustainable Development Bill (1999). The NBSAP focuses on six themes each with specific objectives. The six themes are: Community support – awareness, involvement & ownership; improving our knowledge; species conservation; management of invasive species; capacity building & strengthening;

Also contained in the NBSAP is an implementation framework with the management structure which states that the Biodiversity Strategy Committee (BSC) chaired by the Department of Environment leads and coordinates the implementation of the NBSAP and reports progress to the National Committee on Sustainable Development on an annual basis (Fiji National Biodiversity Strategic and Action Plan, 2007).

5.4.5 Fiji's part in International Treaties and Conventions

Fiji was one of the first countries to sign and ratify the United Nations Convention on Law of the Sea III on 10 December, 1982. Fiji became party to Wetland Ramsar Conservation in 2006 and Fiji's first Ramsar wetland site selected was the Upper Navua Gorge (www.ramsar.org). No marine area has been selected as yet (Techera and Troniak 2009). Fiji endorsed the World Heritage Convention in 1990, and while Fiji does not have any designated site under the Convention, four properties (Sovi Basin, Sigatoka Sand Dunes, Yaduataba Crested Iguana Sanctuary and Levuka, Ovalau Township and Island) have been identified for the tentative list. Fiji endorsed the Convention on Climate Change on 9 October 1992 and the Kyoto Protocol on 17 September 1998, under the United Nations Framework Convention on Climate Change (UNFCCC). Fiji became a member of CITES through accession in 1997.

The table below gives a summary of the international Conventions and treaties that Fiji is a party of. It also indicates the dates of signature, ratification and entry into force of each Convention and or treaty that Fiji is a party of.

Table 3: Treaties and Conventions Fiji is party to:

Treaties/Conventions	Date of Signature	Date of Ratification	Entry into Force
UNCLOS III	10.12.1982	10.12.1982	
Ramsar			11.08.2006
World Heritage		21.11.1990	
United Nations Framework on Convention of Climate Change	09.10.1992	25.02.1993	21.03.1994
Kyoto Protocol	17.09.1998	17.09.1998	16.02.2005
Convention on Biological Diversity	09.10.1992	25.02.1993	
Convention on International Trade in Endangered Species in Wild Fauna and Flora			29.12.1997

5.5 Gaps in Coastal Legislation and Policies

In Fiji, the Fisheries Act and the Environment Act are the two main legislations that regulate activities affecting coral reefs and global change, while the Marine Spaces Act outlines the jurisdiction of ocean space. Upon analysis of the two major acts, some gaps in the current legislation are evident and these gaps need to be acknowledged by policy makers and necessary legislations should be incorporated in the existing local act.

Fish Harvest Restrictions

The Fisheries Act provides for almost all fishing related activities in Fiji. It comprises catch limitations, gear restrictions, closures, export limitations, customary fishing rights and penalties for breaching the laws. While there are restrictions on fish and invertebrate catches, sizes,

species, areas, fishing methods and seasons, the same law provides for exemptions that may be granted upon request from the Fisheries Minister.

Environmental Impact Assessment and Ecosystem Connectivity

The Fisheries Act does not outline laws and regulations specific to coral reefs and their ecosystem management as a whole. On the other hand, the Environment Management Act (EMA) covers a number of ecosystems and area management which links to the coastal and marine resources. The EMA recognizes the connectivity between ecosystems, for example the connectivity among lakes, rivers and coastal zones. The EMA requires Environment Impact Assessments (EIA) to be carried out prior to developments that may have adverse impacts on public health and the environment. However, if the EIA results do not support the development, it is not rejected but put forward for further review by the Environment Management Committee. There is a need for the formulation of laws and policies to halt developments associated with detrimental effects on the natural environment and/or public health.

Aquarium Trade

There are no specific laws and regulations on the aquarium trade. The Fisheries Act indirectly covers issues arising from the aquarium trade, for example size, area, species, fishing methods and seasonal limitation on the fish and invertebrates, which may be associated with the coral reefs. However, specific details associated with coral reef commodities are not addressed. For instance, size and species restrictions could be placed on the export of coral species and associated fish and invertebrates. This is covered under the CITES regulations which Fiji is signatory to. The current procedure followed by the aquarium traders involves getting permission to fish from the traditional Fijian clan (*mataqali*) heads. Thereafter, the traders need a fishing license, an export license and a CITES permit from the Fisheries Department. CITES's quota allocations regulates the coral and live rock exports; however, there are no quotas set for aquarium fish export.

Marine Managed Areas

The Fisheries Act outlines laws and regulations regarding restrictions on fish catches, species, sizes and area closure which may be applied to set up Marine Managed Areas (MMA). However, the *Fisheries Regulations* state that fishing is prohibited 'except by hand net, wading net, spear or line and hook'. Hence, the Minister can allow for the establishment of an MMA, however, under the current *Fisheries Regulations* it is not possible to have an effective MMA. There is also legal tension between the State (which has legal rights over the inshore waters) and the customary owners who have fishing rights on the inshore waters. In addition, the government lacks the resources to police and enforce compliance with inshore MMAs. Hence, an MMA establishment requires the government and the local communities to work together (Techera and Troniak 2009).

The Fiji Locally Managed Marine Area (FLMMA) network has worked with the local communities to establish informal MPAs; which has resulted in improved fish stocks inside the restricted areas. The increased fish stocks in the MPAs have attracted the increased attention of poachers. Since monitoring and enforcement of FLMMA remains a problem, a legislative foundation should be provided for this network to promote best practices (Techera and Troniak 2009).

Studies have shown that fish populations in adjacent reef systems are connected (Palumbi 2003). The recruits of a reef system may originate from adjacent reef systems. Hence, it would be appropriate to establish a network of MPAs in consecutive reef systems (Sale and Kritzer 2003; Harpen and Warner 2002). The policies associated with MMAs should also address the issue of reef connectivity and ecosystem based conservation.

Policies and Strategies - Ministry of Fisheries and Forests

In 2002, upon the request of the Department of Fisheries, a *Community Based Fisheries Management Programme 2002 – 2006* was developed for Fiji. The programme involved the establishment of a series of *Qoliqoli Management Plans* under the government, to supplement the coastal marine conservation efforts of other NGOs. It was prepared by the Secretariat of the Pacific Community (SPC) in consultation with a number of parties including the FLMMA network and the University of the South Pacific. Since, the programme was limited by the mandate of the Fisheries Department; it did not address conservation issues from a holistic view. For instance, the *Qoliqoli Management Plans* only focused on living resources instead of incorporating the entire ecosystems including non-living resources (Techera and Troniak 2009). Currently, the Fisheries Department is undergoing a restructure under the new government; hence, there are no active formal strategic plans and policies on fisheries management. The Fisheries Act is also under review and is expected to be finalized by the end of 2010 (Anare Raiwalui, Pers Comm. 2010).

Global Change and Coral Reefs

Global change is a major issue that needs to be addressed by the government, policy makers and the community. The Pacific Island countries have large portions of their populations concentrated on narrow, low-lying areas fringing the mountain along the coast. The economic activities of the Pacific Island countries are concentrated on the coastal regions as their capital cities are situated on the coast (Mimura, 1999). Hence, effects of global change such as sea level rise and natural phenomena like cyclones would be a major problem for these Islands. Issues related to global change are also affecting Fiji. There is an increase in population by 7.72% (www.statsfiji.gov) in the past decade (1996-2007) which in turn increases the demand for food, space and income. One of the major repercussions of such increased demands for food and space in the coastal area is increased threats on the natural marine resources. This would be a result of overfishing, destructive fishing methods, pollution and coastal development. In order to address these issues, it is essential to introduce policies and regulations associated with sustainable development at a national level.

The current Fisheries and Environment Management Acts and government plans/policies do not specifically address issues related to global change. However, Fiji is a party to numerous International and Regional Treaties/Conventions associated with sustainable management of the environment and global change. One of the regional policies which are associated with oceanic and coastal resources that Fiji is a part of is the Pacific Islands Regional Ocean Policy. This policy is founded on international and regional Conventions, treaties and instruments, however, is not legally binding. The framework of the policy intends to guide the formulation and implementation of sustainable development of oceanic resources at a regional level. Hence, there is a requirement for individual countries to formulate more specific policies and strategic actions suited to their country.

5.6 Recommendations

The population of Fiji has increased significantly over the last decade. With the increase in population over the years, the government and community need to address issues such as: catering for food, space and job demands. The Pacific Island populations depend heavily on the coastal and marine resources as a source of food and income. Hence, in order to maintain a balance in the coastal resources, it is essential that there are strategic plans and policies developed for sustainable coastal development, and sustainable tourism. Furthermore, in order to meet the increased demands of food and income there is a need for the development of alternative livelihood plans. While the Fiji government has covered a number of issues related to inshore fisheries management, there still exist gaps in policies in terms of coral reef ecosystem management as a whole and global climate change.

The following are gaps that need to be addressed:

5.6.1 Fisheries

1. The value of subsistence fisheries is more than half the value of commercial fisheries in Fiji, however, it remains poorly documented. The Fisheries Department should be encouraged and financially supported to continue doing marine inventory surveys and development of fisheries management plans. Fisheries management plans should be given formal recognition to improve management of the subsistence fisheries.
2. Greater use of market surveys of subsistence catches should be encouraged.
3. Hardly any scientific (ecology, reproductive biology, habitat preference) studies are carried out on the species caught for subsistence fisheries. All species important to Fiji's subsistence fisheries should be researched on.
4. We recommend that the impact of climate change events on the coral reef fisheries should be monitored and assessed, for instance, bleaching events, quantification of ocean acidification and sea-level rise.
5. There is a need for more community awareness on potential impacts of climate change on fisheries such as increasing sea surface temperatures, coastal inundation, ocean acidification, and sea level rise.

6. The consequences of the loopholes in the regulations and the potential impacts they have on stocks and endangered species should be considered.

5.6.2 Marine Managed Areas

1. Fiji has more marine managed areas (MMA) than any other Pacific Island Country and this number has increased largely since the establishment of the FLMMA network, however these MMAs do not have any legal basis nor does the status of fish wardens.
2. The MMA network needs to be reinforced through an examination of connectivity, scientific inventories, physical and human resources.
3. There is a need to follow up work carried out on identification of biodiversity hotspots for Fiji. We strongly support the work of the NBSAP technical working groups.
4. Fiji should pursue the possibility of identifying a marine area to be designated as a World Heritage Site.

5.6.3 Multi-sectoral, Multi-stakeholder Consultations

1. There should be a national integrated coastal zone management plan for Fiji. We support the work of the ICM committee currently working on this.
2. We recommend that there be wider consultation among relevant government departments and stakeholders with respect to coastal development.

REFERENCES

Allen, G.R., Steene, R.C. & Allen, M. 1999. *A guide to angelfishes and butterfly fishes*. Singapore: Odyssey Publishing/Tropical Reef Research.

Campbell, J. 2000. *Adapting to climate change: incorporating climate change adaptation into development activities in Pacific Island Countries: a set of guidelines for policymakers and development planners*. Samoa: SPREP.

Cesar, H.J.S., Burke, L., & Pet-Soede, L. 2003. *The economics of worldwide coral reef degradation*. Arnhem: Cesar Environmental Economics Consulting and WWF-Netherlands, 23pp. Online: <http://www.cbd.int/doc/external/oece/oece-coral-reefs-2002-en.pdf>

Conservation International. 2008. *Economic values of coral reefs, mangroves, and sea grass: a global compilation*. US: Conservation International

Craven, J.P. 1982. *The management of Pacific marine resources: present problems and future trends*. Boulder, Colorado: Westview Press.

CRISP. 2005. *Brief overview of CRISP Projects*. Information Paper

Cumming, R.L., Lovell, E.R., Carlson, B.A., Dulvy, N.K., Hughes, A., Koven, J.F., Quinn, N.J., Sykes, H.R., Taylor, O.J.S., Toscano, M.A., & Vaughan D. 2001. *Geographic extent and severity of mass coral bleaching in Fiji 2000, in relation to seawater temperature*. In: 9th International Coral Reef Symposium Proceedings, 2002.

Davis, M.T., Newell, P.F. & Quinn, N.J. 1999. TBT contamination of an artisanal subsistence fishery in Suva harbour, Fiji. *Ocean & Coastal management* 42: 591-601.

Fisheries Department. 2008. Fisheries Annual Report. Suva, Fiji: Fiji- Department of Fisheries.

Gangaiya, P., Tabudravu, J., South, R. & Sotteeswaran, S. 2001. Heavy metal contamination of the Lami coastal environment, Fiji. *South Pacific Journal of Natural Science* 19: 24-29.

Halpern, B.S., & Warner, R.R. 2002. Marine reserves have rapid and lasting effects. *Ecology Letters* 5, 361–366.

Hodgson, G. 1999. A global assessment of human effects on coral reefs. *Marine Pollution Bulletin*, 38(5): 345-355.

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs. *Freshwater Marine Research*, 50: 839-866.

IUCN. 2009. [Press Release] *2.3 million Euro for mangrove management for climate change and livelihood in the Pacific*. December 2009.

IUCN. 2010. *Pacific Ocean 2020 challenge: rescuing an ocean in crisis*. Suva, Fiji: IUCN. Concept Paper.

Jones, G.P., McCromick, M.I., Srinivasan, M., & Eagle, J.V. 2004. Coral decline threatens fish biodiversity in marine reserves. *Proc. Natl. Acad. Sci* 101: 8251-8253.

Lovell, E.R. & McLardy, C. 2008. *Annotated checklist of the CITES-listed corals of Fiji with reference to Vanuatu, Tonga, Samoa and American Samoa*. JNCC, Peterborough 2008, Joint Nature Conservation Committee (JNCC). Report No. 415.

Lovell, E.R. & Sykes, H. 2008. *Fiji report*. In: C. Morris (ed.). Status of coral reefs in the Southwest Pacific Node (Unpublished)

Lovell E.R. & Sykes, H. 2008. *Rapid recovery from bleaching events- Fiji Coral Reef Monitoring Network Assessment of hard coral cover from 1999-2007*. 11th International Coral Reef Symposium Proceedings: FT Lauderdale, Florida: 7-11 July 2008.

Lovell, E. R. & Sykes, H. 2004. *Status of coral reefs in the South West Pacific*. In: R. Sulu (Ed.). Suva, Fiji: IPS Publications, University of the South Pacific.

Mimura, N. 1999. Vulnerability of island countries in the South Pacific to sea-level rise and climate change. *Climate research* 12: 137-143.

Morrison, R., Harrison, N. & Gangaiya, P. 1996. Organochlorine contamination in the estuarine and coastal marine environments of the Fiji Islands. *Environmental Pollution Vol. 93*, No. 2: 159-167.

Mosley, L. & Aalbersberg, W. 2003. Nutrient levels in sea and river water along the Coral Coast of Vitilevu, Fiji. *South Pacific Journal of Natural Science* 21: 35-40.

Newton K., Cote, I.M., Pilling, G.M., Jennings, S., & Dulvy, N.K. 2007. Current and future sustainability of island coral reefs fisheries. *Current Biology* 17: 655-658.

Nunn, P.D. 2007. Climate, environment and society in the Pacific during the last millennium. *Developments in Earth and Environmental Sciences* 6

Nybakken, J.W. & Bertness, M.D. 2005. 6th ed. Marine Biology: an ecological approach. Pearson Education.

Palumbi, R., 2003. Population genetics, demographic connectivity, and the design of marine reserves. *Ecological Applications* 13: 146–158.

Paulay, G. 1997. *Diversity and distribution of reef organisms*. In: C. Birkeland (ed). Life and Death of Coral Reefs. NY: Chapman and Hall.

Pomeroy, R.S., Parks, J.E., & Balboa, C.M. 2004. Farming the reef: is aquaculture a solution for reducing pressure on coral reefs? *Marine Policy*

Roberts, C.M. 1995. Effects of fishing on the ecosystem structure of coral reefs. *Conservation Biology*, 9 (5): 988-995.

Sale, P.F & Kritzer J.P. 2003. Determining the extent and spatial scale of population connectivity: decapods and coral reef fishes compared. *Fisheries Research* 6: 153-172.

Scales, H., Balmford, A. & Manica, A. 2007. Impacts of the live reef fish trade on populations of coral reef off northern Borneo. *Proceedings of the Royal Society B* 274: 989-994.

Scheffer, M., Carpenter, S., & Young, B. 2005. Cascading effects of overfishing marine systems. *Trends in Ecology and Evolution*, 20 (11): 579-581.

Seeto, J. & Baldwin, W.J. 2010. *A checklist of the fishes of Fiji and a bibliography of Fijian fish*. Suva, Fiji: School of Marine Studies, USP. SMS Technical Report No. 1/2010.

Singh, S., Aalbersberg, W. & Morrison, R. 2009. Nutrient Pollution in Laucala Bay Fiji Islands. *Water Air Soil Pollution* 204: 363-372

Solomon, S., Qin, D. Manning, M., Alley, R.B., Berntsen, T., Bindoff, N.L., Chen, Z., Chidthaisong, A., Gregory, J.M., Hegerl, G.C., Heimann, M., Hewitson, B., Hoskins, B.J., Joos, F., Jouzel, J., Kattsov, V., Lohmann, U., Matsuno, T., Molina, M., Nicholls, N., Overpeck, J., Raga, G., Ramaswamy, V., Ren, J., Rusticucci, M., Somerville, R., Stocker, T.F., Whetton, P., Wood, R.A. & Wratt, D. 2007. *Technical Summary*. In: S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller. (eds.). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK & NY: Cambridge University Press

South, G.R. & Low, J. 2008. *The Pacific Islands: Dynamics of regional cooperation on oceans and coasts*, pp.563-595. In: Chau, T.E., Kullenberg, G. & Bongo, D. (eds). *Securing the oceans; essay on ocean governance- global and regional perspectives*. Quezon City, Phillipines: PEMSEA and Nippon Foundation.

South, G.R, Skeleton, P., Veitayaki, J., Resture, A., Carpenter, C., Pratt, C. & Lawedrau, A. 2004. *Global international water assessment, Pacific Islands*. University of Kalmar, Sweden: UNEP GIWA Regional Assessment 62.

Spalding, M.D., Blasco, F., & Field, C.D. 1997. *World mangroves atlas*. Okinawa, Japan: The International Society for Mangrove Ecosystems.

Spalding, M.D., Ravilious, C. & Green, E.P. 2001. *World Atlas of Coral Reefs*. UNEP World Conservation Monitoring Centre.

SPREP. 1995. *Joint responsibility for preserving our natural heritage: the Apia Convention*. Factsheet 12/5.

Techera, E.J. & Troniak, S. 2009. *Marine protected areas policy and legislation gap analysis: Fiji Islands*. Suva, Fiji: International Union for the Conservation of Nature and Natural Resources.

Uniquet. 2009. *Environment Report: RETA 6471: Strengthening coastal and marine resource management in the coral triangle of the pacific – phase 1*. University of Queensland's Centre for Marine Studies: Uniquet Pty Ltd. [Prepared for Asian Development Bank]

Uniquet. 2009. *Policy law and institutional capacity Report: RETA 6471: Strengthening coastal and marine resource management in the coral triangle of the pacific – phase 1*. University of Queensland's Centre for Marine Studies: Uniquet Pty Ltd. [Prepared for Asian Development Bank]

United Nations. 1983. *The law of the sea-official text of the United Nations Convention on the Law of the Sea with annexes and index*. NY: United Nations.

Veitayaki, J. 1995. *Fisheries development in Fiji: the quest for sustainability*. Suva, Fiji: Institute of Pacific Studies, USP.

Veitayaki, J., Evans, N. & South G.R. 2004. The Pacific Islands Regional Ocean Policy: the quest for good ocean governance. *Ocean Yearbook 18*: 558-577.

Veron, J.E.N. 2000. *Corals of the World*. Townsville, Aust.: Australian Institute of Marine Science. 3 Vols.

Wilkinson, C. (ed.). 2004. *Status of coral reefs of the world: 2004*. Townsville, Aust.: Australian Institute of Marine Science. Vol. 1 & 2.

Wilkinson, C. 2008. *Status of coral reefs of the world: 2008*. Townsville, Aust.: Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre.

Ziemann, D.A. 2001. The potential for the restoration of marine ornamental fish populations through hatchery releases. *Aquarium Science and Conservation 3*: 107-117.

Websites:

coris.noaa.org; www.crisponline.net; www.cites.org; www.ciesin.org; www.climatechange.org; www.cbd.int; www.earthtrends.wri.org en.wikipedia.org; www.fsfi.org.fj; www.fao.org; www.ioinst.org; ias.fste.usp.ac.fj; www.iucn.org; www.lmmanetwork.org; mesfiji.org; www.marinebiology.org; www.noaa.gov; www.pcdf.org.fj; www.pcrf.org; www.ramsar.org; see-the-sea.org; www.statsfiji.gov; www.spc.int; www.sopac.org; www.sprep.org; www.sidnet.org; www.usp.ac.fj; unfccc.int; www.un.org; www.usp.ac.fj/ioi; unfccc.int; whc.unesco.org; www.worldsummit2002.org; www.wfpacific.org.fj; www.wcs.org;

6. COUNTRY PROFILE: SAMOA

6.1 Introduction

Samoa, formerly known as Western Samoa, is located in the South West Pacific; 13-17°S, 171-173 °W. It consists of two large islands, Upolu and Savai'i, and several smaller islands. The land area of Samoa is approximately 2 935 km² and the Samoan Exclusive Economic Zone (EEZ) has an area of approximately 120 000 km² (Samuelu and Solofa 2007). The two larger islands are mountainous and of volcanic origin. There is little flat land, except in the coastal areas (www.infoplease.com). The population of Samoa is estimated to be 192 001 for the year 2010 (www.cia.org). About two thirds of Samoa's population resides on the coast line which is 403km long (Samuelu and Solofa 2007).

Important economic commodities of Samoa include: fish, garments, beer, coconut products, taro and kava. Fresh fish and agricultural produce have significant contribution to the GDP (www.spc.int). In 2009, the GDP was worth USD 567 million with GDP per capita estimated at USD 5 446 (www.dfat.gov.au).

6.2 Background

6.2.1 Coastal Resources of Samoa

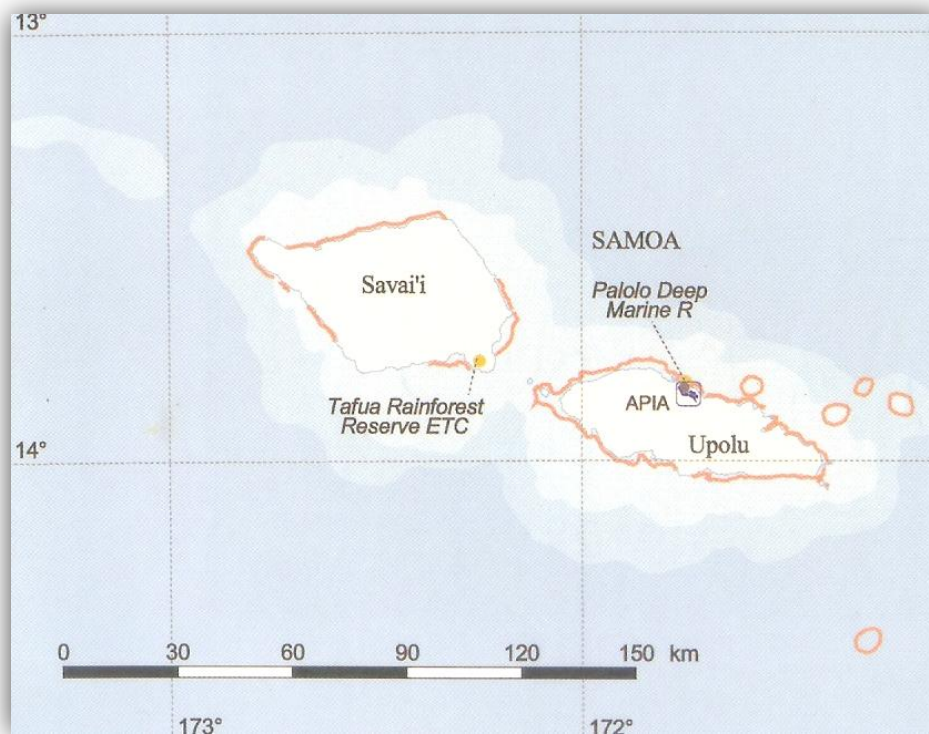


Figure 3: The coral reefs of Samoa. Source: Spalding et al. 2001

Coastal areas play an important role in Samoan society and are essential in national development as a whole. The income generated from tourism and fisheries is dependent on the condition and productivity of critical ecosystems and shoreline features such as coral reefs, beaches, sea grass beds and mangroves. The Samoan population depends on the coral reefs for the bulk of their protein. Over 70 percent of the villages are located on the coastal fringe and depend heavily on subsistence fisheries for survival. According to a fisheries survey in the year 2000, the average CPUE was two kilograms per person per hour fished. The average consumption of seafood was estimated to be 57 kilograms per person per annum; consisting of about 44 kilograms of fish and 13 kilograms of invertebrates and seaweeds (Passfield *et al.* 2000; Samuelu and Solofa 2007).

Reef Area and Types of Coral Reefs

Due to the past volcanic activities and subsequent sea level rise, Samoa has limited fringing coral reef systems. Generally, there are fringing reefs close to the shore around most of the coastline, except on the northwestern coast of Upolu, where the fringing reefs reach up to three kilometers offshore. The lagoons on the southern side of Islands are two to three meters deeper than the northern side and are usually clear. A map illustrating the reef systems of Samoa is presented in Figure 3.

Coral Reef Biodiversity

Currently, information on the coral reef biodiversity of Samoa is limited. Efforts are now being made to address this issue. Most of the studies of the reefs in Samoa are known to have been a result of scientific expeditions undertaken by foreign scientists (Samuelu and Solofa 2007). The known marine biodiversity of Samoa includes: 124 species of hard corals, 991 species of fish (Wass 1984), 2 species of sea grass, 360 species of algae (Skelton and South 2007), 5 species of turtles, 3 species of mangroves and 4 species of giant clams (Samuelu and Solofa 2007; Skelton *et al.* 2000; Zann 1989).

6.2.2 Economic Value of Reef Systems in Samoa

The major uses of the reef resources in Samoa are in the fisheries and tourism industries. Coral reef ecosystems provide dive and snorkeling sites for tourists in Samoa. In addition, local fishermen are contracted by hotels and restaurants for seafood supply. In the year 2007, earnings

Case Study 1: Sedimentation, Nutrient Enrichment and Eutrophication

Zann and Mulipola (1995) documented the widespread die-back of corals on the northern part of Upolu from 1970 to 1985 as a result of sediment and nutrient flow from land-based activities. Poor land practices and management associated with agriculture, forestry, housing and road construction are causing a high level of eutrophication near river mouths and in lagoon areas. Incidences of algal blooms in inshore areas in different parts of the country have the potential to increase in frequency. A recent survey by Saito (2002) on environmental water from local enterprises showed that one of the biggest rivers in Samoa, the Vaisigano River, flushes nutrients at a rate of 7.15 mg per litre, with coliform bacteria at 448 per litre. Other industries are producing an outflow of 50m³ sewage waste a day onto the ground. Such land-based sources are contributing to the destruction of reefs.

Efforts to regulate the use of pesticides, herbicides and other chemicals have been made but their effectiveness is unclear. Samoa does not have a sewage system, and most families have septic tanks. A solid waste management campaign in 2002 saw rubbish collection expanded to cover villages outside of the main towns in Upolu and Savai'i. Despite this initiative, some families continue to burn and discard rubbish either in their surroundings, in waterways or directly into the sea. These domestic and industrial wastes place further strain on the ability of coral reefs to survive. (Samuelu and Solofa 2007).

from the tourism industry of Samoa totaled \$ST282.3 million (107 million USD) (Samuelu and Sapatu 2010).

In 2006-2007, the contribution from the fisheries sector to the nation's economy was less than 50 percent than that contributed by the tourism sector. Overall, fisheries contributed \$ST85.5 million (34.2 million USD) to the nation's economy. Out of this, subsistence fisheries accounted for \$84 million (33.6 million USD) and artisanal fisheries accounted for \$ST1.5 million (0.6 million USD). The total landings for subsistence and artisanal fisheries were 13 666 metric tonnes and 126.47 metric tonnes, respectively. For artisanal fisheries, more than 50 percent of the catch is finfish (Fisheries Division 2007). Although subsistence fisheries are greater than artisanal fisheries, a slow but prominent transition has been noted from subsistence to artisanal fisheries (Samuelu and Sapatu 2010). The fish catches are mostly sold in the local markets in Apia and Salelologa.

On the other hand, according to Mulipola *et al.* (2007; in Gillett 2009) the most recent estimate of fisheries production was 13,686t, worth at ST84 million (32.7 million USD). In 2007, the production from Samoa's coastal commercial fisheries was estimated to be 4 129 t, worth at ST51 240 890 (19.9 million USD) and the coastal subsistence catches were estimated to be 4,495t worth at ST39,048,065 (15.2 million USD). In 2002, the coastal commercial fisheries catch was 4,076t, worth at ST30 million (11.7 million USD) and the coastal subsistence catch was 4 437t, worth at ST22.8 million (8.9 million USD) (Gillett 2009).

Case Study 2: Anchor and Trawler Damage

Large vessels awaiting entry to the Apia port usually anchor at the Five-mile Reef. Since, the surrounding waters are deep, anchorage at the Five-mile Reef is the only option for large vessels.

"An ecological survey of Toatuga Reef (Five-mile Reef) was conducted by the Ministry of Natural Resources and the Environment's Division of Environment and Conservation in February 2004 (Pacific Environment Consultants Ltd and Samoa Marine Ltd 2004). This was in response to concerns that the reef, a popular dive site, had sustained serious damage due to large sea-going vessels and local fishing boats anchoring on the reef while awaiting clearance to dock at Apia Wharf. The survey found that the damage resulting from anchoring is noticeable, and there is a risk that parts of the reef may be severely damaged if anchoring continues" (Samuelu and Solofa 2007).

In 2007 the total Samoan GDP was ST1 372 394 000 (534 684 673 USD). The fishing share of the Samoan GDP was 5.4 percent, worth at ST74 540 546 (29 040 995 USD) (Gillett 2009).

6.2.3 Major threats to Samoa reefs

Samuelu and Sapatu (2010) describe the major human-induced threats to coral reefs in Samoa as coastal development, pollution, sedimentation, nutrient enrichment and eutrophication, overfishing, destructive fishing and coral harvesting. The coral reefs of Samoa are also susceptible to damage by natural phenomena such as hurricanes and tsunamis, predator outbreaks (crown-of-thorns starfish), bleaching events and coral diseases.

The construction of seawalls in order to protect the coastline from erosion is one of the major coastal developments in Samoa. Other developments include reclamation of the coastal zone for the construction of houses and businesses. Coastal developments such as these damage or completely remove ecosystems like sea grass beds and mangroves. In addition, sediments from the increased erosion rates due to coastal developments are

detrimental to the coral reefs. During the rainy seasons (November to April), sediments and nutrients released as a result of increased development and deforestation, are washed into the lagoon and coral reefs. Nutrients also originate from agricultural fields and improper sewage disposal systems which lead to eutrophication (Case Study 1; Samuelu and Sapatu 2010).

A recent survey by Valencia *et al.* (2007) indicates that Samoan reefs are exploited for food fish and that the catch per unit effort has increased over the period 1997 to 2007, with respect to the limited coastal resources of Samoa. Despite the regulation on the ban of destructive fishing methods, a minor group of subsistence fishermen still use dynamite and *Derris* roots to fish. Since 1997, coral harvesting and exportation has been banned (Samuelu and Sapatu 2010). Coral reefs have also been damaged by boat anchors and trawlers (Case Study 2; Samuelu and Solofa 2007).

One of the common coral predators in Samoa is the crown-of-thorns starfish. Surveys carried out over the period 2002-2003 recorded 12 crown-of-thorns starfish in 30 sites (Fisheries 2003; Samuelu and Solofa 2007). Surveys of the Aleipata and Safata MPAs also recorded the presence of crown-of-thorns starfish (Samuelu and Solofa 2007).

Coral bleaching in Samoa is monitored as part of the Fisheries' MPA permanent site monitoring programme. According to surveys by this programme, coral bleaching recorded in the years 2002-2003 was 26.4%, which reduced to 4.6% in the years 2003-2004 (Samuelu and Solofa 2007). Surveys carried out in the years 2005-2007 indicate that the percentage coral bleached had increased to 15.5%. Coral bleaching in the sites surveyed by Fisheries is mainly associated with neap tides around August each year, except for 2004 when the damage was as a result of Cyclone Heta (Samuelu and Sapatu 2010) which damaged an average of 13% of the live corals around Samoa (Samuelu and Solofa 2007). In 2009 Samoa experienced extensive damage by a tsunami generated by an earthquake with an 8.3 reading on the Richter scale (Case Study 3).

There are a number of natural threats to coral reefs of Samoa with the recent tsunami in 2009 being one of the most destructive. The vulnerability of coral reefs is further increased by the effects of human-induced hazards such as coastal development and mismanagement of the coral reef ecosystem.

Case Study 3: 2009 Tsunami Damage in Samoa

The Samoan community experienced the devastating effects of the September 29th 2009 tsunami generated from an earthquake that measured 8.3 on the Richter scale. The tsunami was concentrated on the south-coast of Upolu Island, Samoa. The most extensively damaged districts of Aleipata and Falealili, located on the south-east coast of Upolu, had entire villages, hotels and small resorts annihilated along their coasts (blog.conservaion.org).

The tsunami inflicted a lot of damage on the south shore of Upolu's reef system. The damage was concentrated on the barrier back reefs and the more inshore portion of the fringing reefs due to the transport of shingle, boulders and displaced coral colonies. These resulted in destruction of attached corals through impact and burial (Lovell *et al.* 2009).

The major source of income for communities in the tsunami struck area came from coastal tourism and subsistence fishing, both of which were heavily affected. Since the coral reef has been extensively damaged, a large and long-term need for reconstruction, community income-generation initiatives and ecosystem restoration needs to be undertaken. To ensure the sustainability of the reconstruction and conservation initiatives, Conservation International is trying to fully capitalize the MPA Trust Fund set up by the local communities (blog.conservaion.org).

Case Study 4: Marine Invasive Species in Apia Harbour

Eliminating invasive species is an extremely expensive task [ST1.6 billion (600 million USD)]. A study undertaken by Skelton *et al.* (2008) assessed the presence of marine invasive species in the Apia Harbour and surrounding areas. It documented the presence and status of marine invasive species found in Apia Harbour and its surrounding areas and provided data to build local knowledge and understanding of marine invasive species found in Samoa.

The biota identified by Skelton *et al.* (2008) includes mollusks, echinoderms, platyhelminthes, arthropods, ascidians and algae. Weber-van Bosse (*Caulerpa microphysa*) is one of the species from the phylum Chorophyta, which was reported for the first time to be present in Samoa by this report. This species is not believed to be introduced because it is found in the Western Pacific and in Samoa's neighboring countries, American Samoa and Fiji.

The introduced species identified by Skelton *et al.* (2008) include:

-*Codium arenicola* (Phylum: Chlorophyta): introduced from Thailand and SE Asia.

-*Renouzia antillana* (Phylum: Rhodophyta): possibly introduced, since all samples of this species had been collected in or near harbours.

-*Spatoglossum macordontum* (Phylum: Ochrophyta): which is probably a recent introduction to Samoa, with invasive tendencies.

Another threat to the marine biodiversity of Samoa is by invasive species. Invasive species thrive in their new habitats, out-competing native species and in some instances, dramatically changing ecosystems. Currently, Alien Invasive Species (AIS) are considered to be one of the primary threats to biological diversity (IUCN 2007). There has been a few marine invasive species identified in Apia Harbour, Samoa (Skelton *et al.* 2008; Case Study 4).

6.3 Ecosystem Management Initiatives by Non-Government Organizations

The following sections outline the major initiatives undertaken by NGOs in Samoa to address the issues related to global change and sustainable use of coral reefs.

6.3.1 O le Si'osi'omaga Society Incorporated (OLSSI)

OLSSI is a birdlife affiliate, which was established in 1990. It is one of Samoa's leading conservation NGOs. The Society aims to develop capacity to be a trusted, value adding and catalytic agent in the promotion of wise use of natural resources and conservation of environment in Samoa (www.birdlife.org).

OLSSI has more than 50 financial members, including international and local residents. It has secured access from most villages in Samoa with unique and intAct terrestrial and marine biodiversity resources.

The three major relevant projects under OLSSI are 1) Disaster Preparedness and Risk Reduction: this project aims to strengthen community resilience to natural catastrophes, ensuring communities ability to cope with and recover after disasters. 2) Bird life: while this project aims to protect native birds and their habitat, it also looks at sustainable management of natural resources and invasive species. 3) Indigenous Peoples Network for Change: this project covers biodiversity and climate change issues as well as issues that are likely to affect indigenous people. OLSSI represents the indigenous people in relevant international meeting and workshops (siosiomaga.hostoi.com).

6.3.2 The Foundation of the Peoples of the South Pacific International (FSPI)

FSPI is the regional secretariat for a network of 20 independent community-based organisations working in the Pacific to foster self-reliance and sustainable development. It is one of the largest, most

experienced civil society organisations in the Pacific, with Network Partners in Fiji, Kiribati, Palau, Papua New Guinea, **Samoa**, the Solomon Islands, Tonga, Tuvalu, Vanuatu and Timor-Leste and metropolitan partners in Australia and the United States (www.fspi.org).

FSPI is currently working on the “CRISP Marine Protected Area Capacity Building, Networking and Lessons Learned” project which aims to build capacity of communities, government staff and stakeholders in the establishment and management of MPA through training, networking and communication of lessons learned at both national and international level. Samoa’s Aleipata MPAs are part of this project.

6.3.3 Secretariat of the Pacific Community (SPC)

The Secretariat of the Pacific Community (SPC) has a Reef Fisheries Observatory under their Marine Programme. The SPC Reef Fisheries Observatory aims at providing information to the SPC members and to all parties involved in Pacific Island reef resource management. This section of SPC disseminates information to local communities and international donors interested in the sustainability of the various reef fisheries in the Pacific. The section also aids the Pacific Island governments which require advice on the management of local fishery resources under their jurisdiction. A subsection under the SPC Coastal Fisheries Programme known as the Coastal Fisheries Management Section (CFMS) was established to provide regional support services. The CFMS assists the Pacific Islanders in identifying the status and optimizing the long-term social and economic value of small-scale fisheries and aquatic resources in Pacific waters (www.spc.int).

6.3.4 International Union for Conservation of Nature (IUCN)

IUCN is involved in three related projects: 1) Pacific Ocean 2020 Challenge: rescuing an ocean in crisis; 2) Mangrove Ecosystems for Climate Change and Livelihood in the Pacific (MESCAL); and 3) Pacific Centre for Environmental Governance (PCEG).

The 2020 challenge seeks to focus global attention, build new partnership and generate the necessary commitments and resources required to “develop and implement a long-term comprehensive and cohesive strategy and action plan to curb the impacts on the Pacific Oceans ecosystems and the resulting negative impacts on the Pacific Ocean region and the globe” (IUCN 2010 concept paper).

The MESCAL project started in December 2009 and involves five Pacific island countries: Fiji, **Samoa**, Solomon Islands, Tonga and Vanuatu. The primary goal of MESCAL “is to help reverse recent trends in the loss of mangroves, increase resilience of the people of the Pacific to climate change and provide natural insurance against the effects of climate change and extreme events. The project will help participating countries invest in stakeholder based management of mangroves and associated ecosystems by developing sound evidence-based policies, plans and practices and targeted capacity development of government, NGO, and community members as appropriate in mangrove conservation practices and rehabilitation. This interdisciplinary

applied research and development project will also involve IUCN's collaborating partners, such as the University of the South Pacific, WorldFish Center (WFC), Pacific Regional Environmental Programme (SPREP), and many government agencies and NGOs in the participating countries" (IUCN 2009).

PCEG, under IUCN Oceania, is a "virtual centre of excellence in environmental governance focusing on environmental law, environmental policy, environmental economics and leadership and learning. PCEG aims to strengthen enabling environments of laws, policies, formal and traditional institutions and decision-making processes for effective, efficient, equitable, transparent and accountable decisions within local and national political, socio-economic, and environmental context" (<http://www.iucn.org>). IUCN Oceania also has a Pacific Resource and Environmental Economics Network (PREEN). The inadequate consideration of economics issues in natural resource management is due to lack of capacity in that area. In response to this, IUCN organized a meeting with practicing resource economists in 2007 and formed PREEN, whose purpose is to provide support and share ideas to progress economic analysis for sustainable resource management in the Pacific (<http://www.iucn.org>).

6.3.5 Secretariat of the Regional Environment Programme (SPREP)

SPREP was established by the governments and administrators of the Pacific Island Countries, and was responsible for managing and protecting the environment and natural resources of the Pacific region. The initiative of Pacific Communities to establish SPREP shows their dedication towards sustainable development. Especially in accordance with the outcomes of WSSD implementation plan, the Millennium Development Goals and Declaration, the Barbados Plan of Action and Agenda 21 (www.sprep.org). SPREP's Climate Change Vulnerability and Sea-level Rise project works in line with WSSD and UNFCC goals. SPREP is working on five focal areas under this programme: 1) strengthening meteorological services (project: PIGCOS), 2) Understanding climate change variability and sea-level rise (project: ARMS), 3) Vulnerability, adaptation and mitigation (project: CBDAMPIC and PIGGAREP), 4) Ozone depleting substance (project: ODS) and 5) Policy development on climate change (www.sprep.org).

SPREP has facilitated and coordinated numerous conservation projects in Samoa such as the Pacific Adaptation to Climate Change project; Pacific Invasive Species Management program and the co-ordination of the community oriented Uafato Conservation Area in collaboration with OLSSI. The *fono* of the area aims to sustainably manage and conserve their rainforest and adjacent marine area.

6.3.6 Matuaileoo Environment Trust Inc. (METI)

METI is a local NGO and was setup in June 2000 under the provisions of the Samoan 'Charitable Trust Act 1965'. METI is involved in various projects relating to capacity building and income generation (www.bizearch.com).

METI is working closely with the Samoan Fisheries Department in setting up coral garden projects around Samoa, especially where corals have been damaged (Samuelu and Solofa 2004). Under another project, METI is looking at ways to restore the Apolimafofou marsh as a mullet nursery and grow-out site and as habitat for endangered gray duck.

6.3.7 Faasao Savai'i Society (FSS)

FSS is Samoa's first cultural conservation organization. It focuses on the conservation of Samoa's fragile environment and cultural heritage. The Society supports a wide range of projects to protect local ecosystems and implement sustainable income generation activities, especially on the island of Savai'i (www.greengrants.org). The executive Council of the Society consist mainly of prominent women and men in their villages who would have authority to impose relevant campaigns as part of their on-going initiatives to conserve the environment and encourage sustainable use of resources (orgs.tigweb.org).

6.3.8 Samoa Umbrella for Non Governmental Organization (SUNGO)

"The Samoa Umbrella for Non Governmental Organization was established in 1997 to provide alternative development options for assistance to the community groups in Samoa. It serves to provide input into Government policy and planning processes from Non-Governmental Organizations (NGOs) Community Based Organizations (CBOs) and Civil Society Organizations (CSOs) on issues impacting on the quality of life of the people of Samoa" (www.samoaictp.ws). SUNGO has more than 110 member organisations of which at least 50% are community based. SUNGO "continues to be part of a regional wide network of NGOs that assist in implementing regional and global assistance and projects on issues of concerns to its member organizations and National development" (www.samoaictp.ws).

6.3.9 United Nations Environment Programme (UNEP)

"UNEP is the United Nations system's designated entity for addressing environmental issues at the global and regional level. Its mandate is to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action. The mandate and objectives of UNEP emanate from: a) UN General Assembly resolution 2997 (XXVII) of 15 December 1972; b) Agenda 21, adopted at the UN Conference on Environment and Development (the Earth Summit) in 1992; c) the Nairobi Declaration on the Role and Mandate of UNEP, adopted by the UNEP Governing Council in 1997; d) the Malmö Ministerial Declaration and the UN Millennium Declaration, adopted in 2000; and e) recommendations related to international environmental governance approved by the 2002 World Summit on Sustainable Development and the 2005 World Summit" (www.unep.org).

UNEP has six priority focal areas on environmental changes; 1) climate change; 2) disaster and conflicts, 3) ecosystem management, 4) environment governance; 5) harmful substances and 6) resource efficiency (www.unep.org). UNEP has supported and funded various conservation

projects in the Pacific Region, which is coordinated by their Regional Office of Asia and the Pacific (ROAP). UNEP is addressing transboundary marine environmental and biodiversity issues through regional collaboration, while assisting national governments to strengthen the sustainable management of their coastal and marine resources. This includes efforts to address the problems of loss and degradation of coastal and marine habitats; increasing pollution loads from land-based activities affecting the marine environment; need for improved coastal and marine information management; and lack of awareness on the value and vulnerability of coastal and marine resources (www.roap.unep.org).

“The Regional Seas Programme under UNEP aims to address the accelerating degradation of the world’s oceans and coastal areas through the sustainable management and use of the marine and coastal environment, by engaging neighboring countries in comprehensive and specific actions to protect their shared marine environment. It has accomplished this by stimulating the creation of Regional Seas programmes prescriptions for sound environmental management to be coordinated and implemented by countries sharing a common body of water.” Under the Regional Seas Programme, SPREP works to strengthen environmental education and awareness raising so that, people who are both resilient and have fortitude can be empowered to safeguard their natural resources, lifestyles and economic development.

6.3.10 United Nations Development Programme

The Environment and Energy Unit of UNDP Samoa is based in Apia and is responsible for all energy, environment and UNDP-GEF funded programmes in **Samoa**, Cook Islands, Niue and Tokelau. In addition, the Environment and Energy Section is also responsible for a number of Pacific regional environments and sustainable energy programmes in partnership with the Secretariat of the Regional Environment Programme (SPREP) the Secretariat of the Pacific Applied Geoscience Commission (SOPAC), and the Forum Fisheries Agency (FFA).

In line with UNDP's overall goal of enabling sustainable human development, the UNDP Environment & Energy Unit assists countries by facilitating access to funding opportunities from the UNDP, Global Environment Facility (GEF), bilateral and multilateral donors for environmental and natural resource management projects including sustainable energy. The unit has secured funding and designed projects in each country with some emphasis on biodiversity and climate change (www.undp.org).

The UNDP-GEF funded South Pacific Biodiversity Environment Program (SPBCP) assisted almost 17 Pacific Island Countries in their Conservation Area Projects (CAPS). The two Samoan conservation areas under this project were Sa’anapu-Sataoa and Uafato (www.undp.org). The UNDP GEF-Small Grants program has funded numerous community projects in Samoa for example: conservation of mangrove ecosystem in Moataa Village; MPA and coral gardening projects in Manono-tai; education and public awareness program on valuing the importance of environment conservation at community level with Gautavai EFKS Youth Group; sustainable livelihood through community-based management and conservation of biodiversity resources and mangrove areas in Matafaa; conservation of Fatuvalu wetland area; marine biodiversity

conservation project Savaia village; improving community resilience to address impacts of erosion on Avatele village; coral restoration and fish stock rehabilitation of the marine reserve in Tafagamanu village; protection and conservation of mangroves, ecosystem and coral reefs in Fasitootai etc (sgp.undp.org).

6.3.11 Conservation International

Conservation International is leading numerous initiatives across the Pacific region, helping communities and governments define and establish marine protected areas and create sustainable development activities. These projects include the French government-funded Coral Reef Initiative for the Pacific (CRISP) and the Regional Implementation Team for the Critical Ecosystem Partnership Fund which focuses on the Polynesia-Micronesia Hotspot (www.conservation.org). Their ground work is focused in **Samoa**, Fiji and New Caledonia. CI is also addressing climate change issues in the region by leading a science driven approach to decrease greenhouse gas and assist countries to adapt their conservation approaches to the changes (www.conservation.org).

In Samoa, CI has also worked closely with the traditional owners of Nu'utele and Nu'ulua, Aleipata islands to control invasion by some invasive animals which threatens the native flora and fauna of the Samoan Islands. CI experts and local leaders have developed a plan to free the area of invasive species and convert the two islands into one of the most pristine locally managed wildlife sanctuaries (www.conservation.org).

6.3.12 Pacific Islands Applied Geoscience Commission (SOPAC)

The Ocean and Islands Programme of the Pacific Islands Applied Geoscience Commission (SOPAC) is an integrated programme focused on research, development and management of non-living resources in ocean and island systems addressing issues relating to seabed resources, energy, and maritime boundary delimitation and monitoring of ocean processes. The term ecosystem, in this case, is consistent with the Regional Ocean Policy, the Johannesburg Action Plan for Sustainable Development and the Convention on Biodiversity. An ecosystem-based approach includes all physical, chemical and biological attributes together with living and non-living resources. SOPAC is focused on the physical and chemical attributes of ecosystems and their non-living resources assessment (www.sopac.org).

SOPAC's current South Pacific Sea Level and Climate Monitoring Project (SPSLCMP) funded by AusAID; aims to enable PICs to better manage and sustainably develop their environments. There are 12 countries participating in the project and Samoa is one of them. SOPAC's project on "Reducing Vulnerability through Island System Management" aims to address focal areas such as hazard mitigation and risk assessment; aggregates for construction, and water resource supply and sanitation. Samoa was one of the participating eight countries.

6.4 National Laws, Policies and Action Plans

6.4.1 Fisheries Act

Samoa's Fisheries Act (1988) regulates all fishing related activities through conservation, management and development. The management and enforcement of the Fisheries Act is carried out by the Fisheries Division of the Ministry of Agriculture and Fisheries. The conservation, management and development measures for fisheries is carried out by the Chief Executive Officer by consultation with fishermen, industry and village representatives. Any person who breaches the by-laws of the Fisheries Act is liable for a fine not exceeding 100 penalty units and to a further fine not exceeding 10 penalty units for every day on which the breach has continued.

The Act prohibits the use of explosives, noxious substances, and other destructive fishing substances for fishing. Any fisher or fishing vessel found in possession of these substances will be presumed to be using these for fishing and will be prosecuted accordingly. All local commercial fishing vessels need to be registered and licensed under the Fisheries Division, however these rules does not apply to any local vessel used solely for sport fishing, recreation or subsistence fishing. The conditions of the license issued includes type and method of fishing, species and amount of fish caught (restrictions on by-catch) and area of fishing. Under the licensing conditions, an Observer is authorized to board a vessel and accompany a vessel in a fishing activity.

Under this Act, any vessel or person who desires to carry out marine scientific research is required to acquire authorization by the Minister. An authorized scientific research vessel and/or person may be exempted from the provisions of the Fisheries Act.

The authorization of the Minister is needed for export and import of any fisheries products. The Minister may impose any limitation on the species, type, size, quantity and quality of fish or fish products. The import and export of live fish is prohibited under the Fisheries Act, unless a written permit is given by the Minister. Part V(A) of the Fisheries Act states that despite the provisions of any other Part of this Act and any other law, fish and fish products shall not be processed, traded or marketed except in accordance with this Part (see Part V(A), section 12B for details). To oversee the activities concerning the export and import of fish and fish products, the Samoa Seafood Standards Council has been established.

An authorized officer under this Act has the power to stop, board and search (catch, documents, gear etc) any fishing vessel within the fishery waters, without a warrant. The crew and captain of a vessel are obliged to assist and facilitate an Authorized Officer or Observer in executing their duties, while ensuring the safety of the Authorized Officer or Observer.

The Head of State acting on the advice of the Cabinet has the power to make regulations for the purpose of carrying out or giving effect to the principles and provisions of this Act; including

licensing criteria, area and seasonal closures, gear specifications and restrictions, prohibited fishing methods, catch limitations, pollution etc.

6.4.2 Lands, Surveys and Environment Act

Lands, Surveys and Environment Act (1989) make provisions for the conservation and protection of the environment and the establishment of national parks and other forms of protected areas. The Act is administered by the Ministry of Natural Resources and Environment.

Part VIII of the Act deals with the environmental issues and conservation, including coastal resources. Under this part, principles are outlined for the Division of Environment and Conservation of MNRE which shall provide the Minister with relevant information, policy and guidelines to conserve and manage the environment.

The Act, controls or monitors development activities that may have adverse environmental effects; outlines procedures for EIAs; pollution control and analysis of pollutants and hazardous substances; ensures promotion and protection of natural resources including parks and reserves; and capacity building and public awareness on importance of conserving and protection of natural resources. The Act requires the establishment of an Environment Board that reviews various environmental reports, annual corporate plans and EIA reports; and Act as conciliators between government and development industry.

Under this Act the Minister and his Ministry has powers to:

- Ensure that all important issues relating to the natural and socio-cultural environment have been adequately addressed before committing political or extensive capital funding support to any particular project;
- Establish land use and environmental management guidelines for Government agencies, for village authorities and for developers;
- Assess the environment implication of any development project or proposal which involves or will involve the consumption of terrestrial, coastal or marine natural resources, or any change in the established use of any such resources;
- Carry out monitoring and follow-up work on development projects;
- Devise, promote and carry out experiments, researches, investigations and measures to conserve natural resources and to protect the environment;
- Promote and carry out by publicity and other means the diffusion or dissemination of information relating to the environment for the instruction, guidance and benefit of persons engaged in natural resource-based industries and village communities;
- Enter into agreements with owners and occupiers of customary lands for the purpose of protecting their natural resources and environment;
- Exercise any powers relating to the protection of the environment conferred on him by any Act or regulation in relation to the introduction of plants, animals, chemical or hazardous substance suspected of being injurious to the environment;

- Establish frameworks for planning the use, development, management and protection of land in Samoa.

The Act also provides for the appointment of Conservation Officers that may be staff of the Ministry or other enforcing body. The Conservation officer, in presence of a police officer can seize and/or conduct search of vessels, aircraft, vehicles or premises if he/she suspects the Act has been breached. The Conservation officer in presence of a police officer can also make an arrest of an offender (of the Act) without a warrant. These Conservation Officers are also permitted to enforce rules in National Parks and Nature Reserves. Any person arrested for breaching this Act will be produced in court and either fined or imprisoned. Under Division 4 of Part VIII of this act, the CEO of relevant Ministries is required to draft up management plans for: national parks and reserves; Samoan water and water resources; coastal zones; indigenous forests; soil erosion, pollution and waste disposal.

Division 5 of Part VIII of this Act focuses specifically on coastal zones. Under this Act no person is allowed to take silt, sand, gravel, boulders and corals from foreshore areas and coastal waters unless permitted by the MNRE. Activities which may alter the natural configuration of the foreshore, such as excavation, dredging, clearing, paving, reclaiming and construction is also restricted under this Act, unless permitted by the Minister.

Division 6 of Part VIII of this Act focuses on pollution of sea and inland waters. Pollution of any water systems in Samoa, either by household waste, industrial waste, noxious liquid, oil or wastes from wharf and vessels is not permitted. Any person found to be committing an offence under this Act is liable for fine and/or imprisonment. Where an offence is committed by a vessel (such as discharge of oil, noxious liquid or other harmful substance), the outward clearance of such vessel shall be withheld until the court has finalized its proceedings.

6.4.3 National Parks and Reserve Act

This Act provides for the establishment, preservation and administration of national parks and reserves for the benefit of the people of Samoa.

Under the Act, the Head of State can declare any area of public land, which is not used for any other purpose and/or has an area of not less than 1,500 acres or is an island to be a National Park. Any national park under this Act shall be preserved as far as practicable in its natural state including its flora and fauna and conditions/ restrictions for the preservation of the parks biodiversity shall be setup. The Act provides for the public to access the parks (for inspiration, recreation, enjoyment) provided rules are followed.

Any public area or any area of the territorial sea can be established as a Nature Reserve, provided the area had not been set aside for any other public use prior to the establishment. The Act provides for the protection, conservation and management of terrestrial and aquatic flora and fauna, and their habitats. Once declared a Nature Reserve, the Act may prohibit or restrict persons from altering, damaging, destroying, removing, or interfering with flora, or any

specified species of flora or aquatic life, in nature reserves, or in a specified nature reserve; and prohibit or restrict persons from hunting, killing, taking, capturing, molesting, or disturbing fauna or aquatic life or any specified species of fauna or aquatic life in nature reserves or in a specified nature reserve. The declaration of nature reserves in the territorial sea shall not affect the customary fishing of the Samoan community.

The Minister however has general powers to: alter, widen, build new (or even close) roads or bridges that come through the Nature Reserve or National Park; set aside any parts of a national park or reserve for camping sites, picnic grounds, or vehicle parks for the convenience of the public; authorize to build structures or shelters on the part or reserve area and authorize the use of materials found in the park or reserve.

“Including Samoa’s EEZ which was declared a sanctuary for whales, dolphins, turtles and sharks in 2002, Samoa’s marine protected area network now stands at 12,011,437 hectares. This network includes the Palolo Marine reserve, the Aleipata MPA and the Safata MPA. A very significant part of Samoa’s marine conservation area network is the network of village based fisheries and marine reserves (no area estimate is available). An estimated 71 functional reserves have been reported. This number is likely to have increased as more reserves are being set up with GEF-SGP funding” (Samoa’s 4th National CBD Report, 2009).

6.4.4 Government (Fisheries Division) Fisheries Management Strategy

The difference in economic and social operation of Samoan fishery resulted in the Fisheries Division partitioning its management system into two sections: 1) commercial fishery management which is regulated by the Fisheries Act and 2) Village –based fisheries management program which is regulated by the village by-laws that are setup by village heads and endorsed by the Chief Executive Officer (www.fao.org). Some Management measures set by villages are: banning of destructive fishing, banning of usage of traditional plant poison, establish protected area where fishing is totally banned, organize collection of COT, enforce gear restrictions, banning of pollution from household waste, banning of commercial collection of sea cucumber, banning removal of mangroves, restricting the use of underwater torches for spear fishing at night, banning removal of beach sand, and prohibiting collection of live coral for aquarium trade (www.fao.org). However not all villages use all of the mentioned measures in their traditional fishing ground with some measures enforced up to 100% whilst others are enforced to levels as low as 10%.

Palolo Deep National Marine Reserve

The Palolo Deep Marine Reserve was one of the first marine reserves to be established in the South Pacific (Lovell and Taloa 1994). It is located in Apia, Upolu Island, Western Samoa and was established in 1974. The total area of the reserve is 137.5ha and comprises of a small land area, a fringing reef including shallow inshore flats, the steep sloping reef front and the deep. The area had a boundary of 500m seaward at a depth of 25m (Skeleton and South 2002).

The fore-reef slope and the submarine trenches have rich coral cover (www.mnre.gov.ws). A survey by Lovell and Taloa (1994) revealed that the reserve consists of diverse coral species which provided various degrees of complex habitats for fish. Fishery in the reserve was also observed to be healthy (*For full inventory report see: Lovell and Taloa 1994*).

The reserve also has a rich diversity of marine algae with a total of 124 recorded species of which 88 are Rhodophyceae, 12 are Phaeophyceae and 24 are Chlorophyceae. This pool of diverse stock serves as an important role in reseeding adjacent reefs (Skeleton and South 2002).

The reserve is being used as one of the tourist attractions for Samoa.

Village Fisheries Management Plans for Samoa

The AusAID collaborated Fisheries extension programme established the system of management at community level. Since its inception, approximately 71 village (2001) communities worked closely with the Fisheries Department (Fa'asili and Taua 2001) with the number later increasing to 87 in 2007 (www.tongafish.gov.to).

By 2007, 87 coastal villages had their own Village Fisheries Management Plan (VFMP), however according to Fa'asili and Taua (2001), these VFMPs are written only in local language and are village specific. A total of 69 village marine reserves were also declared. 57 villages had their By-laws approved while 21 villages were awaiting approval.

Village by-laws are "rules that have been prepared in accordance with relevant provisions of national Fisheries Legislation and that are accorded legal recognition by the courts of law in Samoa" (Fa'asili and Kelekolo 1999). By-laws assist in conservation and management of marine resources, provided they are within the limits of the Fisheries Regulations (1996). These by-laws are created in consultation with the village heads and the fisheries department, which is later submitted to the office of the Attorney General, where it is put in a legal context and published.

Traditional punishment for breaching rules can range from simple warnings and fines to banishment from the village. The village reps works closely with the Fisheries Division to manage and conserve their traditional fishing grounds.

6.4.5 Ministry of Natural Resources and Environment Policy on Climate Change

The Samoan Government, in response to the rising threats from climate change prepared a National Adaptation Programme of Action (NAPA) which identified the most urgent need to plan for climate change adaptation. One of the key issues was to reduce the vulnerability of coastal communities and natural habitats to the adverse impacts of climate change. The NAPA project was from 2003-2007 (Government of Samoa 2007; MNREM 2005). Following this the Samoan Government initiated the "Planning for Climate Change Policy (PCCP)" which is set to address national response to climate change as identified in NEMS 1993. Once the plan of this policy is endorsed, it will be called the National Climate Change Policy (NCCP). This policy was supposed to be endorsed by the Cabinet in 2007 (Government of Samoa 2007), however a finalized and endorsed copy of this document could not be obtained during the preparation of this document.

The target is to develop national plans of adaptation and mitigation in response to the impact of climate change. Some of the specific objectives that have been set out are:

1. To mainstream the importance of climate change issues in environmental planning and development assessment at the national level.
2. To strengthen the collection, analysis and use of data to monitor climate change patterns.
3. To promote understanding and awareness of the predicted impacts of climate change and greenhouse effects.
4. To identify the most vulnerable areas and infrastructure at risk from impacts of climate change.
5. To actively participate in international and regional forums/negotiations on matters pertaining to climate change and other pressing environmental issues.

5.4.6 Ministry of Natural Resources and Environment Policy on Biological Diversity

Samoa's "National Policy on the Conservation of Biological Diversity" provides the framework for the conservation, sustainable use and management of Samoa's terrestrial and marine biodiversity, including protection of endemic and native species and the control of invasive

species. The Policy was endorsed by the CEO of MNRE on 31st August 2007 and will be reviewed every five years.

The second component of the Policy relates to marine biodiversity which supports a diversity of marine species and ecosystems such as coral reefs, seagrasses and mangroves. The Policy identifies and has strategies for issues such as overexploitation of marine resources; impacts of unsustainable development; unsustainable use of natural resources; impacts of climate change and sea-level rise; impacts of invasive species; destructive fishing practices and limited awareness.

Some major objectives and strategies in the Policy are:

1) Public awareness and education: aims to promote wide scale public and stakeholder awareness on biodiversity, its threats and future projection of status. Some of the strategies that have been outlined to meet the objectives are:

- Increase awareness through education, seminars, workshops, training courses and awareness events (days).
- Increase media campaign, introduce awareness kits and materials
- Awareness on existing policies and legislations and strict enforcement of EIAs.

2) Capacity Building: aims to improve/upgrade technical and scientific skills of staff and train stakeholders and community members on sustainable development, conservation and management. Some of the strategies that have been outlined to meet the objectives are:

- Conduct specific training programmes for community and stakeholders
- Assess current capacity and identify areas where capacity building is required, followed by training staff members in specific areas
- Develop standard monitoring and assessment system of Samoa's marine and terrestrial biodiversity, compile inventories and upgrade databases and dissemination of information to stakeholders and scientists.
- Secure resources for biodiversity conservation projects and strengthen the legislations to facilitate biodiversity research and development.

3) Conservation of biological diversity and genetic resources: aims to encourage national (community) and global partnership in conservation of biodiversity. Strengthen environmental planning; pest control, invasive species control and monitor the introduction of genetically modified organisms; and have species recovery plans. Some of the strategies that have been outlined to meet the objectives are:

- Protect critical biodiversity and genetic resources; rehabilitate degraded ecosystems with engaging community and international support. Promote establishment of sanctuaries, national reserves, protected areas and community conservation areas

- Strengthen and enforce legislations on the sustainable management, protection and conservation of biodiversity and genetic resources.
- Adopt standards aimed at mitigating potential threats to biodiversity, develop management plans, conduct EIAs for development activities, carry out economic valuation of resources
- Develop links and meet obligations set by International and Regional Conventions
- Finalize Samoa's Invasive Species Action Plan and develop programs to prevent, eradicate and control invasive species. Strengthen border control and quarantine procedures.

4) Sustainable use of biological resources: aims to protect traditional knowledge in conservation; develop sustainable business opportunities, and economic valuation of genetic resources. Some of the strategies that have been outlined to meet the objectives are:

- Encourage active community participation in conservation of biodiversity and genetic resources, through promotion of sustainable investments. Document and preserve traditional conservation practices and encourage integration between modern science and traditional knowledge.
- Develop *sui generis* legislation to protect Samoan traditional knowledge, practices and innovation and to provide benefit sharing mechanisms for appropriate knowledge holders.
- Establish new national parks, reserves, protected areas and community conservation zones to protect biodiversity.

6.4.7 Samoa's National Biodiversity Strategy and Action Plan (NBSAP)

Samoa's Biodiversity Strategy and Action Plan (2001) is an "integral component of its National Environment and Development Management Strategies, its response to the world wide call from the Earth Summit of 1992 for nations to reexamine their developments and make changes that are necessary to turn the tide of environmental degradation and ensure sustainability in human development. The Strategy outlines the state of Samoa's biological resources and actions to curb their degradation and achieve sustainable development. It is the country's foremost expression of commitment to the Convention on Biological Diversity which it ratified on the eve of the Convention's accession.

This work was formulated through a multi-sectoral consultative process involving representatives of various in country governmental and non-governmental organisations as well as national and international experts. In particular, advisory services were given by representatives of three intergovernmental organisations in the Pacific: the Worldwide Fund For Nature (WWF), South Pacific Regional Environment Programme (SPREP) and United Nations Development Programme (UNDP- Apia Office). From the collection of a broad range of information and views, the stakeholders have extended the exercise to the allocation of responsibilities and assignments to groups of organisations.

These groups have achieved so far the compilation of currently available base line information which has provided a fairly comprehensive background to the Strategy and have participated in the first training workshop on Economic Valuation of Natural Resources for implementing the Strategy.”

6.4.8 Ministry of Natural Resources and Environment Management Plan 2008-2011

The Management Plan’s Objective Two deals with sustainable development, management and conservation of terrestrial, marine biodiversity and environment. Outcome 2.2 of the Plan focuses on marine, under which seven outputs has been targeted by the end of 2011. The outputs outlined are:

1. National policies and strategies for the sustainable development and management of marine biodiversity
2. Relevant programmes for the sustainable management, conservation and recovery of target marine species of conservation concern
3. Relevant programmes for the sustainable management, conservation and recovery of marine ecosystems
4. Relevant programme for the control and management of marine alien/invasive species
5. Capacity building, education and public awareness on marine/aquatic resources and environment issues
6. Inventories and database of relevant marine biodiversity information

6.4.9 Samoa’s Part in International Treaties and Conventions

Samoa has adopted a number of regional and international Treaties and Conventions in efforts to conserve its biodiversity. Samoa became party to the Convention of Biological Diversity, United Nations Framework Convention on Climate Change, United Nations Law of the Sea, Apia Convention, and Noumea Convention in the 1990s. Samoa endorsed the World Heritage Convention in 2001 and while Samoa does not have any designated site under the Convention, two properties (Fagaloa Bay-Uafato Tiavea Conservation Zone and Manono, Apolima & Nuulopa Cultural Landscape) have been identified for the tentative list. Samoa has one site under the Ramsar Convention, which was signed in 2002 (MNRE 2005) and ratified in 2005 (www.ramsar.org). Samoa is also party to numerous Conventions related to marine pollution (see Table 3 for details).

6.5 Gaps in Coastal legislation and Policies

In Samoa the two main Acts that regulate activities relating to coral reefs and climate change are the Fisheries Act and the Land, Survey and Environment Act. Samoa’s National Park and Reserves Act also compliments the two acts which formalize and legalize terrestrial and marine protected areas/ reserves and parks. While Samoa has a relatively small reef area compared to most other Pacific Island Countries, the Samoan Government has acknowledged most major issues relating to coral reefs and climate change through Acts, Policies and Plans.

Table 3: List of marine related conventions adopted by Government of Samoa. (Source: Ministry of Natural Resource and Environment (2004))

Convention	Date
Convention on Biological Diversity (CBD)	10 February 1994
United Nations Framework Convention on Climate Change (UNFCCC)	29 December 1994
UNCLOS Provision relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.	23 October 1996
Basel Convention on the Control of the Transboundary Movement of Hazardous Wastes and their Disposal.	22 March 2002
International Convention for the Protection of Pollution from Ships and its Protocols.	7 February 2002
1992 Protocol of the Convention on Civil Liability for Oil Pollution Damage.	1 February 2002
1992 Protocol to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage.	1 February 2002
Rotterdam Convention on Prior Informed Consent on Hazardous Waste.	June 2002
Convention on International Trade in Endangered Species	Instrument of accession in Preparation
Ramsar Convention	November 2002
Convention on the Conservation of Nature in the South Pacific Region (Apia Convention)	20 July 1990
World Heritage Convention	27 2001
United Nations Convention to Combat Desertification	August 1998
Convention on Migratory Species	Instrument of accession in preparation
Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention)	23 July 1990
Convention on the Prohibition of Driftnet Fishing in the South Pacific	9 September 1996
Waigani Convention	16 May 2001
Convention on Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.	2 January 2001
Kyoto Protocol on the Framework Convention	15 November 2000

Proper Sewage Disposal

There is not sufficient link between the national government and the communities (villages) to mitigate the issues associated with sewage disposal. A national waste disposal plan needs to be developed for proper waste disposal. There needs to be education on public awareness on the correct procedures for sewage disposal.

Coral Reef Damage Due to Anchoring

There is a need for an alternative site for vessels to anchor in order to prevent reef damage. A lot of damage is caused to the coral reefs (Five-mile reef – Samuelu and Solofa 2007) due to anchorage. Usually there is no option but to anchor on the reefs for large vessels awaiting entry into the Apia port.

Mitigation Strategies after Natural Disasters

There is a need to develop mitigation strategies that needs to be undertaken after natural disasters. After the 2009 tsunami there were no strategic plans to aid in the recovery of the damage to the coral reef systems. Samoa needs a vulnerability and adaptation plan to recover from damages caused by natural disasters.

Estimating the Value of Fisheries Catches

There is a need to develop a standard method for estimating the value of commercial, subsistence and eventually the total fisheries contribution to the GDP for Samoa. Different studies present different estimates of the fisheries catches for Samoa (Samuelu and Solofa 2007; Gillett 2009).

According to Samuelu and Solofa (2007), there is a shift from subsistence to artisanal fisheries. In order to promote sustainable management of coral reef resources, it is essential to understand the economic shift from subsistence to artisanal fisheries.

Common Platform for Stakeholders and the Government

Stakeholders and the relevant government departments need to work together to achieve sustainable management of coral reefs and its resources. There is a need for multi-sectoral communication when addressing management issues.

Biodiversity Information and Research

Knowledge on the biodiversity of Samoa is limited and/or absent (Samuelu and Solofa 2007). There is a need to build on the scientific database associated with biodiversity of Samoa.

Scientific research is also necessary to plan management strategies. For instance, in order to implement a MMA in the inshore waters of Samoa, a sound scientific study needs to be carried out to select the best place for a MMA. Moreover, scientific research could also aid in better understanding of the threats imposed on the Samoan reef systems (Samuelu and Solofa 2007).

6.6 Recommendations

Samoa has comprehensive policies, legislation and regulations for the sustainable management of coastal resources and biodiversity. This is commendable for a small country. Samoa has also led the way in marine conservation with the establishment in 1972 of the first marine reserve in the Pacific islands region and in the 1990s, establishment of a national network of fish reserves that are community driven and at the same time overseen by the Fisheries department as part of their routine work plans. We identified, however, a number of issues and gaps.

6.6.1 Fisheries

1. There is a need to more accurately document the catch from all sectors so that the full contribution of fisheries to the national GDP can be assessed.
2. Regulation of the fishery has not prevented the continued use of destructive fishing methods (e.g. *Derris*). There is a need for education of fisheries on the consequences of these practices.
3. There is a strong need for increased research on the marine biodiversity of Samoa: it's hard to manage if you don't know what you are managing.
4. Research is needed on the valuation of Samoa's reefs and reef resources, as this information is vital to decision-makers.
5. Sites that are especially vulnerable to identified threats need to be identified.
6. The apparent shift from subsistence to artisanal fishing could have significant socio-economic consequences and therefore needs to be carefully assessed.
7. Damage to critical sites (such as the five-mile reef) is impacting on biodiversity, tourism and the fishery so measures need to be put in place to try and reduce this as far as possible.
8. The impacts of invasive marine species on Samoa's reefs and resources should continue to be assessed.

6.6.2 Marine Managed Areas

1. Do the village fisheries management areas fit into any of the IUCN MMA categories? If not, how should they be regarded in terms of Samoa's obligations under the WSSD requirement to have up to 30% of the coastline protected by 2012?
2. There was a plan in place to extend the Palolo Deep Marine Reserve along the entire Apia waterfront – this plan should be revived if possible?
3. Do the village fisheries reserves serve as MMA's or is there a need for Samoa to identify other areas for full conservation (e.g. Manono Island)?

4. There is a need to obtain empirical data on the impacts of the village fisheries management plans; i.e. there is a need for more scientific research.

6.6.3 Global Change

1. There is a need to measure sea-level rise *vis-à-vis* the “bounce” effects of geological events in the Samoa archipelago (e.g. how do you compare SL rise with these geological events)?
2. The Aleipata reserve (CI) was badly impacted by the 2009 tsunami – is there an adequate V & A plan in place to deal with this and future such events?

6.6.4 Multi-sectoral, Multi-stakeholder Consultation

1. Waste disposal is a major national issue and despite the best of effort, members of the public are still dumping waste inappropriately. There is a need for a strong national campaign towards environmentally responsible waste management.
2. Improved communication between responsible government agencies is needed in areas such as coastal development, tourism, etc.

REFERENCES

Allen, G.R., Steene, R.C. & Allen, M. 1999. *A guide to angelfishes and butterfly fishes*. Singapore: Odyssey Publishing/Tropical Reef Research.

Campbell, J. 2000. *Adapting to climate change: incorporating climate change adaptation into development activities in Pacific Island Countries: a set of guidelines for policymakers and development planners*. Samoa: SPREP.

Cesar, H.J.S., Burke, L., & Pet-Soede, L. 2003. *The economics of worldwide coral reef degradation*. Arnhem: Cesar Environmental Economics Consulting and WWF-Netherlands, 23pp. Online: <http://www.cbd.int/doc/external/oecd/oecd-coral-reefs-2002-en.pdf>

Conservation International. 2008. *Economic values of coral reefs, mangroves, and sea grass: a global compilation*. US: Conservation International.

Craven, J.P. 1982. *The management of Pacific marine resources: present problems and future trends*. Boulder, Colorado: Westview Press.

Fa’asili, U. & Kelekolo, I. 1999. The use of village by-laws in marine conservation and fisheries management. *SPC Traditional Marine Resource Management & Knowledge Information Bulletin* 11.

Fa'asili, U. & Taua, A. 2001. Review of the village fisheries management plan of the extension programme of Samoa. *SPC Field Report No.7*.

Fisheries Division. 2003. *Annual Report 2002-2003*. Apia, Samoa: Samoa- Ministry of Agriculture and Fisheries.

Fisheries Division. 2007. *Annual Report 2006-2007*. Apia, Samoa: Samoa- Ministry of Agriculture and Fisheries.

Gillett, R. 2009. Fisheries in the economies of the Pacific Island countries and territories. *Pacific Studies Series*.

Government of Samoa. 2007. *Implementing Samoa's urgent climate change adaptation priorities in coastal management*. Apia, Samoa.

Hodgson, G. 1999. 'A global assessment of human effects on coral reefs', *Marine Pollution Bulletin*, 38(5): 345-355.

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs. *Freshwater Marine Research*, 50: 839-866.

IUCN. 2007. *Meeting Report*. Workshop on management of invasive species in Marine Protected Areas, Matuatu, Samoa, 12 – 15 March, 2007.

IUCN. 2009. [Press Release] *2.3 million Euro for mangrove management for climate change and livelihood in the Pacific*. December 2009.

IUCN. 2010. *Pacific Ocean 2020 challenge: rescuing an ocean in crisis*. Suva, Fiji: IUCN. Concept Paper.

Jones, G.P., McCromick, M.I., Srinivasan, M., & Eagle, J.V. 2004. Coral decline threatens fish biodiversity in marine reserves. *Proc. Natl. Acad. Sci* 101: 8251-8253.

Lovell, E., Ah-Leong, J., Bell, L., Pulea, I., Faamai, M., Ward, J., Skelton, P. & McAdoo, B. 2009. *Coral reef inspection of selected coral reefs on Upolu Samoa following the September 29, 2009 Tsunami*. Samoa: UNESCO International Tsunami Survey Team (ITST), New South Wales University's Australian Tsunami Research Centre (ATRC), University of the South Pacific, Marine Environmental Assessment Team (MEAT).

Lovell, E.R. & Taloa, F. 1994. *Palolo Deep National Marine Reserve: a survey, inventory and information report*. SPREP Reports Studies Series No. 84.

Ministry of Natural Resources and Environment (MNRE). 2004. *Proposal for a national marine biodiversity conservation project for Samoa*. Apia, Samoa: MNRE (Unpublished)

Ministry of Natural Resources, Environment and Meteorology (MNREM). 2005. *National Adaptation Programme of Action Samoa*. Apia, Samoa: MNREM

Mulipola, A., Taua, A., Tuaepepe, O. & Valencia, S. 2007. *Samoa fisheries socio-economic report 2006-2007*. Apia, Samoa: Fisheries Division, Ministry of Agriculture and Fisheries.

Newton K., Cote, I.M., Pilling, G.M., Jennings, S. & Dulvy, N.K. 2007. Current and future sustainability of island coral reefs fisheries. *Current Biology* 17: 655-658.

Nunn, P.D. 2007. Climate, environment and society in the Pacific during the last millennium. *Developments in Earth and Environmental Sciences* 6.

Nybakken, J.W. & Bertness, M.D. 2005. 6th ed. *Marine Biology: an ecological approach*. Pearson Education.

Passfield, K., Mulipola, A., King, M. & Ropeti, E. 2000. *Profile of village fisheries in Samoa*. Brisbane, Australia: GRM International Pty Ltd. AusAID-Samoa Fisheries Project Milestone 17

Pomeroy, R.S., Parks, J.E. & Balboa, C.M. 2004. Farming the reef: is aquaculture a solution for reducing pressure on coral reefs. *Marine Policy*

Paulay, G. 1997. *Diversity and distribution of reef organisms*. In: Birkeland C. (ed). *Life and Death of Coral Reefs*. NY: Chapman and Hall.

Roberts, C.M. 1995. Effects of fishing on the ecosystem structure of coral reefs. *Conservation Biology*, 9 (5): 988-995.

Saito, Y. 2002. *A survey on environmental and sewage water from enterprises in Samoa*. Apia, Samoa: Report for the Samoa Water Authority.

Samoa Dept. of Environment. 2009. *Samoa's Fourth National CBD Report: Convention on Biological Diversity*. Apia, Samoa

Scales, H., Balmford, A. & Manica, A. 2007. Impacts of the live reef fish trade on populations of coral reef off northern Borneo. *Proceedings of the Royal Society B* 274: 989-994.

Samuelu, J.I. & Sapatu, M. 2010. *Status of Coral Reefs in Samoa*. In: C. Morris (Ed), *Status of Coral Reefs in the South-West Pacific: 2007*. (Unpublished Report)

Samuelu, J.I. & Solofa, A. 2004. *Samoa*, pp.119-127. In: Sulu, R. (Ed), *Status of coral reefs in the South West Pacific*, Suva, Fiji: IPS Publications, University of the South Pacific.

Samuelu, J.I. & Solofa, A. 2007. *Samoa*. In: R. Sulu (Ed), Status of Coral Reefs in the South-West Pacific: 2004', Suva, Fiji: IPS Publications, University of the South Pacific.

Scheffer, M., Carpenter, S. & Young, B. 2005. Cascading effects of overfishing marine systems. *Trends in Ecology and Evolution*, 20 (11): 579-581.

Seeto, J. & Baldwin, W.J. 2010. *A checklist of the fishes of Fiji and a bibliography of Fijian fish*. Suva, Fiji: University of the South Pacific. USP School of Marine Studies Technical Report No. 1/2010.

Skelton, P.A., Bell, L.J., Mulipola, A. & Trevor, A. 2000. *The status of the coral reefs and marine resources of Samoa*. Noumea, New Caledonia: Report to International Coral Reef Initiatives – Regional Symposium, Anse Vata.

Skelton, P.A. & South, G.R. 2000. *Guide of the common seaweeds of the Palolo Deep National Marine Reserve, Apia, Samoa*. USP School of Marine Studies Technical Report 2000 (2).

Skelton, P.A. & South, G.R. 2002. Annotated catalogue of the benthic marine algae of the Palolo Deep National Marine Reserve of Samoa. *Australian Systematic Botany* 15: 135-179.

Skelton, P.A. & South, G.R. 2007. The benthic marine algae of the Samoan Archipelago, South Pacific, with emphasis on the Apia District. *Nova Hedwigia*, Beiheft: 132

Skelton, P.A., South, G.R. & Seeto, J. 2008. *Marine invasive species survey of Apia Harbour, Samoa*. Samoa- Department of Environment and Conservation.

Solomon, S., Qin, D. Manning, M., Alley, R.B., Berntsen, T., Bindoff, N.L., Chen, Z., Chidthaisong, A., Gregory, J.M., Hegerl, G.C., Heimann, M., Hewitson, B., Hoskins, B.J., Joos, F., Jouzel, J., Kattsov, V., Lohmann, U., Matsuno, T., Molina, M., Nicholls, N., Overpeck, J., Raga, G., Ramaswamy, V., Ren, J., Rusticucci, M., Somerville, R., Stocker, T.F., Whetton, P., Wood, R.A. & Wratt, D. 2007. *Technical Summary*. In: S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor & H.L. Miller. (eds.). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK & NY: Cambridge University Press.

South, G.R. & Low, J. 2008. *The Pacific Islands: Dynamics of regional cooperation on oceans and coasts*, pp.563-595. In: T.E. Chau, G. Kullenberg, & D. Bongo. (eds). *Securing the oceans; essay on ocean governance- global and regional perspectives*. Quezon City, Philippines: PEMSEA and Nippon Foundation.

Spalding, M.D., Blasco, F. & Field, C.D. 1997. *World mangroves atlas*. Okinawa, Japan: The International Society for Mangrove Ecosystems.

Spalding, M.D., Ravilious, C. & Green, E.P. 2001. *World Atlas of Coral Reefs*. UNEP World Conservation Monitoring Centre.

SPREP. 1995. *Joint responsibility for preserving our natural heritage: the Apia Convention*. Factsheet 12/5.

Techera, E.J. & Troniak, S. 2009. *Marine protected areas policy and legislation gap analysis: Fiji Islands*. Suva, Fiji: International Union for the Conservation of Nature and Natural Resources.

South, G.R., Skeleton, P., Veitayaki, J., Resture, A., Carpenter, C., Praat, C. & Lawedrau, A. 2004. *Global international water assessment: Pacific Islands*. University of Kalmar, Sweden: UNEP GIWA Regional Assessment 62.

United Nations. 1983. *The law of the sea-official text of the United Nations Convention on the Law of the Sea with annexes and index*. NY: United Nations.

Valencia, S., Mulipola, A., Tauaefa, A. & Tuaepepe, O. 2007. *Samoa Fisheries Socio-Economic Report 2006-07*. Apia, Samoa: Fisheries Division (Unpublished)

Veitayaki, J. 1995. *Fisheries development in Fiji: the quest for sustainability*. Suva, Fiji: Institute of Pacific Studies, University of the South Pacific.

Veitayaki, J., Evans, N. & South G.R. 2004. The Pacific Islands Regional Ocean Policy: the quest for good ocean governance. *Ocean Yearbook 18*: 558-577.

Veron, J.E.N. 2000. *Corals of the World*. Townsville, Aust.: Australian Institute of Marine Science. 3 Vols

Wass, R.C. 1984. *An annotated checklist of the fishes of Samoa*. NOAA Technical Report SSRT-781.

Wilkinson, C. (ed). 2004. *Status of coral reefs of the world 2004*. Townsville: Australian Institute of Marine Science. Vol. 1 & 2.

Wilkinson, C. 2008. *Status of coral reefs of the World: 2008*. Townsville, Australia: Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre.

Zann, L.P. 1989. *A preliminary checklist of the major species of fishes and other marine organisms in Western Samoa (Samoan/Scientific/English)*. FAO/UNDP-SAM/89/002. Field Report No. 1.

Zann, L.P. & Mulipola, A.P. 1995. The inshore resources of Western Samoa database: coastal inventory and fisheries. In: P. Dalzell P. & T.J.H. Adams. 1995. South Pacific Commission and

Forum Fisheries Agency Workshop on the Management of South Pacific Inshore Fisheries. *Integrated Coastal Fisheries Management Project, Technical Document 12 (11)*: 1-5.

Ziemann, D.A. 2001. The potential for the restoration of marine ornamental fish populations through hatchery releases. *Aquarium Science and Conservation 3*: 107-117.

Websites

www.birdlife.org; blog.conservation.org; www.bizearch.com; www.cia.org; coris.noaa.gov; www.cites.org; www.cbd.int; www.climatechange.org; www.ciesin.org; www.conservation.org; www.dfat.gov.au; en.wikipedia.org; www.fao.org; www.fspi.org; www.greengrants.org; www.iucn.org; www.infoplease.com; www.marinebiology.org; www.mnre.gov.ws; www.noaa.gov; orgs.tigweb.org; www.roap.unep.org; www.ramser.org; www.spc.int; www.sprep.org; www.samoaictp.ws; www.sidnet.org; sgp.undp.org; siosiomaga.hostoi.com; see-the-sea.org; www.sopac.org; www.tongafish.gov.to; www.un.org; unfccc.int; www.unep.org; www.undp.org; whc.unesco.org; www.worldsummit2002.org;

7. COUNTRY PROFILE: TONGA

7.1 Introduction

Tonga is an archipelago in the South Pacific Ocean, situated directly south of Western Samoa and about two-thirds of the way from Hawaii to New Zealand (coordinates: 20 00 S, 175 00 W) (www.cia.org). It consists of 176 islands, 36 of which are inhabited; these are divided into three main groups: Vava'u, Ha'apai and Tonagtapu (www.wikipedia.org). Most of the islands have a limestone base formed from uplifted coral formation while others have limestone overlying volcanic bases (www.cia.org). The land area of Tonga is approximately 717 km² and the Tongan Exclusive Economic Zone (EEZ) has an area of approximately 700 000 km² (Miller 2009). The population of Tonga for the year 2010 is estimated to be 122 580 (www.cia.org).

Important economic commodities of Tonga include agricultural products which includes squash, coconuts, copra, bananas, vanilla beans, cocoa, coffee, ginger and black pepper. Major industries of Tonga are tourism, fishing and construction (www.cia.org). In 2009, the GDP was worth USD 262 million with GDP per capita estimated at USD 4 600 (www.cia.org). The composition of the GDP by sector in the fiscal year 2005/2006 were: agriculture – 25%; industry (tourism, fishing, construction) – 17%; services – 57% (www.cia.org).

7.2 Background

7.2.1 Coastal Resources of Tonga

Coastal areas play an important role in the Tongan society and are essential in national development as a whole. The income generated from tourism and fisheries is dependent on the condition and productivity of critical ecosystems and shoreline features such as coral reefs, beaches, sea grass beds and mangroves. An important activity in the country is artisanal fishing. Almost 70% of the artisanal catch is made up of reef fish (notably emperors and mullet). In many areas turtle eggs and meat are still consumed. Several important commercial fisheries exist in Tonga, particularly, an aquarium trade dealing with fish, coral and live rock together with limited numbers of invertebrates (Spalding *et al.* 2001).

Reef Area and Types of Coral Reefs

The total reef area of Tonga is 1 500 km² (Spalding *et al.* 2001). Tonga has complex reef systems; the central Ha'apai group is a complex spread of reefs and low-lying islands, the Vava'u group in the north includes a wide spread of islands and reefs on its southern side. There is conflicting claim of authority by Tonga and Fiji over the Minerva Reefs, lying to the southwest of 'Ata and south of Fiji's Lau Islands. There are reports of highly remote reefs to the south and east of Tonga, including Albert Meyer Reef about 300 km east of Tongatapu and Gleaner Reef about 175 km southeast of 'Eua (Spalding *et al.* 2001). A map illustrating the reef systems of Tonga is presented in Figure 4.



Figure 4: The coral reefs of Tonga. Source: Spalding *et al.* 2001

Coral Reef Biodiversity

There is little information available on the coral reef biodiversity of Tonga. The known marine biodiversity of Tonga includes: 192 species of scleractinian corals (recorded at 11 reefs around Tongatapu), 229 reef fish from 39 families, 55 bivalves, 83 gastropods and 13 holothurians. For all the organisms, these are considered to be underestimates. There is likely to be high variability in coral cover on the reefs, with records of only two percent in Monuafe but, up to 50 percent at Hakaumama'o Reef (Spalding *et al.* 2001).

7.2.2 Economic Value of Reef Systems in Tonga

The major uses of the reef resources in Tonga are in fisheries and tourism; coral reefs support the livelihood of Polynesian populations through subsistence fishing and tourism (Vieux *et al.* 2008). Coral reef ecosystems provide dive and snorkeling sites for tourists. In addition, commercial fisheries also contribute significantly towards Tonga's fisheries sector (Gillett 2009).

The 2007 contribution to the nation's economy by the fisheries sector was projected to be T\$23 757 000 (USD12 025 794), out of a total GDP of T\$505 679 000 (USD255 974 718). Out of the total fisheries contribution, subsistence fisheries accounted for T\$12 488 000 (USD6 321 425) and commercial fisheries accounted for T\$22.8 million (USD11.5 million). The total landings for subsistence and commercial fisheries were 2 800 tonnes and 3 700 tonnes, respectively. For commercial fisheries 700 tonnes (worth at T\$4.8 million (USD2.4 million) out of the 3 700 tonnes were exported (Gillett 2009).

For the fiscal year 2006 the local market component of Tongan fisheries was worth at T\$11 645 000 (USD5 894 699), the non-local market component was worth at T\$4 436 000 (USD2 245 503), the export component was worth at T\$4 067 000 (USD2 058 715) and the total fisheries contribution to the Tongan GDP was worth at T\$20 148 000 (USD10 198 917). For the year 2006, the GDP for Tonga was T\$478 226 000 (USD242 078 008), which had a fishing share of 4.2% (Gillett 2009).

7.2.3 Major threats to Tonga's reefs

Vieux *et al.* (2004) indicate that coral reefs in the Polynesia (including Tonga) are remote from most of the damaging human stresses to reefs closer to large land masses. Hence, most coral reefs in Polynesia are in generally good condition with a few near the expanding urban centres and heavily used lagoons showing signs of damage with low fish populations, low coral cover and algal growth.

Cyclones cause periodic damage to the reefs with recorded damages in the years 1995, 1997, 1999 and 2000. The Tongan reefs were largely unaffected by the 1998 bleaching event however, the reefs suffered a major bleaching event in 2000 (Spalding *et al.* 2001).

The areas with high population density, particularly Tongatapu, face the problem of overfishing. Holothurians (especially sandfish; *Holothuria scabra*) and target species for export have been overfished throughout the country. Due to overfishing two giant clam species namely, *Tridacna gigas* and *Hippopus hippopus* were thought to be

Case Study 1: Giant Clam Revitalization in Tonga

Two giant clam species (*Tridacna gigas* and *Hippopus hippopus*) became locally extinct in Tonga due to overfishing. Despite being aware of the threat of overfishing on the lagoon invertebrates, the fishers of Kotu Island in the Ha'apai group chose to ignore it. They believed that there would be no point in working towards sustainable use of the lagoon resources when the lagoon was being exploited by fishermen from other islands in the district (Johannes 2002).

The two giant clam species were re-introduced in 1990 and 1991. Since then there have been a number of giant clam nursery established in Tonga, to be managed at the community level. In 1997 there was a complete ban on sea cucumber export for 10 years as a response to chronic overharvesting. The lack of local ownership of reef resources exacerbated the problems associated with overfishing of giant clams in Tonga. This enabled commercial collectors to harvest close to local communities as well as other areas (Spalding *et al.* 2001).

locally extinct, but were re-introduced in 1990 and 1991 (Case Study 1; Spalding *et al.* 2001). Apart from overfishing, other threats to coral reefs include destructive fishing practices (notably smashing of reefs to chase fish into nets and trampling of reef flats), use of poison (bleach and pesticides) and eutrophication. Eutrophication due to untreated sewage and fertilizer runoff is evident in Tongatapu and Vava'u (Spalding *et al.* 2001).

Newton (2008) found that there is no reticulated wastewater system in Tonga; hence people rely on household-based management. Individual households are left to deal with wastewater (from bathroom, kitchen and toilet) which presents a number of problems. The issues related to improper wastewater management include: groundwater and marine water pollution, human health complications, improper human excreta disposal and animal waste mismanagement (Case Study 2). A study by South *et al.* (2004) indicates that the Lifuka Island, in the Ha'apai Group, Tonga, shows a close linkage between sanitation systems and groundwater pollution of wells (Crennan 2001).

Case Study 2: Sanitation and Wastewater Management in Tonga

The constraints in dealing with issues arising from improper wastewater management in Tonga include: insufficient knowledge on the benefits of improving household sanitation facilities, lack of funding and capacity-building opportunities, negative behaviors and attitudes, institutional barriers and lack of village regulation enforcement.

Tonga does not have a central/ public sewerage system. The methods of wastewater and sewage disposal in Tonga include: septic tanks (common means of disposal in residential areas with piped water), ventilation pit latrines and water seal latrines (in areas where water supplies do not allow septic tanks), flush pits and traditional pits and open soaked pits. The improper disposal of wastewater in Tonga has resulted in high faecal coliform bacteria levels in piped water systems and high nutrient levels in lagoons. There is a lot of improvement required in the sanitation sector of Tonga (Newton 2008).

“The most disturbed areas in Tonga now are: Faga'uta lagoon in Tongatapu (eutrophication, major coral mortality and collapse of fisheries); Nuku'alofa and adjacent northern Tongatapu (physical disturbance, loss of habitat, eutrophication, over-fishing, coral mortality); inner Neiafu harbour in Vava'u (sedimentation, COTS, over-fishing, coral mortality); and Pangae harbour on Lifuka Island in Ha'apai (eutrophication, high coral mortality)” (Vieux *et al.* 2004).

5.3 Ecosystem Management Initiatives by Non-government Organizations in Tonga

5.3.1 Civil Society Forum of Tonga (CSFT)

The CSFT is the umbrella organization for NGOs and Civil Society Organizations (CSOs) in Tonga with 46 members and is the key contact organization for PIANGO. It promotes opportunities for capacity building, NGO and leadership development through open dialogue, equal participation, collective decision making and consensus building.

Its focus is on identifying, negotiating and developing long-term relationships that will help in capacity building of its members. Its community development activities are focused on alleviating poverty, environmental protection, women and youth development and income generation.

Its relevant activities have involved administering the European Union Community Development Fund, administering of Small

Grant schemes, facilitating the GEF/ Small Grant Projects and partnership with FSPI's Mainstreaming of Rural Development Innovation Programme (MORDI). (civilsocietytonga.org)

5.3.2 Tonga Community Development Trust (TCDT)

Tonga Community Development Trust is an affiliate of FSPI, established in 1979 as the Foundation of the Peoples of the South Pacific Tonga (FSP Tonga) before being given its current name in 1985. It is an indigenous, non-governmental development organization whose focus is on capacity building, promoting self-reliant and technologically appropriate development with particular attention to the poor, rural and outer island communities. The Trust priority lies in village-based projects in four main areas namely, women in development, water supply and health, training and institutional development and environment and natural resources.

Two current climate change-related projects being facilitated by TCDT are: 1) GEF/ Small Grant Programme: Mitigating Climate Change impacts in Ha'apai: the project utilizes an integrated approach of community empowerment, communication and awareness to demonstrate best mitigation and adaptation practices for the Lifuka and Foa Island communities. Sea level rise has resulted in a lot of beach erosion in the islands and it has also affected the quality of ground water. The ongoing increase in atmospheric temperature has brought changes in weather patterns which have a detrimental impact on the production level of agriculture and fisheries. This project will generate lessons learned for replication in other island groups in Tonga. 2) Force of Nature (FON) & NZAID: Disaster Preparedness: Coping Communities Project: this project aims to increase resilience of the targeted communities in Hihifo-Ha'apai & Neiafu-Vava'u, 'Lifuka District in Ha'apai & Koloa and Holeva in Vava'u to better respond to the impacts of a disaster by enabling them to revive, apply and share traditional methods and where necessary merging these practices with modern scientific and technical knowledge. (www.tcdt.to)

7.3.3 Vava'u Environmental Protection Association

The Vava'u Environmental Protection Association (VEPA) was established in May 2009 by a group of local leaders concerned with the pressing environmental issues facing the island of Vava'u. It is aimed at ensuring biodiversity conservation, increasing knowledge exchange and securing sustainable livelihoods.

VEPA works on conservation projects in a range of environmental habitats including coral reefs, mangroves and forest areas. It also engages in education and awareness work on current environmental issues and in connecting environmental advocates. (www.vavauenvironment.org)

7.3.4 Langafonua a Fafine Tonga (National Women's Council)

The National Women's Council of Tonga was set up by Her Late Majesty Queen Salote Tupou III in 1953 with the objective of ensuring the development, growth and wellbeing of Tongan

women. Women's Committees and Organizations come under the Women's Council and have been at the forefront of development, conservation, environmental protection, village beautification and awareness initiatives.

A successful relevant project was carried out by the National Women's Council in Haveluloto Village where it worked with the community in mobilizing participation in environmental awareness and waste management practices (www.pacificwater.org).

7.3.5 PAN Pacific and South-East Asia Women's Association of Tonga (PPSEAWA)

The PPSEAWA is part of a wider regional (Pacific and South East Asian) network, set up in the early 1950s to deal with international issues concerning the women of Tonga. It has approximately 100 financial members, over 60 of whom are active. Amongst the Association's goals is the desire to strengthen the bonds of peace, friendship and mutual support amongst women, to assist local charities and to improve the status of Tongan women in all areas. PPSEAWA's parent body is the National Women's Council (www.ppseawa.org).

7.3.6 Tonga National Youth Congress

The TNYC is an NGO that pools together youth from age 14 – 24 to respond to challenges from a political level to a grassroots community level. It focuses on creating and promoting youth employment, promoting youth empowerment and leadership skills and also advises the Ministry of Training, Employment, Youth and Sports on youth issues.

The Tonga National Youth Congress is the umbrella organization for groups focusing on the interests of youth. Its goal is to better the welfare of youths through programs that foster responsibility, citizenship, community service and leadership. The Congress focuses on activities in the areas of sports, environmental awareness, education, health and mental well being, enterprising careers/vocations.

It has a partnership with the Pacific Leadership Program (PLP) to fund its operation system. It facilitates the GEF/ Small Grants Programme launched in Eua for the Eua Youth Congress and will soon launch the GEF/ Small Grants Programme- funded project in Haapi, Vavau and Tongatapu (www.pacificyouthcouncil.org).

7.3.7 Australian AID Programme

Tonga Community Development Scheme: this scheme focuses on rural community needs with a committee of government, community and donor representatives considering proposals. Since it began, the scheme has supported projects in education, water and sanitation, transport and communications, power generation, fisheries and agriculture. Small-scale infrastructure projects include teachers' housing, jetties, water tanks and health centre upgrades. In recent years assistance has included building a produce market in Ha'apai and repairing Ha'apai air terminal. Support for climate change adaptation has also helped communities suffering from

saltwater infusion of the water table into their drinking water, erosion, and tidal encroachment on marginal lands in Tongatapu, Ha'apai and Vava'u. The contribution from AusAID is up to a million a year and this is an ongoing scheme (ausaid.gov.au).

Fisheries Management: this project aims to help Tonga develop and manage living marine resources by helping remote and disadvantaged communities conserve their fish stocks and increase their incomes. The project is strengthening the Ministry of Fisheries to be more responsive to its stakeholders. The activity also works with the export fishing industry to improve fisheries management. In addition, the project provides assistance to small-scale fishers. Incomes from under-exploited fisheries and inshore living marine resources are increasing and marketing opportunities are improving (ausaid.gov.au).

Climate Change Adaptation Project: this project aims to develop climate change adaptation policies and strategies to assist the Pacific Island tourism sector protect and grow local livelihoods. Pacific tourism is particularly vulnerable to climate change impacts due to the climate sensitivity of the natural environmental assets upon which the industry is based, the industry's reliance on a long haul travel market threatened by global climate change policy and changing consumer demands and the vulnerability of coastal infrastructure. It will inevitably need to adapt to risks from future climate change. Policy analysis is being tentatively conducted in 10 Pacific Island countries (Fiji Islands, Kiribati, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu).

This interactive project links Victoria University, University of New South Wales, SPTO, UNDP, SPREP and FSPI and is being funded by AusAID (www.south-pacific.travel).

7.3.8 The Foundation of the Peoples of the South Pacific International (FSPI)

FSPI is the regional secretariat for a network of 20 independent community-based organizations working in the Pacific to foster self-reliance and sustainable development. It is one of the largest, most experienced civil society organizations in the Pacific, with Network Partners in Fiji, Kiribati, Palau, Papua New Guinea, Samoa, the Solomon Islands, **Tonga**, Tuvalu, Vanuatu and Timor-Leste, and metropolitan partners in Australia and the United States (www.fspi.org).

Two relevant projects under FSPI's Disaster Risk Management Programme involving Tonga are 1) **Coping Communities: Vulnerability Reduction Initiatives with Pacific Island Communities:** funded by NZAID, this project works with FSPI's network partners in PNG, Solomon Islands, Tonga and Vanuatu with the goal of reducing the social, economic and environmental impacts of disasters on Pacific Island communities and achieving associated Millennium Development Goals. 2) **Building Community Resilience to cope with the impacts of Floods and Cyclones:** this project, funded by Force of Nature (FON), targets the villages of Hihifo and Neiafu in Tonga in increasing their resilience towards natural disasters. It aims to help these communities cope with natural disasters through the application of traditional coping strategies and Community-based Disaster Risk Management. (www.fspi.org.fj/index.php/disaster-current-projects.html)

7.3.9 International Union for Conservation of Nature (IUCN)

IUCN is involved in three related projects: 1) Pacific Ocean 2020 Challenge: rescuing an ocean in crisis; 2) Mangrove Ecosystems for Climate Change and Livelihood in the Pacific (MESCAL); and 3) Pacific Centre for Environmental Governance (PCEG).

The 2020 challenge seeks to focus global attention, build new partnership and generate the necessary commitments and resources required to “develop and implement a long-term comprehensive and cohesive strategy and action plan to curb the impacts on the Pacific Oceans ecosystems and the resulting negative impacts on the Pacific Ocean region and the globe” (IUCN 2010 concept paper).

The MESCAL project started in December 2009 and involves five Pacific island countries: Fiji, Samoa, Solomon Islands, **Tonga** and Vanuatu. The primary goal of MESCAL “is to help reverse recent trends in the loss of mangroves, increase resilience of the people of the Pacific to climate change and provide natural insurance against the effects of climate change and extreme events. The project will help participating countries invest in stakeholder based management of mangroves and associated ecosystems by developing sound evidence-based policies, plans and practices and targeted capacity development of government, NGO, and community members as appropriate in mangrove conservation practices and rehabilitation. This interdisciplinary applied research and development project will also involve IUCN’s collaborating partners, such as the University of the South Pacific, WorldFish Center (WFC), Pacific Regional Environmental Programme (SPREP), and many government agencies and NGOs in the participating countries” (IUCN 2009).

PCEG, under IUCN Oceania, is a “virtual centre of excellence in environmental governance focusing on environmental law, environmental policy, environmental economics and leadership and learning. PCEG aims to strengthen enabling environments of laws, policies, formal and traditional institutions and decision-making processes for effective, efficient, equitable, transparent and accountable decisions within local and national political, socio-economic, and environmental context” (<http://www.iucn.org>). IUCN Oceania also has a Pacific Resource and Environmental Economics Network (PREEN). The inadequate consideration of economics issues in natural resource management is due to lack of capacity in that area. In response to this, IUCN organized a meeting with practicing resource economists in 2007 and formed PREEN, whose purpose is to provide support and share ideas to progress economic analysis for sustainable resource management in the Pacific (<http://www.iucn.org>).

7.3.10 Secretariat of the Regional Environment Programme (SPREP)

SPREP was established by the governments and administrators of the Pacific Island Countries, and was responsible for managing and protecting the environment and natural resources of the Pacific region. The initiative of Pacific Communities to establish SPREP shows their dedication towards sustainable development. Especially in accordance with the outcomes of WSSD implementation plan, the Millennium Development Goals and Declaration, the Barbados Plan

of Action and Agenda 21 (www.sprep.org). SPREP's Climate Change Vulnerability and Sea-level Rise project works in line with WSSD and UNFCCC goals. SPREP is working on five focal areas under this programme: 1) strengthening meteorological services (project: PIGCOS), 2) Understanding climate change variability and sea-level rise (project: ARMS), 3) Vulnerability, adaptation and mitigation (project: CBDAMPIC and PIGGAREP), 4) Ozone depleting substance (project: ODS) and 5) Policy development on climate change (www.sprep.org).

Tonga has been involved in all these projects, being a core country party to the Ozone Depleting Substance Project (ODS), a participant country in the Vulnerability, Adaptation and Mitigation Project (CBDAMPIC and PIGGAREP) and a part of the ARMS and PIGCOS Project (www.sprep.org).

7.3.11 Pacific Islands Applied Geoscience Commission (SOPAC)

The Ocean and Islands Programme of the Pacific Islands Applied Geoscience Commission (SOPAC) is an integrated programme focused on research, development and management of non-living resources in ocean and island systems addressing issues relating to seabed resources, energy, and maritime boundary delimitation and monitoring of ocean processes. The term ecosystem, in this case, is consistent with the Regional Ocean Policy, the Johannesburg Action Plan for Sustainable Development and the Convention on Biodiversity. An ecosystem-based approach includes all physical, chemical and biological attributes together with living and non-living resources. SOPAC is focused on the physical and chemical attributes of ecosystems and their non-living resources assessment (www.sopac.org).

SOPAC's current South Pacific Sea Level and Climate Monitoring Project (SPSLCMP) funded by AusAID aims to enable PICs to better manage and sustainably develop their environments. Tonga is one of the 12 countries participating in the project. Another SOPAC project "Reducing Vulnerability through Island System Management" aims to address focal areas such as hazard mitigation and risk assessment, aggregates for construction, and water resource supply and sanitation. Tonga was one of the eight participating countries.

7.3.12 United Nations Environment Programme (UNEP)

"UNEP is the United Nations system's designated entity for addressing environmental issues at the global and regional level. Its mandate is to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action. The mandate and objectives of UNEP emanate from: a) UN General Assembly resolution 2997 (XXVII) of 15 December 1972; b) Agenda 21, adopted at the UN Conference on Environment and Development (the Earth Summit) in 1992; c) the Nairobi Declaration on the Role and Mandate of UNEP, adopted by the UNEP Governing Council in 1997; d) the Malmö Ministerial Declaration and the UN Millennium Declaration, adopted in 2000; and e) recommendations related to international environmental governance approved by the 2002 World Summit on Sustainable Development and the 2005 World Summit" (www.unep.org).

UNEP has six priority focal areas on environmental changes; 1) climate change; 2) disaster and conflicts, 3) ecosystem management, 4) environment governance; 5) harmful substances and 6) resource efficiency (www.unep.org). UNEP has supported and funded various conservation projects in the Pacific Region, which is coordinated by their Regional Office of Asia and the Pacific (ROAP). UNEP is addressing transboundary marine environmental and biodiversity issues through regional collaboration, while assisting national governments to strengthen the sustainable management of their coastal and marine resources. This includes efforts to address the problems of: loss and degradation of coastal and marine habitats; increasing pollution loads from land-based activities affecting the marine environment; need for improved coastal and marine information management; and lack of awareness on the value and vulnerability of coastal and marine resources (www.roap.unep.org).

7.3.13 United Nations Development Programme

UNDP's Environment and Energy Unit is responsible for a number of Pacific regional environments and sustainable energy programmes in partnership with the Secretariat of the Regional Environment Programme (SPREP), the South Pacific Applied Geoscience Commission (SOPAC) and the Forum Fisheries Agency (FFA). In line with UNDP's overall goal of enabling sustainable human development, it assists countries by facilitating access to funding opportunities from the UNDP, Global Environment Facility (GEF), bilateral and multilateral donors for environmental and natural resource management projects including sustainable energy. The UNDP-GEF funded South Pacific Biodiversity Environment Program (SPBCP) assisted almost 17 PICs in their Conservation Area Projects (CAPS). The Tongan conservation area under this project was Ha'apai Island (www.undp.org).

The UNDP Fiji Multi-Country Office serves the Federated States of Micronesia, Fiji, Republic of Marshall Islands, Palau, Vanuatu, Tuvalu, **Tonga**, Kiribati, Nauru and the Solomon Islands. The Multi-Country Office is involved in three related projects: 1) Capacity Building Project for MDG-based Budget, Planning and Aid Management; 2) Tsunami Early Recovery Project; 3) Second National Communications.

The MDG-based Budget, Planning and Aid Management project seeks to assist the Government of Tonga to achieve the Millennium Development Goals by strengthening institutional capacity to collect disaggregated MDG data accurately and consistently for evidence based policy formulation, planning, and budgeting. It also aims to provide a MDG monitoring & accountability framework by integrating relevant and localized MDG indicators into the Medium Term Development Strategy and Expenditure Framework with emphasis on mainstreaming of environment and energy issues into sector and national development plans to mitigate the effects of climate change and to support the national policy dialogue & negotiations with development partners for interventions to fast track MDG achievement. The project will place emphasis on aligning Tonga's aid flows to fund environment interventions in the area of climate change and related fields (MDG7 - Environment).

The Government of Tonga signed a project with UNDP that will assist the country in efforts to facilitate and coordinate recovery measures on the island of Niuatoputapu, which was severely affected by the September 2009 tsunami. UNDP supported the Government's efforts in organizing relief and the rebuilding of infrastructure and homes on the island as well as improving the livelihoods of the affected residents, the overall practices for disaster risk management and early warning systems and making the people aware of the importance of preparing for future disasters.

UNDP is also providing assistance to the Government of Tonga in its Report for the Second National Communication which comprises of three major elements: a national greenhouse gas inventory, abatement analysis and vulnerability and adaptation assessments as basis to access implementation funding. Some activities include gathering data on green house gas emissions and assessing coastal erosion and these are then collected and noted in the SNC reported (www.undp.org.fj).

The UNDP GEF-Small Grants program has funded numerous community projects in Tonga for example: Tatakamotonga Coastal Protection and Muinahafu Community Based Conservation Area Project, Lifuka and Foa Coastal Management Project, Halaleva Youth Group Lagoon Project, and Tonga National Youth Congress' Youth Conservation and Environmental Stewardship Project (sgp.undp.org).

7.4 National Laws, Policies and Action Plans

7.4.1 Parks and Reserves Act

The Parks and Reserves Act (1988ed) of Tonga provides for the establishment, preservation and administration of parks and reserves. The Act requires the establishment of the Park and Reserve Authority, whose members will be determined and appointed by the Privy Council of Tonga. Privy Council belongs to the executive and judiciary branch and their functions are exercised primarily through the King and his Cabinet. The Privy Council makes major policy decisions for the country (en.wikipedia.org).

The Park and Reserve Authority (or the Minister of Lands if an Authority has not been determined) with consent from the Privy Council, has the authority to declare any area of land or sea to be a park or reserve. All parks and reserves should be published in the gazette and registered in accordance with the Lands Act.

The Authority with the consent of the Privy Council has the right to set up regulations for parks or reserves such as closures or restricted areas for the protection, preservation and conservation of resources. They may charge entry fee for the parks and reserves and employ people who will assist in the maintenance of the area. The Act allows for signs, buildings, fences, roads, rules etc that may be necessary.

The Parks and Reserves, subject to the conditions and restrictions by the Authority, shall be administered for the benefit of the people of Tonga and for the protection, preservation and maintenance of the natural resources. Part III, No. 9 of the Act states that “every marine reserve shall be administered for the protection, preservation and control of any form of life and any organic or inorganic matters therein.”

Any persons found breaching the conditions set by the Authority is liable for fine and imprisonment following prosecution by the Court. The fines and imprisonment shall not exceed \$500 and 3 months respectively.

Tonga, under its obligation to national legislations and international conventions, had declared 10 marine areas for protection. Eight areas are designated as reserves: Fanga’uta and Fanga Kakau lagoons; Mounu reef sanctuary; Ha’atafa beach; Hakaumama’o reef; Malinoa island park and reef; Mui Hopa Hoponga coastal reserve; Monuafa Island park and reef and Pangaimotu reef while Falevia may be an MPA and Ha’apai is designated as a multi use conservation area (Wood 2007).

7.4.2 Fisheries Management Act (2002)

The Fisheries Management Act has replaced the Fisheries Act (1989). The Act provides for the conservation, management, sustainable utilization and development of fisheries resources in Tonga and is administered by the Minister of Fisheries.

Under this Act the Minister needs to ensure that: there are long-term conservation and sustainable use of fishery resources; management measures are based on the best scientific evidence available; measures are in place to conserve aquatic living resources and protect biodiversity in the marine environment and ecosystem as a whole for present and future generations; pollution is minimized; sustainable fishing is performed; and Tonga fulfils its obligations to international laws and conventions. The Minister shall, in consultation with the Fisheries Advisory Committee, determine the total allowable catch or total allowable level of fishing with respect to any stock of fish subject to the provisions of this Act or as provided in a fisheries management agreement.

The Minister may determine and allocate participatory rights in a fishery which may favor Tongan subjects, locally based fishing vessels and locally based foreign fishing vessels. However it may include restrictions such vessel type, gear type, seasons of operations, areas in which the fishing can take place and any other restriction relevant to fisheries conservation and management. These rights may be canceled if the conditions are not followed.

The department shall progressively prepare and keep under review plans for the conservation, management, sustainable utilization and development of fisheries in the fisheries waters and ensure the implementation of such fishery plans. The plans shall address issues such as management objectives, exploitation rate, conservation methods, licensing issues, and fisheries

quota and fisheries statistics. A management committee shall also be performed to oversee the plans and actions taken.

The Minister shall also establish a Fisheries Management Advisory Committee which can advise him on such matters relating to the conservation, management, sustainable utilization and development of fisheries. The Committee should consist of representatives from the Fisheries Department; Lands; Labor, Commerce and Industries; commercial fishery industry; women's interests; local fisherman and coastal communities.

Minister may by Order published in the Gazette, declare any area of the fisheries waters and corresponding subjacent area to be a Special Management Area (SMA) for purposes of coastal community management, application of certain conservation and management measures, subsistence fishing operations or other specified purpose. The Order should specific detailed conditions of the management area. In collaboration with the Fisheries Management Advisory Committee and the coastal communities, the minister is responsible to make regulations for the special management areas. While the Act also specifies that the Minister can to issue any type of license to fish in the SMA, the Act further states that the minister may with prior consultation with the coastal community in question give license to fish in the area (Part II, 15(2)).

The Minister also has the right to declare a particular species of fish as protected or make regulations for management of particular species of fish by notice in the Gazette. Any person found in possession of the protected species will be prosecuted under the conditions of this Act. Fishing using explosives, poison and noxious substances is prohibited under this Act. Offenders can be fined up to 100,000 or imprisonment for two years. Any vessel owners or fisher found in possession of a prohibited fishing gear can be fined up to \$100, 000.

The Minister, by the consent of Cabinet and by Notice in the Gazette, draws up prohibitions for fishing and fishing related activities such as size, species, weight, age of fish to be caught, total allowable catch and catch per unit effort, area of fishing and types of vessels.

No local fishing vessels are permitted to fish in Tongan waters unless registered under the fisheries department (Part IV) however, this section does not apply to any vessels used only for sport fishing (non profit), subsistence fishing or to non-motorized canoes. Where vessel owners are found to be breaching this Act, they are liable for penalties. All registered vessels also require a fishing license to be able to fish legally in the Tongan waters however, a license is not needed for subsistence fishing and sport fishing. All licenses shall contain conditions/restrictions such are area of fishing permitted, fishing method and gear to be used and fishery resources to be caught. All commercial sport fishing vessels need to acquire license. Any foreign investor, who wants to be involved in fishing or fish processing in Tonga, will also have to acquire a license from the Minister of Fisheries.

The Minister, upon submission of a research plan, may authorize marine scientific research operations in Tongan waters and except such vessel from any fisheries management and

conservations that may be prescribe under the Act. However the minister is also permitted to impose conditions on scientific research. Persons, who are found not following the conditions set by the Minister, may be prosecuted.

Under the Act, permission needs to be acquired prior to import and export of fish and fish products to and from Tonga and once approval is granted for import or export, the Minister may put restrictions on the quantity, size and species of live fish to be exported or imported. Fish processing industries also requires a permit from the Fisheries Department. The permit/ license shall consist of conditions that are set by the Minister, which he thinks is necessary for the conservation and management of resources.

Under this Act, the Minister may appoint Authorized Officers to assist in enforcement. The Authorized Officers shall have the power to stop, board and search any foreign and local fishing vessels/ aircrafts in or outside the fishery waters without a warrant. The Officers, if having valid reasons, can also enter and search premises (except residential) without a warrant.

While Tonga does not have a major Environment Act which addresses all environmental issues, it does have numerous other environmental related Acts and policies.

7.4.3 Environment Impact Assessment Act (2003)

The Act provides for the application of environment impact assessment for the planning of development projects in Tonga, and is administered by the Minister of Environment

The Act requires all major projects to submit an EIA report along with its developments plans. The EIA shall follow the criteria given by the Environment Department. The Act requires the formation of an Environment Assessment Committee, which shall consist of Director Environment, Director Health, Director Planning, and a member from the private sector. The Environmental Assessment Committee shall review all necessary documents and recommend conditions to be attached to major projects and the means by which they should be implemented. No major projects shall be permitted to process unless it has satisfied the appropriate environment impact assessment requirement.

Offences (Part IV) in the Act is categorized into three sections: a) non compliance with environmental conditions (# 17) - offender can be fined up to \$10,000 or imprisonment for one year; b) supply of false information- offender can be charged up to \$20,000 or 2 years imprisonment; c) Penalty for carrying out activity or project without approval – offender may be fined up to \$1,000 or one month imprisonment.

7.4.4 Marine Pollution Prevention Act (2002)

The Act provides for the prevention of and response to marine pollution and the dumping of wastes and other matters and to give effect to international marine pollution conventions. All

vessels in Tongan waters, to which MARPOL 73/78 applies, shall comply with the design and pollution prevention equipment provisions.

Part II (5) prohibits the discharge of pollutant or harmful substances in Tongan waters. Part II (6) prohibits the discharge of ballast water containing non-indigenous harmful aquatic organisms. The master of a vessel that discharges ballast water in Tongan waters shall comply with any voluntary or mandatory ballast water management requirements issued by the International Maritime Organization in force at the time of the discharge. Part II (7) prohibits the scraping and cleaning of the hulls and other external surfaces of vessels in a manner that may result in the introduction of non-indigenous harmful aquatic organisms or pathogens into Tongan waters. Part II (8) prohibits the use of anti-fouling paint on vessels less than 30 meters in length. The owner of any vessel (less than 30 meters) using anti-fouling paints or systems containing organotin compounds commits an offence and shall on conviction be fined up to \$50,000. Part II (10) has provisions for persons wishing to discharge waste in Tongan waters, for the purpose of legitimate scientific research or to combat a specific pollution incident shall apply in writing to the Secretary for a Discharge Permit. The Act requires the appointment of Inspectors who are permitted to any vessel, platform, place on land, apparatus etc.

Part III of the Act provides the guideline for Ministries involved, for the response to marine pollution such as oil spills.

7.4.5 Waste Management Act (2005)

The Act regulates the waste collection and disposal system in Tonga. The Act allows authorities to properly manage the waste problem, by having criteria of disposal, public awareness on cleanliness of environment etc.

7.4.6 Inter-departmental Environment Committee (IDEC)

The Inter-departmental Environment Committee (IDEC) is chaired by the “Ministry of Lands Survey and Natural Resources (MLSNR) and it consists of high level representatives of the various ministries including Central Planning Ministry. There are no representations of NGOs. Its responsibilities include overseeing and coordinating the preparation of a National Environmental Management Plan (EMP) and compiling and reviewing the documentation. It is not actively functioning as a coordinating body and has no administrative capacity to oversee implementation of environmental strategies and programmes other than those of MLSNR” (www.unescap.org).

7.4.7 National Capacity Building Action Plan for Environment Management 2008-2013(draft)

To fulfill obligations under UNCBD, UNFCCC and UNCCD, a National Capacity Self Assessment for Global Environment Management (NCSA) tool was developed to help the government of Tonga to assess its current level of capacity in environment management. The Capacity Action Plan consists of four thematic areas:

Climate Change Adaptation and Mitigation – Actions outlined under this themes are: a) enhance the adaptive capacity of the people and environment of Tonga to the adverse effects of climate change, variability and sea level rise; b) promote sustainable management, conservation and enhancement of carbon sinks; c) assess viable options to mitigate concentration of GHG emission; d) promote climate change educational training and awareness programmes; e) improve disposal of solid wastes throughout Tonga; and d) ensure preparedness to natural disaster/extreme weather events.

Biodiversity Conservation – Objective two under this theme relates to the protection of marine ecosystems. Actions outlined are to promote sustainable management of marine ecosystems; promote information dissemination, research and monitoring; promote marine public awareness; increase number of marine conservation areas; and reduce impacts of land based activities.

Desertification and Land Degradation – This outlines actions for naturally induced (sea-level rise, drought, cyclone) and human induced (soil erosion, forest clearing, population growth) environmental issues.

Crosscutting Environmental Issues – Actions under this themes aims: a) for Tonga to be resilient to extreme weather events; b) to promote sustainable agriculture; c) to protect coastal environment degradation; d) minimize the destruction of forest ecosystems; e) promote integrated land use; f) proper solid waste disposal; and g) environmentally sustainable ecotourism operations.

7.4.8 Strategic Development Plan 8 (2006/7, 2008/9) Tonga (SPD 8)

Six fisheries-related strategies for the years 2006-2009 were developed under this Plan (SDP 8): Its function is to continue to support, and where feasible extend the geographic coverage of, Community-based Management and Development Plans for inshore fisheries; to promote the sustainable development of small-scale fisheries and aquaculture through scientific research and resource assessment, through the provision of equipment and marketing information and facilities to communities and through improving communities' access to credit through the Special Initiatives Fund; to establish and declare Tonga's Exclusive Economic Zone; to pass necessary amendments to the Fisheries Management Act and finalize regulations for this Act and the Aquaculture Management Act; to review infrastructure support for commercial fishing as part of the formulation of a port development strategy; and to privatize non-core functions of Fisheries (except instances of community service obligations).

The key environmental strategies developed for the same period in SDP 8 are as follows:

- Complete and enforce the legislative framework for environmental conservation and management.

- Integrate environmental costs and benefits into Government decision-making procedures covering policies, projects and private investment proposals.
- Implement environmental education programmes and engage communities in remedial measures.
- Implement and ensure sustainability of the Nuku'alofa Waste Management Project.
- Continue to support, and where feasible extend the geographic coverage of, Community-based Management and Development Plans for inshore fisheries.

While the Strategic Development Plan for 2010 onwards could not be obtained, the framework for the new national strategic plan identifies the need to: integrate environmental sustainability and climate change into all planning and executing of programs; and analyze the options, risks and uncertainties in mitigating and adapting to environmental change and variability (National Strategic Planning Framework 2009).

7.4.9 National Biodiversity Strategy and Action Plan (NBSAP)

As a contribution to the conservation and protection of global biodiversity, Tonga has committed to implement actions at the national level to conserve, sustainably use and protect its biological diversity under the Convention on Biological Diversity (CBD).

Following Tonga's NBSAP in 2006, the process of community and public consultation and the stocktaking of existing data and information was carried out by the aid of local experts. A wealth of information on Tongan biodiversity has been documented including fisheries and other marine species of cultural significance. However, some of this information is outdated or incomplete and needs re-surveying to reaffirm their current status and provide baselines for future conservation action and monitoring.

"Of the biodiversity that is known and documented, the main threat is from the indiscriminate expansion of agriculture. The resulting impacts are loss of habitats for native fauna, extinction of rare flora species and the undermining of essential ecosystem functions and services including hydrological cycle, microclimate conditioning, and the loss of forest wood and non-wood products. Degraded and disturbed ecosystems provide conditions conducive to the spread of invasive weed and fauna species. Other threats are the over-harvesting of forests, mangroves and marine fin-fish resources and the degradation of the mangrove areas by reclamation and waste dumping. Against this backdrop of threats and limited scientific information, the major constraints to effective implementation are the lack of: technical information for conservation planning, technical expertise and capacity, public awareness and appreciation for conservation and, the weak and ineffective legislation" (Kingdom of Tonga – National Biodiversity Strategy and Action Plan).

In order to address the problems associated with these issues and constraints, Tonga's NBSAP organized key issue areas reflecting a combined emphasis on the ecosystems approach and species-specific focus. "A section on agro-biodiversity is indicative of the cultural and economic importance of agriculture and the need to document and preserve its species diversity. Access

and benefit sharing issues, local communities and civil society participation and mainstreaming are treated separately, reflecting their relative importance. A final section is dedicated to discussing ways of funding NBSAP implementation” (Kingdom of Tonga – National Biodiversity Strategy and Action Plan).

Fourth Report on the Review of Tonga NBSAP – 2009

The fourth report on the review of Tonga NBSAP reviewed the status, trends and threats to Tonga’s biodiversity since the inception of its own NBSAP in 2006. It addresses the issues associated with the four sectors highlighted in the NBSAP of Tonga, namely, forest, marine, agriculture, terrestrial fauna and flora. The section associated with the marine sector is quoted below.

“Tonga’s progress towards CBD 2010 targets and strategic plans is 17%. There are more marine species recorded in 2010, in comparison with 2006 when the last stock take was undertaken. One reef fish was found to be endemic, increasing the total of endemic species to two. There was no trend detected in terms of richness of species due to a lack of data; however, a decrease in the amount of catch both offshore and inshore is indicative of an overall decrease in abundance of fish. Based on the latest reef-fish assessment conducted by SPC under PROCFish (2009), results indicate that there is a decrease in the reef fish abundance (on average between 20 - 40%) and sizes (50% less than actual size for most reef-fish species) including coral cover percentage (20-30% decrease on live coral cover especially back-reef). The status of mangrove ecosystems is expected to improve due to a number of youth replanting programs around the lagoon edge, sponsored through GEF Small Grant and other funding agencies.

The threats to the marine species and ecosystems remained the same as those identified in the NBSAP, except for the tsunami that hit Niuatoputapu in early 2010. This was the first time Tonga had experienced great devastation from this natural phenomenon. As a result of the tsunami, reef materials and marine species were taken ashore. Coastal forest, crops and properties were totally obliterated as the waves surged onshore for almost a kilometer in places. Nine people lost their lives in this event.”

7.5 Tonga’s Commitment to International Treaties and Conventions

Tonga has adopted a number of regional and international Treaties and Conventions in efforts to conserve its biodiversity. Tonga became party to the Convention of Biological Diversity, United Nations Convention to Combat Desertification and United Nations Framework Conventions on Climate Change in the 1990s. Tonga endorsed the World Heritage Convention in 2004 (whc.unesco.org) and while Tonga does not have any designated site under the Convention, two properties (Ancient capitals of the Kingdom of Tonga and Lapita pottery archeological sites: a national serial site for consideration as the Kingdom of Tonga’s contribution to a trans-national serial site listing for 2007) have been identified for the tentative list (whc.unesco.org). Tonga is also party to several other Conventions and Protocols (see Table 3 for details).

Table3: List of Conventions and Protocols adopted by the Kingdom of Tonga. (Source: National Capacity Building Action Plan for Environment Management 2008-2013(draft))

International Agreements	Date Signed	Date Acceded/ Ratified
Convention on Biological Diversity		19 May 1998
Cartagena Protocol on Biosafety		18 May 2003
UN Convention to Combat Desertification		20 July 1998
UN Framework Convention on Climate Change		20 July 1998
Vienna Convention for Protection on Ozone Layer		29 July 1998
Montreal Protocol		29 July 1998
London Amendment		26 November 2003
Copenhagen Amendment		26 November 2003
Montreal Amendment		26 November 2003
Beijing Amendment		26 November 2003
Stockholm Convention on Persistent Organic Pollutants	22 May 2002	
Marine Pollution Convention (MARPOL)		1 May 1996
Protocol to the Convention on the Prevention of Marine Pollution by Dumping Wastes and other Matters		18 September 2003
Waigani Convention	16 September 1995	22 May 2002
Agreement establishing SPREP	15 September 1995	

7.6 Gaps in Coastal Legislation and Policies

In Tonga the Fisheries Act is the major Act that regulates activities relating to coral reefs, supplemented by the Parks and Reserves Act under which marine reserves can be regulated. Tonga also has several Acts that collectively manage the environmental issues while their Strategic Plans identifies the need for climate change adaptation policies. Upon analysis of the major Acts and Policies, some gaps in the current legislation are evident and these gaps need to be addressed by the policy makers.

Weak Penalties

The penalties, especially for the Parks and Reserve Acts are too lenient. The fines and imprisonment penalties for an offender breaching the conditions set by the Authority is only for a maximum of \$500 and/or three months, respectively.

Special Managed Areas

The Fisheries Act restricts the issue of licenses to fish in Special Managed Areas. However, upon consultation with the coastal community in question, a Minister can give license to fish in a Special Managed Area.

“There were nine MPAs off Tongatapu in the 1990s, but these had no management, education or enforcement programs. Tonga had limits on catch sizes for fishes, invertebrates and shellfishes, but enforcement was usually poor” (Vieux *et al.* 2004).

Lack of Biodiversity Information and Conservation Efforts

There is little information available on the coral reef biodiversity of Tonga. Some of this information is outdated or incomplete and needs re-surveying to reaffirm their current status. The National Biodiversity Strategy Action Plan of Tonga identifies “lack of: technical information for conservation planning, technical expertise and capacity, public awareness and appreciation of conservation and weak and ineffective legislation” as the major constraints to effective implementation.

Turtle eggs and meat are still consumed in Tonga (Spalding *et al.* 2001). According to the Tonga Fisheries Act, there are no restrictions specifically for turtles; the restrictions on turtle harvest are the same as that of fish.

Improper Wastewater Management

There is no central/public sewerage system in Tonga. As a result of improper waste disposal there are high amounts of bacteria and nutrients in the water systems, including piped water systems and lagoons. Due to high nutrient levels in the lagoons, eutrophication has become a major cause of coral mortality in certain areas such as Tongatapu and Lifuka Island in Ha’apai (Vieux *et al.* 2004).

7.7 Recommendation

7.7.1 Fisheries

1. Tonga fisheries should consider the possibility of imposing a turtle moratorium (such as in Fiji).

2. There is a need to obtain more comprehensive information on the biodiversity of Tonga's reefs with the necessary scientific input.
3. There is need for a plan to address the sharp decline in coastal fisheries.
4. There is a need for improved enforcement of the Fisheries Management Act.

7.7.2 Marine Managed Areas

1. There should be a clear definition of what is meant by the various categories of marine parks, reserves, special management areas and marine protected areas.

7.7.3 Climate Change

1. We recommend that progress on the UNDP MDG project be discussed at the workshop.
2. We recommend the establishment of a clearing house for climate change information and exchange.

7.7.4 Multi-sectoral and Multi-stakeholder Consultation

1. There is a need to resolve ongoing issues regarding ownership of remote reefs (under UNCLOS).
2. Note wastewater and sewage management plan?
3. Are the results of the post tsunami report on Niuatoputapu available and will they be brought into wider national disaster management plans?
4. The IDEC should consider inclusion of NGO and civil society representatives on the committee.
5. It's recommended that mechanisms be found for implementing the environmental management plan.
6. A national marine awareness program on marine issues should be developed.

REFERENCES

Allen, G.R., Steene, R.C. & Allen, M. 1999. *A guide to angelfishes and butterfly fishes*. Singapore: Odyssey Publishing/Tropical Reef Research.

Campbell, J. 2000. *Adapting to climate change: incorporating climate change adaptation into development activities in Pacific Island Countries: a set of guidelines for policymakers and development planners*. Samoa: SPREP.

Cesar, H.J.S., Burke, L., & Pet-Soede, L. 2003. *The economics of worldwide coral reef degradation*. Arnhem: Cesar Environmental Economics Consulting and WWF-Netherlands, 23pp. Online: <http://www.cbd.int/doc/external/oecd/oecd-coral-reefs-2002-en.pdf>

Conservation International. 2008. *Economic values of coral reefs, mangroves, and sea grass: a global compilation*. US: Conservation International.

Craven, J.P. 1982. *The management of Pacific marine resources: present problems and future trends*. Boulder, Colorado: Westview Press.

Crennan, L. 2001. Integration of social and technical science in groundwater monitoring and management. Groundwater pollution study on Lifuka, Ha'apai, Tonga and recharge study on Bonriki, South Tarawa, Kiribati. *UNESCO IHP-V, Technical Documents in Hydrology, No. 43*

Gillett, R. 2009. Fisheries in the economies of the Pacific Island countries and territories. *Pacific Studies Series*

Hodgson, G. 1999. A global assessment of human effects on coral reefs. *Marine Pollution Bulletin, 38(5)*: 345-355

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs. *Freshwater Marine Research, 50*: 839-866.

IUCN. 2009. [Press Release] *2.3 million Euro for mangrove management for climate change and livelihood in the Pacific*. December 2009.

IUCN. 2010. *Pacific Ocean 2020 challenge: rescuing an ocean in crisis*. Suva, Fiji: IUCN. Concept Paper.

Johannes, R.E. 2002. The renaissance of community-based marine resource management in Oceania. *Annual Review of Ecology and Systematics 33*: 317-340.

Jones, G.P., McCromick, M.I., Srinivasan, M. & Eagle, J.V. 2004. Coral decline threatens fish biodiversity in marine reserves. *Proc. Natl. Acad. Sci 101*: 8251-8253.

Prime Minister's Office. 2009. National Strategic Planning Framework. Tonga: Tonga- Prime Minister's Office.

Newton, A.F. 2008. Sanitation and wastewater management in Tonga. *SOPAC Miscellaneous Report 671*

Newton K., Cote, I.M., Pilling, G.M., Jennings, S., & Dulvy, N.K. 2007. Current and future sustainability of island coral reefs fisheries. *Current Biology 17*: 655-658.

Nunn, P.D. 2007. Climate, environment and society in the Pacific during the last millennium. *Developments in Earth and Environmental Sciences 6*

Nybakken, J.W. & Bertness, M.D. 2005. 6th ed. *Marine Biology: an ecological approach*. Pearson Education.

Paulay, G. 1997. *Diversity and distribution of reef organisms*. In: Birkeland, C. (ed). *Life and Death of Coral Reefs*, NY: Chapman and Hall.

Pomeroy, R.S., Parks, J.E. & Balboa, C.M. 2004. Farming the reef: is aquaculture a solution for reducing pressure on coral reefs. *Marine Policy*

Roberts, C.M. 1995. Effects of fishing on the ecosystem structure of coral reefs. *Conservation Biology* 9 (5): 988-995.

Scales, H., Balmford, A. & Manica, A. 2007. Impacts of the live reef fish trade on populations of coral reef off northern Borneo. *Proceedings of the Royal Society B* 274: 989-994.

Scheffer, M., Carpenter, S. & Young, B. 2005. Cascading effects of overfishing marine systems. *Trends in Ecology and Evolution*, 20(11): 579-581.

Seeto, J. & Baldwin, W.J. 2010. *A checklist of the fishes of Fiji and a bibliography of Fijian fish*. Suva, Fiji: School of Marine Studies, USP. SMS Technical Report No. 1/2010.

Solomon, S., Qin, D. Manning, M., Alley, R.B., Berntsen, T., Bindoff, N.L., Chen, Z., Chidthaisong, A., Gregory, J.M., Hegerl, G.C., Heimann, M., Hewitson, B., Hoskins, B.J., Joos, F., Jouzel, J., Kattsov, V., Lohmann, U., Matsuno, T., Molina, M., Nicholls, N., Overpeck, J., Raga, G., Ramaswamy, V., Ren, J., Rusticucci, M., Somerville, R., Stocker, T.F., Whetton, P., Wood, R.A. & Wratt, D. 2007. *Technical Summary*. In: S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller. (eds.). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK & NY: Cambridge University Press

South, G.R. & Low, J. 2008. *The Pacific Islands: dynamics of regional cooperation on oceans and coasts*, pp.563-595. In: T.E. Chau, G. Kullenberg, & D. Bongo. (eds). *Securing the oceans; essay on ocean governance- global and regional perspectives*. Quezon City, Philippines: PEMSEA and Nippon Foundation.

South, G.R., Skelton, P.A., Veitayaki, J., Resture, A., Carpenter, C., Pratt, C. & Lawedrau, A. 2004. The global international waters assessment for Pacific Islands: aspects of transboundary, water shortage, and coastal fisheries issues. *Ambio* 33(1-2): 98-106.

Spalding, M.D., Blasco, F. & Field, C.D. 1997. *World mangroves atlas*. Okinawa, Japan: The International Society for Mangrove Ecosystems.

Spalding, M.D., Ravilious, C. & Green, E.P. 2001. *World Atlas of Coral Reefs*. UNEP World Conservation Monitoring Centre.

SPREP. 1995. *Joint responsibility for preserving our natural heritage: the Apia Convention*. Factsheet 12/5.

Techera, E.J. & Troniak, S. 2009. Marine protected areas policy and legislation gap analysis: Fiji Islands. Suva, Fiji: International Union for the Conservation of Nature and Natural Resources.

South, G.R, Skeleton, P., Veitayaki, J., Resture, A., Carpenter, C., Pratt, C. & Lawedrau, A. 2004. *Global international water assessment, Pacific Islands*. University of Kalmar, Sweden: UNEP GIWA Regional Assessment 62.

United Nations. 1983. *The law of the sea-official text of the United Nations Convention on the Law of the Sea with annexes and index*. NY: United Nations.

Veitayaki, J. 1995. *Fisheries development in Fiji: the quest for sustainability*. Suva, Fiji: Institute of Pacific Studies, University of the South Pacific.

Veitayaki, J., Evans, N. & South G.R. 2004. The Pacific Islands Regional Ocean Policy: the quest for good ocean governance. *Ocean Yearbook 18*: 558-577.

Veron, J.E.N. 2000. *Corals of the World*. Townsville, Aust.: Australian Institute of Marine Science. 3 Vols.

Vieux, C., Aubanel, A., Axford, J., Chancerelle, Y., Fisk, D., Holland, P., Juncker, M., Kirata, T., Mecki, K., Osenberg, C., Pasisi, B., Power, M., Salvat, B., Shima, J. & Vavia, V. 2004. *A century of change in coral reef status in southeast and central Pacific: Polynesia Mana Node, Cook Islands, French Polynesia, Kiribati, Niue, Tokelau, Tonga, Wallis and Futuna*, Vol 2: 303-557. In: C. Wilkinson (ed.), *Status of Coral Reefs of the World: 2004*. Townville Australia: Australian Institute of Marine Science.

Vieux, C., Salvat, B., Chancerelle, Y., Kirata, T., Rongo, T. & Cameron, E. 2008. *Status of coral reefs in Polynesia Mana Node countries: Cook Islands, French Polynesia, Niue, Kiribati, Tonga, Tokelau and Wallis and Futuna*. In: C. Wilkinson (ed.), *Status of coral reefs of the world: 2008*. Townsville, Australia: Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre.

Wilkinson, C. (ed). 2004. *Status of coral reefs of the world 2004*. Townsville, Australia: Australian Institute of Marine Science. Vol. 1 & 2.

Wilkinson, C. (ed). 2008. *Status of coral reefs of the World: 2008*. Townsville, Australia: Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre.

Wood, L.J. 2007. *MPA Global: A database of the world's marine protected areas*. UNEP-WCMC & WWF: Sea Around Us Project (Source: www.mpaglobal.org)

Ziemann, D.A. 2001. The potential for the restoration of marine ornamental fish populations through hatchery releases. *Aquarium Science and Conservation* 3: 107-117.

Websites:

ausaid.gov.au; www.cia.org; civilsocietytonga.org; www.cites.org; www.climatechange.org; www.ciesin.org; coris.noaa.org; www.cbd.int; en.wikipedia.org; www.fao.org; www.fspi.org; www.iucn.org; www.marinebiology.org; www.noaa.gov; www.pacificwater.org; www.ppseawa.org; www.pacificyouthcouncil.org; www.ramsar.org; www.roap.unep.org; see-the-sea.org; scienceray.com; sgp.undp.org; www.sidnet.org; www.south-pacific.travel; www.sopac.org; www.spc.int; www.sprep.org; www.tcdt.to; www.un.org; www.unep.org; www.unescap.org; www.undp.org; unfccc.int; www.vavauenvironment.org; whc.unesco.org; www.worldsummit2002.org;

8. COUNTRY PROFILE: TUVALU

8.1 Introduction

Tuvalu, is an island group consisting of nine coral atolls in the South Pacific Ocean, about one-half of the way from Hawaii to Australia; 8 00°S, 178 00 °E. It is one of the smallest and most remote countries on Earth; six of the nine coral atolls including Nanumea, Nui, Vaitupu, Nukufetau, Funafuti and Nukulaelae have lagoons open to the ocean, Nanumaya and Niutao have landlocked lagoons and Niulakita does not have a lagoon (www.cia.org). The land area of Tuvalu is approximately 26 km² and the Tuvaluan Exclusive Economic Zone (EEZ) has an area of approximately 900 000 km² (Miller 2009). Tuvalu has a population of 10 475 (July 2010 estimate) (www.cia.org)

Tuvalu's GDP contribution by sectors include: agriculture – 16.6%, industry – 27.2% and services – 56.2%. The agricultural produce of Tuvalu consists of coconuts and fish. The major industries in Tuvalu are fishing, tourism and copra. In 2002, the GDP was worth USD 14.94 million with GDP per capita estimated at USD 1 600 (www.cia.org).

8.2 Background

8.2.1 Coastal Resources of Tuvalu

Coastal areas play an important role in the Tuvaluan society and contribute significantly to the nation's economy (Section 5.2.2). The marine resources of Tuvalu are dependent on the condition and productivity of critical ecosystems and shoreline features such as coral reefs, beaches, sea grass beds and mangroves. The major use of the marine resources is for subsistence fisheries. The fresh fish and fish products are also sold locally to generate income for the locals. Other reef animals collected for consumption include shellfish and bêche-de-mer. Another use of the reef in Tuvalu involves the production of scented body oils (*te ponu ponu*) from a marine worm. Apart from these, certain reef resources are used for healing purposes and seashells are handcrafted into jewellery and sold at the local market (Poulasi 2007). The tourism industry in Tuvalu at present is almost non-existent.

Reef Area and Types of Coral Reefs

The small archipelago of Tuvalu consists of five true atolls and four other platform islands with encircling fringing reefs. Seamounts which may reach within 30 meters of the surface are also present (Spalding *et al.* 2001). The fringing reefs found throughout the Tuvalu seas are typically narrow with water depths increasing rapidly from the coast to over 1000 meters within a few kilometers of the shore or outer reefs. There are numerous patch reefs found in the Tuvalu waters, existing at different depths within the island lagoons (Sauni 2000; Poulasi 2007).

Coral Reef Biodiversity

The outer slopes of the reefs surrounding the lagoons in Tuvalu are reported to be rich in both coral cover and diversity, although detailed faunal inventories have not been prepared. Approximately 400 (now believed to be greater than 400 (ADAB 1985; Kaly 2001)) fish species has been recorded from Funafuti and there are small mangrove stands in a few areas (Spalding *et al.* 2001). The estimated numbers of the major groups of organisms occurring in the Tuvalu waters are as follows: corals – 36, crustaceans – 86, echinoderms – 27, mollusks – 435, marine worms 15, seagrasses – 1, algae – 45, and hydrozoans – 8 (ADAB 1985; Kaly 2001). A general overview of the coral cover, fish and invertebrate distribution in Tuvalu has been given in the Global Coral Reef Monitoring Network (GCRMN) South West Pacific Node (Poulasi 2010; Poulasi 2007).

8.2.2 Economic Value of Reef Systems in Tuvalu

The major use of the reef resources in Tuvalu is in the fisheries industry and to a small extent, in the tourism industry. On an average, less than 1 000 tourists visit Tuvalu annually. One of the primary economic activities in Tuvalu is subsistence fisheries. In addition, one of Tuvalu's major revenue sources is the US Government because of payments from a 1988 treaty on fisheries (www.cia.org). Hence, it is essential for Tuvalu to maintain a healthy and productive coral reef ecosystem.

Information on fish production in Tuvalu was produced from the 2004/2005 Household Income and Expenses Survey (HIES). According to this survey, the total reef fish production in Tuvalu over those years was 295 223 Kg, worth at A\$693 775 (USD612 027). Out of this the urban total for reef fish production was 110 426 Kg worth at A\$259 501 (USD228 924) and the rural total was 184 797 Kg worth at A\$434 274 (USD383 116) (Gillett 2009). Annual fish consumption in Tuvalu during 2004 and 2005, based on information from HIES, conducted in that period was 68.8 Kg per capita in urban areas (fresh fish were 97% of this amount), and 147.4 Kg per capita in rural areas (99% fresh fish) (Bell *et al.* 2009; Gillett 2009). The estimated annual fisheries productions for the mid-2000s, based on the 1990s data are: commercial production – 226 tonnes worth at A\$733 666 (USD647 239) and subsistence production – 989 tonnes worth at A\$2 656 896 (USD2 343 399) (Gillett 2009).

Case Study 1: Sedimentation, Nutrient Enrichment and Eutrophication

“Application of fertilizers to improve soil productivity continues and the poor retention ability of the soil allows fertilizer to be washed into the lagoon and ocean. Raw sewage from households is disposed off either in septic tanks or directly into the soil. Underground seepage is also possible due to the porous soil texture. Construction of pens for pigs and chickens adjacent to the foreshore, and people defecating on the beach further escalates nutrient levels at some localities.

The existence of landfills and the growing need for more in the future is a concern. The presence of a landfill brings with it the risk of increased run-off and sedimentation, the presence of leachates, increased nutrients, and the risk of releasing toxic chemicals if disposal is not strictly controlled (Kay 2001; Poulasi 2007). There is improper regulations regarding access restrictions and management at most landfill sites, for instance, unsupervised disposal of solid wastes (Poulasi 2007).

Erosion caused as a result of seawall construction is evident along the coastlines of Funafuti. The sediments from the eroding coastlines pose a threat to the coral reefs (Poulasi 2007).

In 2002, the fishing contribution to the country's GDP was: market component – A\$80 600 (USD71 089), non-market component – A\$2 139 400 (USD1 886 768), with the total fishing component amounting to A\$2 220 000 (USD1 957 717). The total GDP of Tuvalu for the year 2002 was A\$26 944 400 (USD23 758 286); with the fishing share of the GDP at 8.2% (Gillett 2009).

8.2.3 Major threats to Tuvalu reefs

Poulasi (2007; 2010) describes the major human-induced threats to the coral reefs of Tuvalu as land-based sediment and nutrient pollution, destructive fishing methods, dredging activities, coastal development and overfishing. Natural threats to coral reefs include coral bleaching and outbreaks of invasive organisms.

High amounts of nutrients in the form of fertilizer and improper wastewater disposal is discharged into the lagoon waters (Case Study 1; Poulasi 2007). Eutrophication due to high nutrient levels in the lagoon waters is prominent in the waters adjacent to the main island of Fogafale (Poulasi 2010).

Damage to coral reefs has been caused by reef blasting in the 1980s (Case Study 2; Sauni 2000; Poulasi 2007). Sand dredging and foreshore extraction are also identified as activities initiating erosion. Considerable amounts of sand and gravel and coral boulders have been removed from the shore for construction purposes (Poulasi 2007).

There is no threat to the reef fish from the use of poisons and explosives since this form of fishing is not practiced in Tuvalu. However, there is considerable damage to the coral reefs from gill-net fishing and night fishing (Case Study 3; Poulasi 2007).

Two major coastal developments in Tuvalu include, upgrading the Funafuti Port and the establishment of a new power house. If not planned properly such development activities could lead to damage and death of coral reefs (Poulasi 2007). Pollution originating from boat discharges and chemicals from anti-fouling paints used on boats are a prominent problem in Funafuti Port (Kay 2001). Overfishing is not an immediate concern in most of the islands of Tuvalu. However, it is apparent in heavily populated areas. The growing interest from foreign companies in marine resource trade (especially for groupers and bêche-de-mer) could lead to overfishing (Poulasi 2007).

Case Study 2: Damage to Coral Reefs – Reef Blasting

Reef blasting in the 1980s has caused substantial damage to coral reefs. "Starting in the early 1980s, reef blasting was undertaken in all the islands to create channels for safe passage. Channels vary in size, with some extending for several hundred meters offshore. Some are wide and deep and are known to have caused changes in the physical and biological environments in the immediate surroundings" (Sauni 2000; Poulasi 2007).

The 30-40 percent of coral damage due to the bleaching event in 2002 had recovered by 2003. The 2002 bleaching mostly occurred in shallow waters (reef slope and crest). There was no sign of bleaching in the 2003 survey (Poulasi 2007). There have been few investigations of the presence and abundance of the crown-of-thorns starfish (Anon. 1995). Surveys in the 1990s

indicated the high abundance of the crown-of-thorns starfish in Funafuti lagoon. However, surveys carried out in 2002 and 2003 recorded only a few individuals (Poulasi 2007).

8.3 Ecosystem Management Initiatives by Non- Government Organizations

The following sections outline the major initiatives undertaken by NGOs in Tuvalu to address the issues related to global change and sustainable use of coral reefs.

8.3.1 Tuvalu Association of Non Government Organizations (TANGO)

TANGO was formed in 1986 and since 2000, it has focused much of its work on assisting NGOs with their project proposals, with the aim of supporting sustainable development of NGOs, not only through the provision of training, services and information but also, through the collaboration and communication between NGOs, government and international agencies.

Made up of 47 members, its goals are to promote good governance; to assist communities in establishing and managing conservation areas and preservation of reefs and coastal areas; on behalf of the non-state actors, TANGO has the responsibility of coordinating, reporting and monitoring activities under the EDF programme and through an AusAID funded regional HIV/AIDs program, provide capacity building on HIV/AIDs, assist development of National Aids Committees and give small grants for HIV/AIDs programs at national and community levels (<http://www.piango.org/nlu/tuvalu.html>).

TANGO also engages in community capacity building on turtle conservation and protection and it is the host organization and focal point for the Global Environment Facility. It has a strong interest in ensuring that NGO capacities are developed to access funds and implement projects effectively. Relevant projects run by TANGO, in association with FSPI have been the Disaster preparedness program, Small scale gardening projects, Strengthening Outer Island NGOs and the Pacific Skills- link Project (www.fspi.org.fj).

8.3.2 The Luaseuta Foundation

The Luaseuta Foundation has been set up to help the social and economic development of the Tuvalu population, specifically from the island of Niutao. The Foundation achieves its objectives through various special projects.

Case Study 3: Destructive Fishing Methods in Tuvalu

“Extensive gill-net fishing has caused considerable damage to coral reefs. Damage is caused by dragging the net on corals, by running and stepping on corals and by throwing stones in attempting to drive fish into the net. The dwindling catches observed in recent years are attributed to the use of nets with smaller mesh sizes (Sauni 2000). Night spear-fishing is now common, increasing the damage arising from stepping on corals and spears striking the corals. The selective nature of this fishing method can lead to depletion of certain important fishes.

Being aware of the dangers associated with such fishing techniques, the respective islands have enacted by-laws through their island councils (though some have since been repealed). The degree of prohibition varies between the islands. Some islands apply closed seasons, closing part of reefs for a certain period of time to all fishing. Some islands declared certain fishing practices to be off-limits, either permanently or on a shifting basis similar to that in other parts of the Pacific (Veitayaki 1995). Gill-nets of smaller mesh size (8cm or less) are usually banned in Tuvalu (Tuvalu Government 1990)” (Poulasi 2007).

The organization focuses on the relief and prevention of poverty and sickness and the advancement of the health of the people of Tuvalu through innovative and appropriate community-based development and education in the islands of Tuvalu; advancement of the education of the people of Tuvalu through the provision of innovative and appropriate educational activities and facilities in the islands of Tuvalu; and relief and prevention of the effects of cyclones, storms, high tides, 'king tides', earthquakes, tsunamis and any form of emergency situation or disaster that is the consequence of any natural phenomena that affects the islands of Tuvalu (www.tvhope.org).

8.3.3 Tuvalu Ship Registry

The Tuvaluan government has appointed Tuvalu Ship Registry of Singapore as the exclusive authority for the registration of vessels worldwide under the Tuvalu flag. Tuvalu Ship Registry's mission is to work with all its stakeholders such as the Tuvaluan government, ship-owners, classification societies and the shipping community to ensure the safety of Tuvaluan ships and keeping the marine environment clean for future generations. (www.maritimechain.com/ship_registry/TVR)

8.3.4 Alofa Tuvalu

Alofa Tuvalu is a French-based volunteer organization whose goal is to help Tuvalu deal with climate change and other environmental issues, with full participation of its people. It is an association created to raise awareness of the rising water crises in Tuvalu. To achieve this, they have created the "Small is Beautiful" program which focuses on media campaigns around the world to gain support from public, aid agencies and governments.

The program also promotes solutions for governments to consider, as well as, a worst case scenario evacuation plan for Tuvalu residents. As part of their awareness program, they provide general information about the country, climate change and its effects on Tuvalu as well as a comprehensive timetable of the history of climate change research and provide links to other relevant organizations and publications (<http://alofatuvalu.tv>).

8.3.5 Tuvalu National Council of Women (TNCW)

The Tuvalu National Council of Women has operated as an umbrella NGO for women in Tuvalu since 1977. The Council addresses issues affecting the women of Tuvalu. This includes looking at the effects of climate change and the role women can play in abating the impact on Tuvalu, and it encourages discussion and understanding amongst the women of Tuvalu.

8.3.6 Island Care

Island Care is one of Tuvalu's environmental organizations which is undertaking tree-planting to reduce the impact of erosion by the tides. The organization will also run the UNDP-GEF funded "Turtle tagging and Nest monitoring Project in Funafuti" which seeks to address the issue of

declining populations and the lack of awareness on turtle biodiversity and conservation activities at the community level. As yet, there are no legislations or by-laws protecting marine turtle harvesting (<http://sgp.undp.org/>).

8.3.7 Australian AID Programme

Australia's Aid program supports Tuvalu's development priorities as identified in the Te Kakeega II National Strategy for Sustainable Development 2005 -2015. The aid program is currently directed by the Tuvalu/Australia/Asian Development Bank Joint Country strategy 2007-11 and focuses on three key areas: 1) effective management of the Tuvalu Trust Fund to provide recurrent budget support and build future financial reserves; 2) effective fiscal management to manage revenue sources and expenditure allocation; and 3) improving the quality of Tuvalu's education system and vocational skills development. As well, AusAID has partnered with UNDP in several major projects being carried out in Tuvalu (www.ausaid.gov.au).

8.3.8 New Zealand AID Programme

NZAID's priorities with Tuvalu are outlined in a 5-year programme strategy, New Zealand - Tuvalu Development Cooperation Programme Framework 2002-2007. The goal of the strategy was to support the efforts of Tuvalu's Government and people to achieve equitable and sustainable development. The strategy focused on 3 key areas, which are also priority areas in Te Kakeega II: outer island development, financial management support, and human resource development. The strategy is currently being reviewed and updated to cover the next 10 years (www.nzaid.govt.nz).

8.3.9 The Foundation of the Peoples of the South Pacific International (FSPI)

FSPI is the regional secretariat for a network of 20 independent community-based organizations working in the Pacific to foster self-reliance and sustainable development. It is one of the largest and most experienced civil society organizations in the Pacific with network partners in Fiji, Kiribati, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, **Tuvalu**, Vanuatu, Timor-Leste and metropolitan partners in Australia and the United States.

FSPI looks at climate change and its impacts on every aspect of life in the Pacific, on health, governance, disaster preparedness, economic development, environment and culture. Climate change profoundly affects the regions' largest and fastest growing industry, tourism so FSPI partners for this important undertaking with the Oceania Sustainable Tourism Alliance (www.oceaniatourismalliance.net) and SPREP's Island Nations Climate and Oceans Program amongst others.

FSPI's Community Disaster Risk Management Programme works with Network Partners in Tuvalu and the region to help communities, not only to cope during and after a disaster but, to build an ingrained attitude towards development and lifestyle that should soften the impacts of any natural disaster that may strike. Its Communities and Coasts Programme currently have 3

related projects, funded by the Coral Reef Initiative for the Pacific (CRISP). These are the 1) CRISP Marine Protected Areas; 2) CRISP Marine Protected Areas Capacity Building, Networking, and Lessons Learned; and 3) CRISP Reef Restoration.

The CRISP Marine Protected Areas Project is a regional initiative focused on the development of new MPAs and strengthening of existing MPAs to serve as pilots or models for management intervention and building capacity in communities for marine resource management. It seeks to support the establishment and implementation of effective community-based MPAs and improved watershed management, empowering local communities to effectively protect and manage coastal marine biological diversity and helping them achieve sustainable use of marine resources to sustain Pacific coral reefs and associated habitats.

The MPA Capacity building Project seeks to build capacity of communities, governments and other actors in the establishment and management of MPAs through training, networking, communication of lessons learned at both national and regional levels. The focus of capacity building is based on recognized keys (reflection, self-directed learning and continuity) for effective capacity building. Effective capacity building focuses on helping individuals and organizations take control of their own learning and develop new insights, behaviors and skills.

The Reef Restoration Projects aims to improve knowledge in reef restoration, train scientists and technicians in this field and promote the industrial research by carrying out two pilot projects in Moturiki, Fiji and in Funafuti, Tuvalu. The initiative will have to be used as catalyst with the development of operations of restoration in the Southern Pacific Islands. The experience and the knowledge gained in the Southern Pacific could then be developed in other tropical areas.

Another relevant project conducted by FSPI in Tuvalu is the “Building resilience in Samoa and Tuvalu.” Funded by the Government of Finland, it aims to increase the resilience of communities in Samoa and Tuvalu when disaster strikes. This is being done through risk-reduction measures which incorporate traditional methods and where necessary, merge these practices with modern scientific and technical knowledge (www.fspi.org.fj).

8.3.10 Secretariat of the Pacific Community (SPC)

The Secretariat of the Pacific Community (SPC) has a Reef Fisheries Observatory under their Marine Programme. The SPC Reef Fisheries Observatory aims at providing information to the SPC members and to all parties involved in Pacific Island reef resource management. This section of SPC disseminates information to local communities and international donors interested in the sustainability of the various reef fisheries in the Pacific. The section also aids the Pacific Island governments which require advice on the management of local fishery resources under their jurisdiction. A subsection under the SPC Coastal Fisheries Programme known as the Coastal Fisheries Management Section (CFMS) was established to provide regional support services. The CFMS assists the Pacific Islanders in identifying the status and

optimizing the long-term social and economic value of small-scale fisheries and aquatic resources in Pacific waters.

With funding assistance from the Australian Agency for International Development (AusAID), and in relation with an ongoing assessment of the vulnerability of coastal fisheries to climate change, SPC has launched the “Vulnerability and adaptation of coastal fisheries to climate change: Monitoring indicators and survey design for implementation” Project to assist Pacific Island countries and territories to design and field-test monitoring pilot projects to determine whether changes are occurring in the productivity of coastal fisheries and, if changes are found, to identify the extent to which such changes are due to climate change as opposed to other causes (www.spc.int).

8.3.11 International Union for Conservation of Nature (IUCN)

IUCN is involved in three related projects: 1) Pacific Ocean 2020 Challenge: rescuing an ocean in crisis; 2) Mangrove Ecosystems for Climate Change and Livelihood in the Pacific (MESCAL); and 3) Pacific Centre for Environmental Governance (PCEG).

The 2020 challenge seeks to focus global attention, build new partnership and generate the necessary commitments and resources required to “develop and implement a long-term comprehensive and cohesive strategy and action plan to curb the impacts on the Pacific Oceans ecosystems and the resulting negative impacts on the Pacific Ocean region and the globe” (IUCN 2010 concept paper).

The MESCAL project started in December 2009 and involves five Pacific island countries: Fiji, Samoa, Solomon Islands, Tonga and Vanuatu. The primary goal of MESCAL “is to help reverse recent trends in the loss of mangroves, increase resilience of the people of the Pacific to climate change and provide natural insurance against the effects of climate change and extreme events. The project will help participating countries invest in stakeholder based management of mangroves and associated ecosystems by developing sound evidence-based policies, plans and practices and targeted capacity development of government, NGO, and community members as appropriate in mangrove conservation practices and rehabilitation. This interdisciplinary applied research and development project will also involve IUCN’s collaborating partners, such as the University of the South Pacific, WorldFish Center (WFC), Pacific Regional Environmental Programme (SPREP), and many government agencies and NGOs in the participating countries” (IUCN 2009).

PCEG, under IUCN Oceania, is a “virtual centre of excellence in environmental governance focusing on environmental law, environmental policy, environmental economics and leadership and learning. PCEG aims to strengthen enabling environments of laws, policies, formal and traditional institutions and decision-making processes for effective, efficient, equitable, transparent and accountable decisions within local and national political, socio-economic, and environmental context” (<http://www.iucn.org>). IUCN Oceania also has a Pacific Resource and Environmental Economics Network (PREEN). The inadequate consideration of economics issues

in natural resource management is due to lack of capacity in that area. In response to this, IUCN organized a meeting with practicing resource economists in 2007 and formed PREEN, whose purpose is to provide support and share ideas to progress economic analysis for sustainable resource management in the Pacific (<http://www.iucn.org>).

The Ecosystem and Livelihood Project is working to support beneficiary countries in the development and implementation of environmentally sound, sustainable energy policies and also facilitating the implementation of renewable energy pilot projects focusing on ecosystem conservation and livelihood enhancement. The 6 participating countries are the Marshall Islands, Palau, Samoa, Tonga, **Tuvalu** and Vanuatu and the overall goal of this project is to lessen the impacts of climate change (www.iucn.org).

8.3.12 Secretariat of the Regional Environment Programme (SPREP)

SPREP was established by the governments and administrators of the Pacific Island Countries, and is responsible for managing and protecting the environment and natural resources of the Pacific region. The initiative of Pacific Communities to establish SPREP shows their dedication towards sustainable development. Especially in accordance with the outcomes of WSSD implementation plan, the Millennium Development Goals and Declaration, the Barbados Plan of Action and Agenda 21.

Tuvalu is a core participant in the following projects being facilitated by SPREP's Climate Change Vulnerability and Sea-level Rise Programme which works in line with WSSD and UNFCC goals. SPREP is working on five focal areas under this programme: 1) Strengthening Meteorological services (Project: PIGCOS), 2) Understanding climate change variability and sea-level rise (Project: ARMS), 3) Vulnerability, adaptation and mitigation (Project: CBDAMPIC and PIGGAREP), 4) Ozone depleting substance (Project: ODS) and 5) Policy development on climate change (www.sprep.org).

8.3.13 United Nations Environment Programme (UNEP)

“UNEP is the United Nations system’s designated entity for addressing environmental issues at the global and regional level. Its mandate is to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action. The mandate and objectives of UNEP emanate from: a) UN General Assembly resolution 2997 (XXVII) of 15 December 1972; b) Agenda 21, adopted at the UN Conference on Environment and Development (the Earth Summit) in 1992; c) the Nairobi Declaration on the Role and Mandate of UNEP, adopted by the UNEP Governing Council in 1997; d) the Malmö Ministerial Declaration and the UN Millennium Declaration, adopted in 2000; and e) recommendations related to international environmental governance approved by the 2002 World Summit on Sustainable Development and the 2005 World Summit” (www.unep.org).

UNEP has six priority focal areas on environmental changes; 1) climate change; 2) disaster and conflicts, 3) ecosystem management, 4) environment governance; 5) harmful substances and 6) resource efficiency (www.unep.org). UNEP has supported and funded various conservation projects in the Pacific Region, which is coordinated by their Regional Office of Asia and the Pacific (ROAP). UNEP is addressing trans-boundary marine environmental and biodiversity issues through regional collaboration, while assisting national governments to strengthen the sustainable management of their coastal and marine resources. This includes efforts to address the problems of: loss and degradation of coastal and marine habitats; increasing pollution loads from land-based activities affecting the marine environment; need for improved coastal and marine information management; and lack of awareness on the value and vulnerability of coastal and marine resources (www.roap.unep.org).

8.3.14 United Nations Development Programme

UNDP's Environment and Energy Unit is responsible for a number of Pacific regional environments and sustainable energy programmes in partnership with the Secretariat of the Regional Environment Programme (SPREP), the South Pacific Applied Geoscience Commission (SOPAC) and the Forum Fisheries Agency (FFA). In line with UNDP's overall goal of enabling sustainable human development, it assists countries by facilitating access to funding opportunities from the UNDP, Global Environment Facility (GEF), bilateral and multilateral donors for environmental and natural resource management projects including sustainable energy. The UNDP-GEF funded South Pacific Biodiversity Environment Program (SPBCP) assisted almost 17 PICs in their Conservation Area Projects (www.undp.org).

The UNDP Fiji Multi-Country Office serves the Federated States of Micronesia, Fiji, Republic of Marshall Islands, Palau, Vanuatu, **Tuvalu**, Tonga, Kiribati, Nauru and the Solomon Islands. The Multi-Country Office in association with other Aid agencies are involved in 5 related projects in Tuvalu: 1) Aid Management and Coordination; 2) Support to Local Governance; 3) Increasing Resilience of Coastal Areas and Community Settlements to Climate Change in Tuvalu; 4) NBSAP (National Biodiversity Strategy and Action Plan); 5) Second National Communications.

The Aid Management and Coordination Project is a joint project with AusAID, with the aim of enhancing effective and efficient assistance to Tuvalu ensuring that it is fully in line with the country's development priorities. Through this project, UNDP and AusAID will assist the Government of Tuvalu in reviewing existing aid management, strengthening its current approaches, and developing new mechanisms where gaps exist. This will include the use of an aid management database to strengthen the effective and efficient alignment of Overseas Development Assistance (ODA) to Tuvalu's development priorities as outlined in the Te Kakeega II - the National Strategy for Sustainable Development 2005-2015. The project will also help to enhance the Household and Income survey data collection and Census systems in order to monitor progress towards the Millennium Development Goals.

The Government of Tuvalu, UNDP and NZAID have forged a new partnership to strengthen institutions of local governance in Tuvalu. As a small island developing state in the South Pacific,

Tuvalu is struggling with challenges posed by climate change and, by the global economic crisis in trying to meet its Millennium Development Goals (MDGs). The new partnership will support achievement of national development priorities and strengthening resiliency of local communities through consolidated effort to build robust institutions of decentralized governance in Tuvalu's outer islands. The Project partners will support compilation and updating of Island development profiles and bring about community participation in development planning, implementation and monitoring.

The new "Increasing Resilience of Coastal Areas and Community Settlements to Climate Change in Tuvalu" project agreed to by the Government of Tuvalu and UNDP will address the country's increasing climate change related threats, particularly to its highly vulnerable, low-lying atoll island communities. Tuvalu's livelihood opportunities as well as the islands' natural resource base are seriously undermined by the combined effects of sea-level rise, drought, rapidly progressing coastal erosion, increasing crop damage, and reductions of fresh water supply. Tropical cyclones appear to have increased in frequency, and it is also reported that there is a high risk of further climate-change related damage including irreversible loss of habitable areas of land.

With the realization of the need to protect whatever natural resources they possess, the Government's Department of Environment is going to implement the National Biodiversity Strategy and Action Plan (NBSAP) for the next two years. With the assistance of UNDP, the Department will conduct awareness raising workshops at community level, compile Tuvalu's Fourth National Report and adopt an integrated approach to ensure the participation of all stakeholders like other government departments, fishermen, handcrafters, garland weavers and local medicine doctors. For Tuvalu, the NBSAP is a vital piece of document that is aimed at helping Tuvaluans re-think the way they view and use the environment to their livelihoods and, how they can sustain it for the generations to come.

UNDP is providing assistance to the Government of Tuvalu in its Report for the Second National Communication which comprises three major elements: a national greenhouse gas inventory, abatement analysis and vulnerability and adaptation assessments as basis to access implementation funding. Some activities include gathering data on green house gas emissions and assessing coastal erosion and these are then collected and noted in the SNC reported. The project aims to enhance national capacities and improve knowledge and awareness on climate change and its effects in Tuvalu. It will also ensure that climate change issues are mainstreamed into national development strategies and policies and, that national capacities are developed and strengthened for participation in different mechanisms related to GHG mitigation and to fulfilling other commitments to the UNFCCC (www.undp.org.fj).

The UNDP GEF-Small Grants program is funding a few community projects in Tuvalu for example: *Turtle Tagging and Nest Monitoring Project in Funafuti* which seeks to address the issue of declining populations and the lack of awareness on turtle biodiversity and conservation activities at the community level. As yet, there are no legislations or by-laws protecting marine turtle harvesting; *Community Mangrove and Coconut Rehabilitation Initiative* which aims to

sustain and increase the conservation of mangrove belts in the outer islands through better management of existing mangrove and mulberry trees and extensive tree replanting including coconut trees, in areas where tree stocks have declined been seriously degraded or destroyed through over use; *Nukulaelae Island Community Biodiversity Conservation Initiative* which will implement activities under their Community-Based Fisheries Management Plan, developed in association with the Fisheries Department, as well as empower and build the capacity of community groups to take on lead implementation and management roles in the roll-out of the CBFMP as well as be trained on aspects of natural resources management particularly conservation activities in their marine and coastal areas; and the *Nanumea Community Biogas Initiative* (<http://sgp.undp.org/>).

8.4 National Laws, Policies and Action Plans

8.4.1 National Fishing Corporation of Tuvalu Act

This Act provides for the establishment and incorporation of a corporation known as the National Fishing Corporation of Tuvalu for the exploitation, processing and marketing of the marine resources of Tuvalu.

The Corporation shall be a body corporate with perpetual succession; shall have a common seal; (c) subject to section 5 of the Native Lands Act may acquire hold and dispose of property of every description; may sue or be sued in its corporate name; and may do or perform such acts and things as bodies corporate may by law do and perform.

The Corporation shall carry on business generally in the exploitation, processing and marketing of marine resources. The Corporation shall have the powers, in addition to any other powers conferred on it by this Act, to:-

- a) engage in fishing, culturing and harvesting of all forms of aquatic life; and process, buy, sell and market all forms of aquatic life;
- b) encourage and assist in the development of locally owned fishing enterprises;
- c) encourage the people of Tuvalu to exploit marine resources of all kinds;
- d) borrow money whether by overdraft or otherwise, or accept aid by way of grant or loan in cash or kind;
- e) draw, make, accept, endorse, discount, execute and issue Bills of Exchange, Bills of Lading, Warrants and other negotiable or transferable instruments;
- f) enter into contracts, working arrangements or joint enterprises with any person or Government to accomplish works of all description in keeping with the objects of the Corporation;
- g) incorporate a company under any law of Tuvalu to exercise or carry out all or any of the powers or functions of the Corporation and to be owned either wholly by the Corporation or jointly with any other person or persons
- h) raise such capital in such manner as the Board deems to be necessary from time to time for the better implementation of the functions or powers of the Corporation;

- i) make a financial contribution to the Consolidated Fund of the Government of Tuvalu;
- j) do in Tuvalu or elsewhere, either alone or jointly with any person or institution, all things necessary or convenient to be done for or in connection with or consequential upon any of its powers or functions.

All activities of the Corporation will be under the directions provided by the Minister, who may also make regulation for the conduct of business of the Corporation.

8.4.2 Environment Protection Act

This Act provides for the protection and management of the environment in Tuvalu. The Act generally aims to: coordinate the role of government in relation to environmental protection and sustainable development; provide a mechanism for the development of environmental policy and law; promote a clean and healthy environment for all Tuvaluans; prevent, control, monitor and respond to pollution; promote public awareness and involvement in environmental issues; facilitate compliance and implementation of obligations under any regional and international environmental or natural resource agreements or conventions to which the Government of Tuvalu has ratified or acceded to; facilitate the assessment and regulation of environmental impacts of certain activities; promote the conservation and, where appropriate, sustainable use of biological diversity and the protection and conservation of natural resources on the land, air and in the sea; reduce the production of wastes and promote the environmentally sound management and disposal of all wastes.

The Minister (of the Ministry of Natural resources and Environment) is responsible for the administration of this Act. The Minister shall have the powers to delegate activities that will assist in meeting the objectives of this Act.

The Act allows the Minister to delegate his powers to the Director of Environment, who may by notice in writing, delegate any other officer of the Department to assist in the application of this Act.

The Minister may appoint in writing any sufficiently qualified person to be an Environment Officer, including employees of the Department of Environment, police officers, quarantine officers, fisheries officers and public health inspectors. The Act allows the Environment officers to enter and conduct search (with a warrant) of any vessel, aircraft, ship and property (other than residential house), if they believe that provisions of this Act is being breached under any circumstances. The officers shall have powers to ascertain the nature and condition of the land, building, water or reef; or investigate an alleged offence of which an environment officer has reasonable and probable grounds to believe that such entry will produce evidence. See Part III of the Act for detailed power of enforcement.

The Act requires the establishment of National Environment Forum, Council and Island Environment Committees.

The Minister may, from time to time, convene a National Environment Forum for the purposes of discussing environment related matters, dissemination of information of related projects, formulation and implementation of policies and environmental activities. The National Environment Council shall provide advice to the Minister on matters relating to environmental protection and sustainable development. On the other hand, the Island Environment Committees are responsible for identifying priority areas of environmental concern and to convey information on such matters to the Department; and recommend to the Minister regulations to be made under this Act to provide for the proper protection and management of the environment in that island.

Part V of the Act deals with the procedures of **Environment Impact Assessment**. The Department of Environment is responsible for monitoring activities that are likely to have, or are having an environmental impact in any area of land or sea within the jurisdiction of Tuvalu. Regulations relating to environmental impact assessments may make provision for:

- a) the types of projects, developments and activities (including definitions of major projects) which, if undertaken within Tuvalu, shall require a prior environmental impact assessment, or such an assessment at any time during the course of the establishment or operation of a project, development or activity;
- b) the recognition of any assessments undertaken in other countries, and any conditions which may be applied to such recognition for the purposes of such assessments in Tuvalu;
- c) procedures for the assessment of environmental impacts, including any reports, scientific testing or analysis or any other matter to verify any aspect of an assessment;
- d) prescribed or approved forms and fees for any aspect of the assessment of environmental impacts, including applications, reports, assessments, findings and approvals;
- e) the powers of the Minister to determine, apply and enforce any procedures for the assessment of environmental impacts in relation to any type or specific project, development or activity;
- f) the establishment, composition, powers, functions and procedures of an Environment Impact Assessment Taskforce;
- g) the granting of approvals and the imposition of general or specific conditions;
- h) the enforcement of conditions which apply to approved projects, developments or activities; and
- i) offences for the breach of any requirements applying to the system of environmental impact assessment, and penalties for such offences being fines not exceeding \$10,000, and terms of imprisonment not exceeding 3 years.

Part VI of the Act focuses on the role of the Department in relation to **pollution and wastes**. The section consists of regulations for waste disposal and management; pollution control and usage and disposal of hazardous waters and substances.

Under this Act, the Department is obliged to meet requirements of related International and Regional Conventions and Treaties (see section VII)

Part VIII of this Act focuses on the response to **climate change**. In collaboration with other Departments, each Kaupule, and relevant international agencies, and through the involvement of the community, the Department shall formulate, apply and implement strategies and programs to:

- (a) raise the level of understanding throughout the world about the implications of climate change, and activities which contribute to climate change, on Tuvalu and the future of its people;
- (b) address the effects of climate change within Tuvalu on its water resources, coastal areas, lands and land usage, food security, biodiversity, fisheries, economic welfare, public infrastructure and its vulnerability to natural disasters;
- (c) implement programs and facilitate projects to protect its water resources, coastal areas, mangroves, lands, biodiversity, fisheries and public infrastructure, and to contribute to the well-being and livelihoods of Tuvaluans;

Regulations made under this Act may provide for: any matter associated with the response in Tuvalu to climate change; the protection and conservation of Tuvalu's fresh water resources; matters concerning drought prevention and response; and the protection, improvement and expansion of relevant public infrastructure.

Under this Act, the Department of Environment is required to formulate, apply and enforce policies and programs for the protection of the biodiversity in Tuvalu (Part IX) especially, control of invasive species, conservation and protection of endemic species, protection and application of traditional knowledge, declaration and management of protected areas, regulating access to genetic resources, implementing plans and monitoring systems.

Any person found breaching any sections of this Act will be prosecuted accordingly, as per provisions of this Act.

8.4.3 Marine Resources Act

This Act has replaced the Marine Ordinance (1978). The Act makes provisions for the promotion and regulation of the long-term conservation and sustainable use of the living marine resources for the benefit of the people of Tuvalu. For the purpose of meeting the objectives of this Act, the Minister has authority for the conservation, management, development and sustainable use of the living resources in the exclusive economic zone in accordance with this Act. The Minister shall take into account the following principles and measures:

- a) adopt measures which ensure long-term sustainability of fish stocks and promote the objective of the optimum utilization;

- b) ensure that such measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, and taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether sub-regional, regional or global;
- c) assess the impacts of fishing, other than human activities and environmental factors on target stocks, and non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks;
- a) minimize waste, discards, catch by lost or abandoned gear, pollution originating from fishing vessels, catch of non-target species and impacts on associated or dependent species, in particular endangered species, and promote the development and use of selective, environmentally safe and cost-effective fishing gear and techniques;
- j) prevent or eliminate over-fishing and excess fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources;
- k) collect and share, in a timely manner, as may be required in accordance with this Act and regional or international obligations accepted by the Government, data concerning fishing activities on, inter alia, vessel position, catch of target species and fishing effort, as well as information from national and international research programmes;
- n) ensure that the distribution of access to the benefits from marine resources among Tuvaluans is fair;
- o) implement and enforce conservation and management measures to the extent possible through effective monitoring, control and surveillance.

Exclusive management and control over fish, fisheries, and other aquatic resources within the fishery waters are vested in the Government. The Minister shall have the vital authority and responsibility in relation to this law for fisheries conservation, management and sustainable use in Tuvalu and the fishery waters, and for the preparation and implementation of such additional policy and legislation as he sees fit. The Minister may in writing, appoint Fisheries Officer who will be responsible for: determining total allowable catches; issuance of permits, and appointment of authorized observers and officers and other duties delegated by the Minister.

Part III of this Act focuses on fisheries conservation, management and sustainable use. Subsection seven gives detailed protocols of what is required such as conservation and management measures, scientific evidence, precautionary measures, impact assessments, pollution, overfishing etc. Subsection eight requires the Fisheries officers to have management plans for all designated fishery in Tuvalu. The officer shall oversee the development; implementation and timely review of the plans (see subsection 8(4) for detailed requirements of the plans).

Part III, subsection nine deals with conservation and management measures. Under this section, the Minister may take measures to protect marine resources. The minister may

designate open and closed fishing seasons of any species; designate prohibited areas; place gear, catch and size restrictions; declare marine parks, reserves or sites of scientific or historic interest. Part III subsection 10 allows the minister and the Fisheries officers to allocate total allowable catches for any species that he may believe to be threatened with overfishing. Total allowable catch preference should be given to local and domestic based fishing vessels and the Minister need to have prior knowledge on fishing patterns and scientific data of that particular fishery. The Act allows the Minister by order, to declare any stock or species of fish as protected which is designated as endangered by international agreement, or which is identified by any other generally recognized scientific criteria as endangered or likely to become endangered. Any person found to be catching and/or selling endangered fish may be fined up to \$50,000 or face imprisonment for 6 months. The Fisheries Officer has the authority to ask fishermen for any data related to fishing. Any person who refuses to do so or does not have data will be liable for conviction.

No domestic-based fishing, foreign fishing, commercial fishing, commercial pilot fishing, marine scientific research, transshipment, or such other fishing or other activity related to fisheries is permitted to fish in the fishery waters unless they have a valid permit and license. Any person owning a fish processing facility shall be required to hold a valid permit and license. The permit and license shall have necessary conditions that will assist in fisheries conservation and sustainable management. The Minister may, by Order, require that any fisher or class of fishers, or any vessel or class of vessels or any person undertaking an activity governed by this Act be registered with the Fisheries Officer.

The Act allows for scientific research in Tuvalu waters, provided the researchers submit a detailed research plan to the Fisheries Department. A Fisheries observer shall be onboard the research vessel at all times.

Under this Act, no person shall destroy, damage or take any part of a fish aggregating device, artificial reef, mooring buoy, float, tray or other device which belongs to another person or has been installed by the Government. Any person found to be using or in possession of prohibited fishing gear, poison and explosives will be prosecuted. A person who within the fishery waters engages or attempts to engage in any driftnet fishing activity shall be liable on conviction to a fine of \$500,000 and to imprisonment for one year. A person who introduces into the fishery waters any live fish originating from any place outside Tuvalu without written authorization of the Fisheries Officer, which requires prior quarantine approval, shall be liable on conviction to a fine of \$10,000 and imprisonment for 6 months.

The Act prohibits the export of any live fish, live rock, viable fish eggs or spawn taken from the fishery waters. No person shall export any fish or fish products from Tuvalu unless exporting for personal consumption and is not intended for commercial trade or sale. For commercial trade, prior written documentation is needed from the Fisheries Department.

Any person who directly or indirectly contaminates the fishery waters in any way, including by the discharge of any substance (non-biodegradable trash, poison, chemicals, noxious

substances, oil, petroleum, metals or sewage) or by any Act or omission that is likely to damage to or deteriorate the quality of the marine resources, shall be liable on conviction to a fine of \$500,000 and imprisonment for six months.

8.4.4 Marine Zone (Declaration) Act

This Act makes provisions in respect of the internal waters, the archipelagic waters, the territorial sea, the exclusive economic zone and the contiguous zone of Tuvalu.

For the purposes of any law of Tuvalu, the internal waters of Tuvalu are all waters on the landward side of the base-lines from which the breadth of the territorial sea is measured; and where closing lines are drawn in accordance with subsection (2) the waters inland of those lines to the waters inland of those lines to the extent that they are outside those base-lines. The Act future defines the archipelagic waters, territorial sea, EEZ and the contiguous zone. The Act consists of regulations within all waters of Tuvalu.

8.4.5 Prohibited Area Act

This Act provides for certain islands and their “territorial waters” to be declared prohibited areas. “Territorial waters” in this context means part of sea adjacent to the coast of any island, which is within three geographical miles from low water mark of the seaward side of the reef if present, otherwise from low water mark off the coast itself.

Under this Act, the Minister may by notice, declare any island and its territorial waters to be a prohibited area. No person shall remain in or enter into or attempt to enter into any prohibited area without the authority in writing of the Minister. Authorized officers have full powers to remove and detain anyone found in the prohibited area. Any person who shall remain in or enter or attempt to enter a prohibited area without authority shall be liable to a fine of \$50 and to imprisonment for 3 months.

8.4.6 Marine Pollution Act

This Act makes provision for preventing and dealing with pollution of the sea, and to enable effect to be given to international conventions for the prevention of marine pollution and the protection of the marine environment. The Act also acknowledges related International and Regional Conventions that Tuvalu is party to.

Part II of the Act deals with prevention of pollution. It is an offence if oil (crude oil, fuel oil, lubricating oil, heavy diesel oil, sludge and oil refuse etc) or pollutants (garbage, sewage, noxious waste or chemicals) are discharged into Tuvaluan waters, either by ships, any land based plant, any floating platforms or any other structures. If oil or pollutants are discharged, the owner of the structure (ship or plant or platform) will be penalized (fined up to \$100,000) under this Act, however under subsection six of this part, the offenders will be given a **change** for defense and if proven that the discharge was an accident and all necessary steps have been

taken to minimize pollution, he may not get a hefty sentence. In order to prevent pollution due to faulty equipment, the Act specifies that no equipment shall be installed unless the equipment type is tested and approved by relevant authorities appointed by the Minister. Ships, platforms and structures are also required to have equipments that will assist in dealing with accidental pollutant discharges. The Harbor Act provides for the installation and usage of reception facilities at the ports, where ships can discharge or deposit oil residues, pollutant residues, garbage or sewage. Subsection 10, 11 and 12 provides further details on port proper discharge processes.

The Minister may appoint any person as an inspector, who will report to him whether the provisions of this Act is being followed by all stakeholders. The inspector shall also have powers to inspect any ship or structure.

This Act may empower persons as may be designated by or under the regulations to go on board any ship to which a Convention applies (being a Convention to which Tuvalu is a party) while that ship is within Tuvalu waters, and to require production of any records required to be kept in accordance with any such Convention.

Part III of the Act provides regulations for dumping and incineration of wastes. This part applies to any ship, aircraft, and facility which may have onboard any substance that may be regarded as pollutants under this Act. The section further specifies respective offences dealing with radioactive wastes, toxic and hazardous substances and illegal incineration of these substances.

8.4.7 Conservation Areas Act

This Act provides for the declaration and management of conservation areas and related purposes. Under the Act, the Minister by order in the Gazette, declare any part of the territory of Tuvalu as a Conservation Area upon consultation with the Kaupule (executive arm of the Falekaupule which is the traditional assembly in each island of Tuvalu). The Kaupule is required to submit a report consisting of the scientific assessment, best location and size of area in question.

Any conservation area designated under section 3 of this Act shall have one or more of the following objectives:

- b) to protect the environment including coastal, marine and terrestrial;
- c) to conserve the living and non-living natural resources of the island communities and to provide for their sustainable utilization by present and future generations;
- d) to preserve the biological diversity of the conservation area, especially those species which are endemic, threatened, or of special concern and the coastal and marine habitats upon which the survival of these species depend;
- e) to preserve and enhance the natural scenic beauty of the conservation area including sites that are already degraded or those that may become degraded if not protected;
- f) to promote public interest and enjoyment of conservation areas; and

g) to promote the scientific study and research of the conservation area.

The Kaupule will be responsible for the assessment and management of the conservation area. The Kaupule, with assistance from the government and in full consultation with the community, prepares management plan for the area (section 7 gives details of what is required in the management plan).

The Kaupule may enter into a written agreement with owners of such land as it considers necessary to secure its right to access and to control such land as part of the conservation area. The Kaupule can also make by-laws.

Under the Act, no person shall release or cause to be released into a conservation area any polluting or hazardous substances by dumping or through the atmosphere; no person shall hunt, kill or capture any turtle, bird or fish in conservation areas designated; and no person shall collect or remove any non-living material or resources from the conservation areas without the written approval of the Kaupule. Any person found in breach of the conditions of this Act will be prosecuted.

The Kaupule shall have the power to enforce necessary measures for preventing or mitigating as far as possible any destruction of the environment and natural resources of the conservation areas or for the implementation of this Act or regulations or by-laws under it.

The Act also provides for the establishment of a fund that will be used for the management of the Conservation Area. However the Act requires an annual report including financial details from the Kaupule.

While Tuvalu has only one globally recognized conservation area (Funafuti Conservation Area (FCA)), there are additional locally managed conservation areas under the Kaupule.

8.4.8 Wildlife Conservation Act

This Act provides for the conservation of wildlife in Tuvalu. Under this Act, the Minister may by notice declare any bird or animal (other than a fish) to be:

- a) fully protected for the purposes of this Act, either throughout Tuvalu or in such area or areas as the Minister may designate;
- b) partially protected for the purposes of this Act, either throughout Tuvalu or in such area or areas as the Minister may designate, in which case the Minister shall specify in the notice the closed season for that bird or animal which shall be the period between and inclusive of two dates in every year specified in the notice (hereinafter referred to as the closed season).

The Act prohibits the hunting of protected birds and animals. Egg collection of protected birds is also prohibited. No person shall hunt, kill or capture any wild turtle on land except under and

in accordance with the terms of a valid written license granted to that person by the Minister under this section. Any person found to be in unlawful possession of any fully or partially protected bird, animals and turtles will be prosecuted.

The Act provides for the appointment of wildlife wardens to enforce the regulations under this Act.

8.4.9 Ozone Layer Protection Act

In its efforts to reduce effects from climate change, Tuvalu has an Ozone Layer Protection Act to control ozone depleting substances in accordance with the obligations applying under the Vienna Convention for the protection of the ozone layer and the Montreal Protocol.

The objectives of this Act are to: - (a) protect human health and the environment from adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer; (b) phase out ozone depleting substances as soon as possible except for essential uses; and (c) give effect to the Tuvalu's obligations under the *Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer*.

Importation of any controlled substance specified under Part III and Part VI of the Schedule (Reg. 2: Pg 17-20 of the Act), is prohibited. Subject to provisions, importation into Tuvalu of the following is prohibited: - (a) any bulk controlled substance specified in Parts I, II, IV and V of the Schedule; (b) any bulk methyl bromide, as specified in Part VIII of the Schedule; and (c) any bulk hydro chlorofluorocarbons, as specified in Part VII of the Schedule (whether alone or in a mixture). Products (e.g. fire extinguisher, aerosol cans, plastic foam) containing such substances are also prohibited unless permitted by the authorities. Section 6 of the Act allows for importation of certain products containing banned substances provided an approval is acquired from relevant authorities.

The Act further prohibits /regulates the export, manufacture and sale of banned substances or products containing banned substances. Part III of the Act provides condition for special permits. Part IV of the Act allows for the appointment of enforcements officers who will see that the laws under this Act are followed.

8.4.10 National Strategy for Sustainable Development 2005-2015 (NSSD)

The NSSD was developed in 2005 and was structured around the Millennium Development Goals and the present and potential future challenges facing Tuvalu.

The NSSD has outlined key fisheries objectives and policies that need to be addressed for the period of 2005-2015:

- Improve management of fisheries resources- inshore and EEZ

- Eliminate subsidies to Commercial Fishing Center through efficient gains, privatization or closure;
- Increase revenue for fishing license
- Formulate and implement a clear fisheries sector development programme

The key environment policies and strategies outlined in the NSSD are to:

- Develop and implement an urban and waste management plan for Funafuti.
- Establish national climate change adaptation and mitigation policies.
- Encourage international adoption of Multilateral Environmental Agreements, including the Kyoto Protocol.
- Increase the number of conservation areas and ensure regulatory compliance.

5.4.11 National Adaption Programme of Action

The National Adaptation Programme of Action (NAPA) for Tuvalu, prepared under the Office of the Prime Minister (OPM), and the Ministry of Natural Resources and Environment, is the Government of Tuvalu's response to COP 7 decisions.

The Tuvalu National Adaptation Programme of Action (NAPA) is based upon existing environmental information, reports and expert judgments, understanding gathered from community consultations and climate change awareness campaigns with each Island Falekaupule, and the national NAPA prioritization workshop on Funafuti. In the course of the Tuvalu NAPA development process, it has become clear that climate change will intensify existing environmental problems in Tuvalu – and natural hazards. For some existing environmental problems in Tuvalu; coping mechanisms have been developed. All new coping mechanisms under the NAPA are linked to the urgency and immediacy of the problem, and should be complimentary to the Kakeega II (NSSD) development process.

NAPA has seven adaptation projects that address the major issues faced by Tuvalu. The projects are:

1. **Coastal:** Increasing resilience of Coastal Areas and Settlement to climate change:- this project aims to increase protection of coastal area from erosion and increase protection of coastal communities from natural phenomenon
2. **Agricultural:** Increasing subsistence pit grown pulaka productivity through introduction of a salt-tolerant pulaka species.
3. **Water:** Adaptation to frequent water shortages through increasing household water capacity, water collection accessories, and water conservation techniques.
4. **Health:** Strengthening of Community health through control of vector borne/climate sensitive diseases and promoting access to quality potable water.
5. **Fisheries:** Strengthening of Community Based Conservation Programmes on Highly Vulnerable near-shore Marine Ecosystems.

6. **Fisheries:** Adaptation to Near-Shore Coastal Shellfish Fisheries Resources and Coral Reef Ecosystem Productivity.
7. **Disaster:** Strengthening Community Disaster Preparedness and Response Potential.

8.4.12 Tuvalu National Biodiversity Strategic Action Plan (NBSAP)

Tuvalu did not prepare the first three reports for the NBSAP program under the Convention on Biological Diversity (Carter 2007). Their first report for Tuvalu NBSAP is the Fourth National Report to the Convention on Biological Diversity (Tilling and Fihaki 2009). The first set of work carried out under the Tuvalu NBSAP was in February 2009. The initial stage of the program carried out much work to determine local knowledge about the environment, perceived trends and threats to biodiversity of Tuvalu.

There have been establishments of additional conservation areas under the local Kaupules (Island Councils). In order to maintain the conservation areas, there is a need to institute management systems that will be on-going and self-financing. There have been numerous one-off studies; however, thus far, there are no on-going surveys in Tuvalu which could aid in the establishment of a systematic management system for conservation areas. The perceived or subjective assessments of changes to biological diversity made are insufficient for sound management.

There is no consideration for ecosystem connectivity when setting up conservation areas. Currently, there are many areas outside formally declared or designated protected areas which should be given equal significance when considering proper coastal management areas.

Initiatives undertaken by NGOs and central and local government agencies with donor funding include projects related to biodiversity conservation, management of liquid and solid wastes, promotion of mangrove and tree planting and tourism. "So far, the NBSAP project has revealed that environmental laws and regulations need to be further developed and articulated, especially in regards to biodiversity conservation. Climate change policies and adaptive strategies should have a positive impact, as they will promote environmentally beneficial actions. They can become a focus, catalyst and imperative for conservation in the widest sense" (Tilling and Fihaki 2009).

8.5 Tuvalu's Commitment to International Treaties and Conventions

Tuvalu has adopted a number of regional and international Treaties and Conventions in efforts to conserve its biodiversity. The international environment agreements that Tuvalu is a party to include: Convention on Biodiversity, United Nations Framework on Convention of Climate Change, Kyoto Protocol, United Nations Convention on Laws of the Sea (UNCLOS) III, Vienna Convention on protection of Ozone Layer and United Nations Convention to Combat Desertification (www.cia.org). The details of the international agreements are given in *Table 3* below.

Table 3: List of Conventions and Protocols adopted by Tuvalu. (Source: www.un.org)

International Agreements	Date of Signature	Date of Ratification	Entry into Force
Convention on Biological Diversity		20-12-2002	
United Nations Framework on Convention of Climate Change	08-06-1992	26-10-1993	21-03-1994
Kyoto Protocol	16-11-1998	16-11-1998	16-02-2005
United Nations Convention on Laws of the Sea (UNCLOS) III		09-12-2002	
Vienna Convention on protection of Ozone Layer		15-07-1993 (Accession)	
United Nations Convention to Combat Desertification		14-09-1998 (Accession)	13-12-1998

8.6 Gaps in Coastal Legislation and Policies

Tuvalu has a number of Acts that regulates the major activities related to coral reefs. These include the National Fishing Corporation of Tuvalu Act, Environment Protection Act, Marine Resources Act, Marine Zone (Declaration) Act, Prohibited Area Act, Marine Pollution Act, Conservation Areas Act, Wildlife Conservation Act and Ozone Layer Protection Act. These Acts are supplemented with three major policies and plans: National Strategy for Sustainable Development 2005-2015 (NSSD), National Adaption Programme of Action and Tuvalu National Biodiversity Strategic Action Plan (NBSAP). Upon analysis of the major Acts and Policies, some gaps in the current legislation are evident and these gaps need to be addressed by the policy makers.

Lack of Implementation

“Compliance is absolute in the outer islands. However, in Funafuti, where many different ethnic groups co-exist, laws are usually breached. By-laws issued by the Funafuti Kaupule (Funafuti Island Council) are frequently abused, for example, there is poaching inside the Funafuti reserve. In many cases, the accusers are non-indigenous residents. Several compliance problems have been identified including the relatively large size and distant location of the reserve, inadequate resources to effectively carry out enforcement, relatively large human population, and lack of prosecution for offenders” (Poulasi 2007).

Lack of Biodiversity Information and Conservation Efforts

Little information is available on the coral reef biodiversity of Tuvalu. There is a lack of technical information for conservation planning, technical expertise and capacity, public awareness and appreciation of conservation and weak and ineffective legislation.

The NBSAP project has identified the lack of systematic surveys and baseline data for Tuvalu. This places considerable constraints on the management plans for conservation areas (Tilling and Fihaki 2009).

There is little knowledge about the land-based processes and activities and climate change impacts on the coastlines of Tuvalu. The land-based processes (including pollution from liquid and solid wastes and vegetation clearance for agriculture) could have potential negative impacts on biodiversity and have already adversely affected conservation areas (Tilling and Fihaki 2009).

Improper Wastewater Management

Nutrient pollution is high in Tuvalu lagoons. The nutrient enrichment in lagoons is mostly from fertilizers, domestic animal waste (chickens and pigs) from construction of their pens in the coastal areas and improper wastewater disposal (Poulasi 2007; Poulasi 2010).

8.7 Recommendation

8.7.1 Fisheries

1. There is a need to obtain more comprehensive information on the biodiversity of Tuvalu's reefs with the necessary scientific input.

8.7.2 Marine Managed Areas

1. There is a need to enforce the by-laws associated with conservation areas.
2. There is a need to establish the procedures of systematic surveys for taking marine resource inventories on a regular basis to maintain a long-term data set.

8.7.3 Climate Change

1. We recommend that the progress of the NAPA activities be reviewed and finally, an examination of potential adaptation strategies for climate change-induced threats be undertaken.

8.7.4 Multi-sectoral and Multi-stakeholder Consultation

1. There is a need to assess the impacts of land-based activities on the coral reef resources.
2. There is a need to design and implement proper waste disposal practices.

REFERENCES

ADAB. 1985. Tuvalu lagoon resources survey. *Report prepared for the Tuvalu Government, Vol. 1.* ADAB.

Anon. 1995. *Funafuti marine conservation project preparation document.* Funafuti, Tuvalu: Ministry of Natural Resources, Environment Unit.

Bell, J.D., Kronen, M., Vunisea, A., Nash, W.J., Keeble, G., Demmke, A., Pontifex, S. & Andrefouet, S. 2009. Planning the use of fish for food security in the Pacific. *Marine Policy* 33: 64-76.

Carter, E. 2007. *National Biodiversity Strategies and Action Plans.* Pacific Regional Review, Commonwealth Secretariat, SPREP.

Gillett, R. 2009. Fisheries in the economies of the Pacific Island countries and territories. *Pacific Studies Series*

Kaly, U.L. 2001. *Ecological audit of Funafuti landfill: marine baseline surveys and assessment of site suitability.* Tuvalu Waste Management Project. [Report prepared for the Government of Tuvalu]

Miller, C. 2009. *Current state of knowledge of cetacean threats, diversity and habitat in the Pacific Islands Region.* CMS official information document. UNEP/CMS/PIC2/Inf.6-01.

Ministry of Finance, Economic Planning and Industries. 2005. *Te Kakeega II: National Strategy for Sustainable Development 2005-2015.* Funafuti, Tuvalu: Government of Tuvalu.

Poulasi, T. 2007. *Tuvalu.* In: R. Sulu (Ed), Status of Coral Reefs in the South West Pacific: 2004, Suva, Fiji: IPS Publications, University of the South Pacific.

Poulasi, T. 2010. *Tuvalu.* In: R. Sulu (Ed), Status of Coral Reefs in the South West Pacific: 2007, Global Coral Reef Monitoring Network Southwest Pacific Node, *Unpublished Report.*

Sauni, S. 2000. *Status of coral reefs in Tuvalu.* [Paper presented at the Coral Reef Symposium, Noumea, New Caledonia]

Tilling, A.J. & Fihaki, E. 2009. *Tuvalu: National Biodiversity Strategy and Action Plan*. Fourth National Report to the Convention on Biological Diversity.

Tuvalu Government. 1990. Rev. ed. *Fisheries Legislation of Tuvalu*. Laws of Tuvalu

Veitayaki, J. 1995. Fisheries Department in Fiji. Suva, Fiji: IPS Publications, University of the South Pacific.

INSTITUTE OF MARINE RESOURCES (IMR)

IMR provides scientific and technical skills, and capacity-building, marine resource assessments, coral reef monitoring/ database maintenance and socio-economic analysis for fisheries and aquaculture. IMR aims to increase the regional capacity to sustainably develop its marine resources through applied research, training and teaching. Research and development projects focus on marine ecology, aquaculture and biodiversity issues.

Much of IMR's work is externally-funded research and consultancies on the region's marine environment and its resources. Current activities centre on coral reef monitoring, marine biodiversity assessment, aquaculture management and cetacean research. The Institute also coordinates the South-West Pacific node of the Global Coral Reef Monitoring Network (www.GCRMN.org).

CONTACT DETAILS

Phone: 323 2930/ 323 2988

Fax: 323 1526

Website: www.usp.ac.fj/imr

Email: joeli.veitayaki@usp.ac.fj OR cherie.morris@usp.ac.fj



School of Marine Studies
Institute of Marine Resources