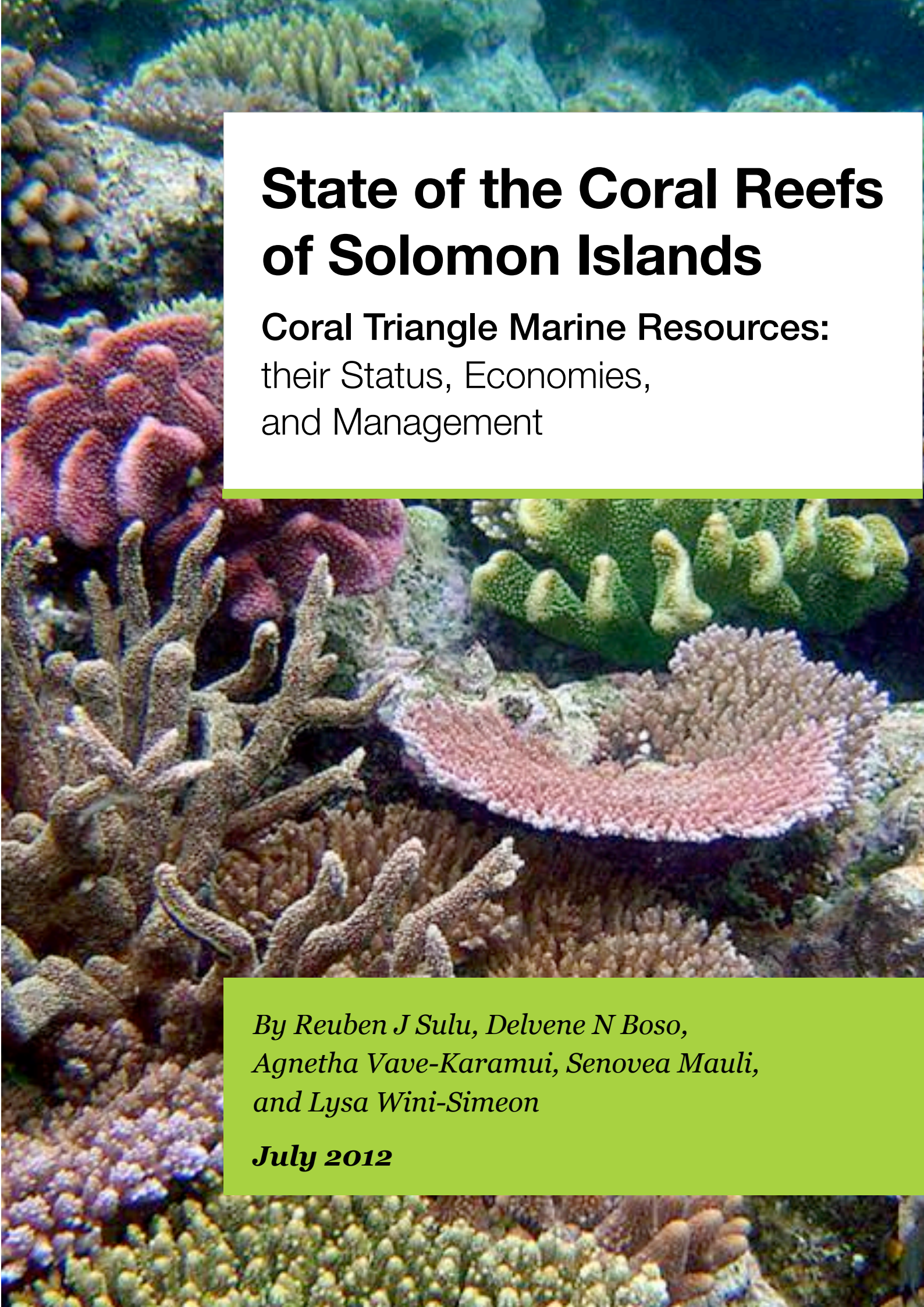
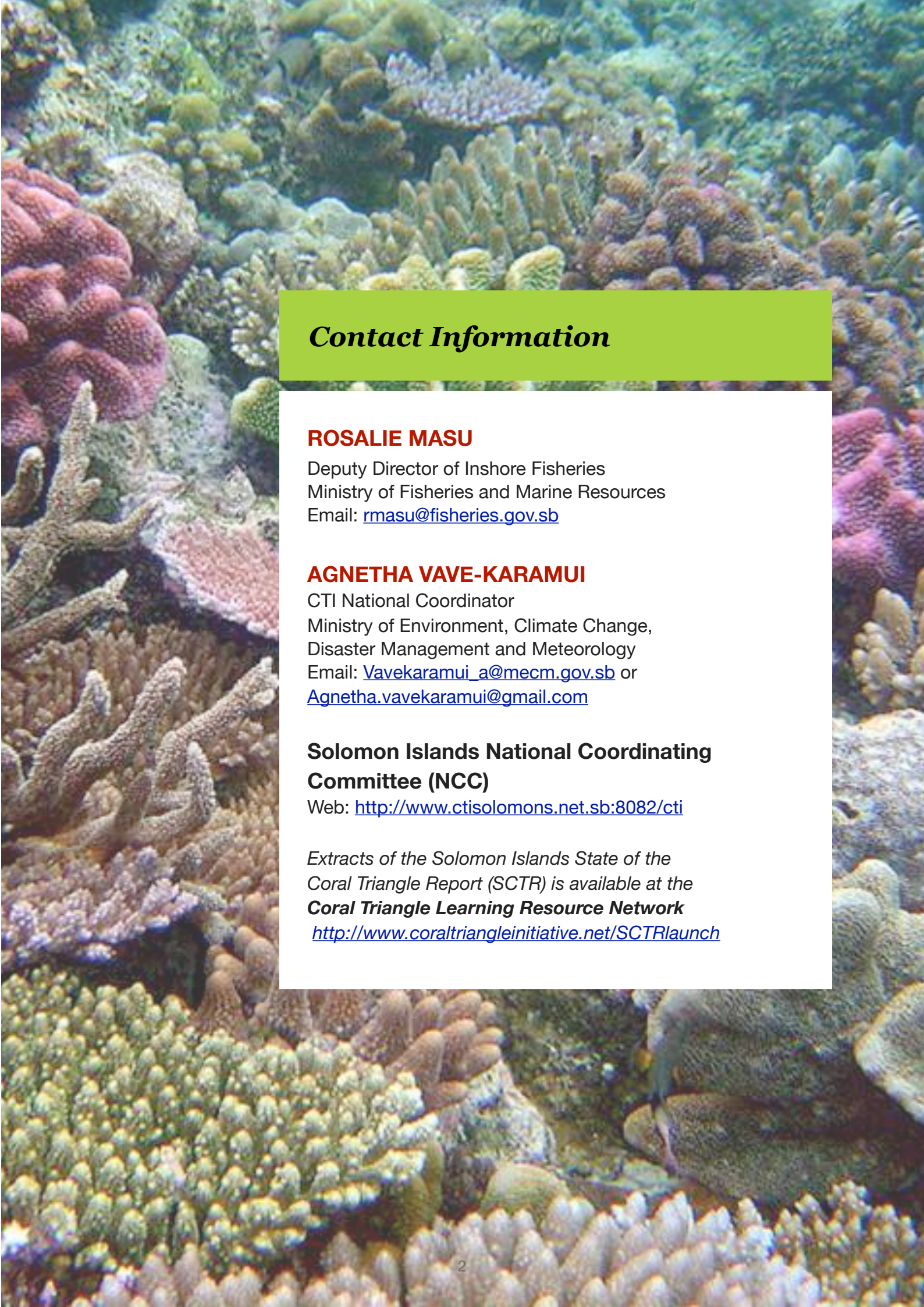


State of the Coral Reefs of Solomon Islands

Coral Triangle Marine Resources: their Status, Economies, and Management

By Reuben J Sulu, Delvene N Boso, Agnetha Vave-Karamui, Senovea Mauli, and Lysa Wini-Simeon

July 2012



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Extracts of the Solomon Islands State of the Coral Triangle Report (SCTR) is available at the ***Coral Triangle Learning Resource Network***
http://www.coraltriangleinitiative.net/SCTRlaunch

Table of Contents

CHAPTER 1

Introduction

Solomon Islands is the eastern most range of the Coral Triangle, the global epicenter of marine biodiversity. Coral reefs play an important role in the lives of Solomon Islanders for both direct and indirect benefits. In this report we describe the coral reefs of Solomon Islands and what is currently known about aspects of its biota, the utilisation, governance and management of coral reefs and related marine resources and ongoing coral reef conservation issues and initiatives.

We conclude that some progress has been made since 2000 on:

(1) understanding the coral reefs of Solomon Islands and the ecological consequences of reef fisheries and other forms of exploitation;

(2) devising of required policies and enacting necessary legislations to protect and conserve coral reefs;

(3) initiatives at the national and regional level by the government, development partners and non-government organisations to protect, sustainably utilize and conserve coral reef resources.

Threats to coral reefs still emanates from rapid population growth, need to meet daily subsistence needs, increasing opportunities to convert coral reef resources to cash and effects of development activities such as logging, tourism development, plantation, mining, urban development, and the effects of climate change. While progress has been made to protect, sustainably utilize and conserve coral reefs much more needs to be done to mitigate future threats.

CHAPTER 2

Biophysical Characteristics

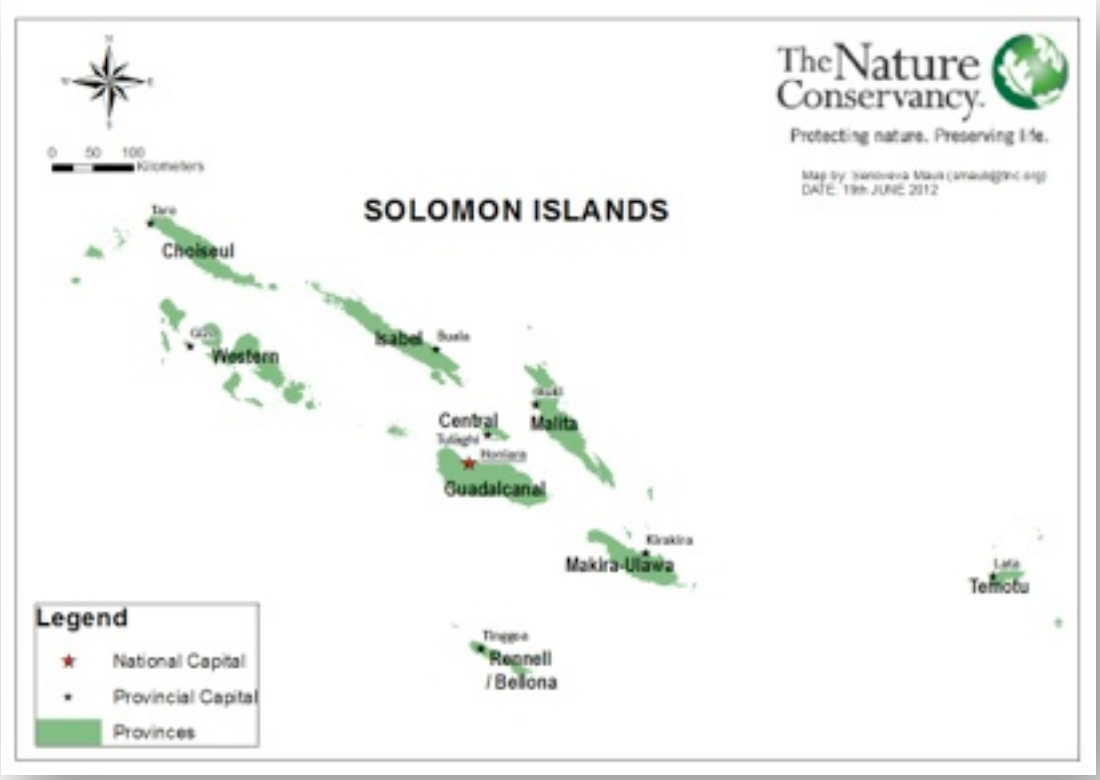

Fig. 1: Map of Solomon Islands

A.Physical Geography

Solomon Islands forms a double – chained archipelago of approximately 990 islands that lies 5-12°South and 152-170°East along the western margin of the Pacific plate. This double chain of islands runs from the northwest to the southeast converging on Makira Province (Santa Cristabol). The easternmost province is Temotu (Provincial headquarters is Lata), which falls outside the Coral Triangle region (Figure 1). Solomon Islands occupy a total land area 28,000 km² and a total ocean area of 1, 340, 000 km². The six main islands that make up this archipelago are: Choiseul, New Georgia, Santa Isabel, Guadalcanal, Malaita and Makira. These islands are mostly rugged, mountainous and with deep internal valleys and steep sides which descend immediately into the depths of the oceans. They are all volcanic in origin and are surrounded by barrier, patch, lagoonal and fringing reefs. The smaller islands are mostly raised coral islands and atolls.

Geologically, Solomon Islands lies along the south-western border of the Pacific Ocean where Pleistocene, recent and contemporary volcanoes are important landscape features of several of the islands, notably New Georgia (Grower et al. 1962). The main islands differ considerably in their broad structural characteristics, although they probably share similar

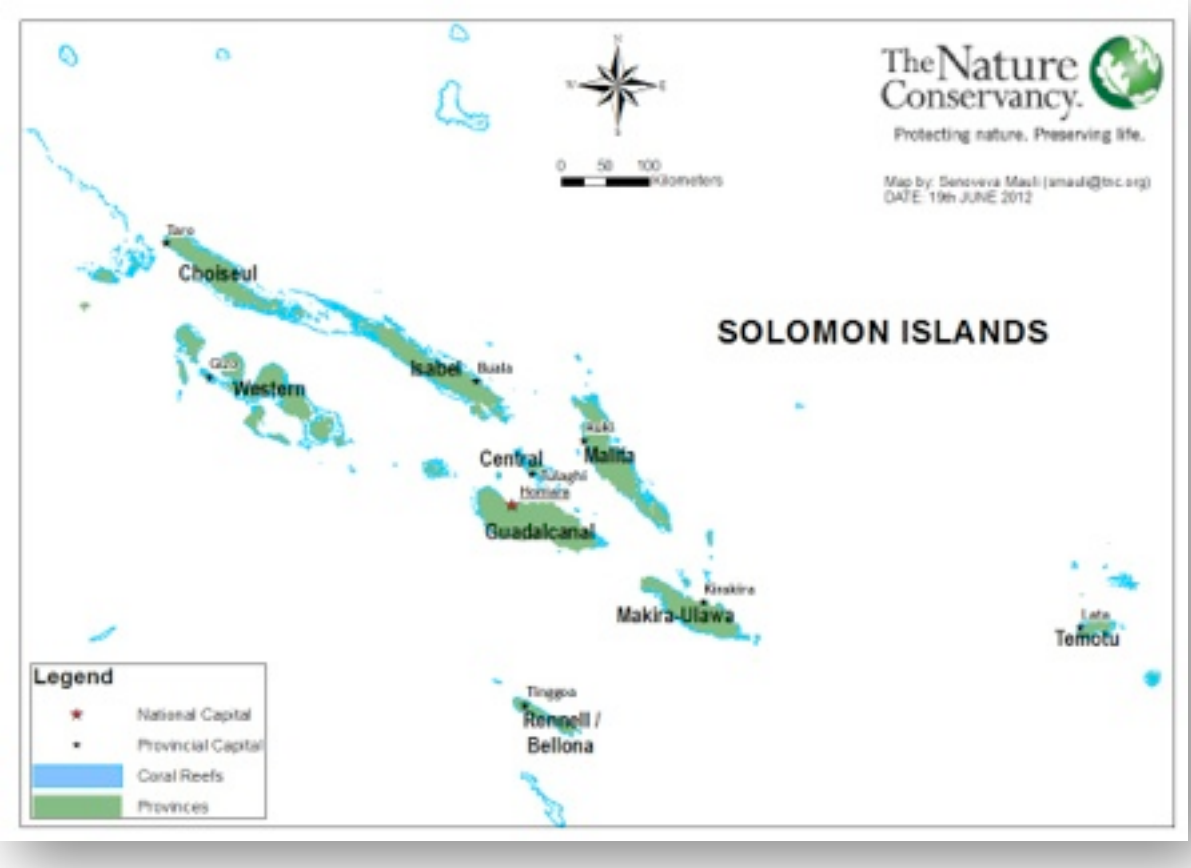

Fig. 2: Map showing significant coral reef sites in the Solomon Islands

evolutionary patterns. Solomon Islands (excluding the Santa Cruz group) is divided into three geological provinces; a Pacific Province, a Central Province and a Volcanic Province (Falvey et al. 1991). Guadalcanal, Choiseul and San Cristabol are intensely faulted showing no true folding of any importance, while Malaita and Santa Isabel are both dominated by folding, and the most "primitive" of the group, New Georgia, consists of a number of Pleistocene to recent volcanic cones which are only five to six million years old (Coleman 1989)

Coral reefs are mainly fringing and intermittent around all the islands although areas north and south of Guadalcanal appear to have no coral patches along the main island. Long barrier and expansive intertidal reef flats are uncommon. Ontong Java, the only large atoll is a northern outlier (70 by 11-36km). Sikaiana Atoll (Steward Islands) located some 200km northeast of Malaita is a triangular atoll about 10km in width. Reefs surrounding these atolls drop steeply at great depths and highly raised atolls such as Rennell and Bellona have high coastal cliffs and fringing reefs along the coastline.

Some of the largest coral reef areas occur where large lagoon complexes are protected by volcanic islands, raised islands, sand cays and barrier reefs. Significant areas are; around the Shortland islands near Bougainville, along the northeastern coasts of Choiseul, on either side of Manning Strait between Choiseul and Santa Isabel, in Ghizo – Vona vona and the lagoonal area on New Georgia, around Vangunu in southeastern New Georgia and along the northeastern coast area past Ramata, at the northern end of Malaita Province (Lau Lagoon) and in the eastern Guadalcanal. Figure 2, provides a map of these significant coral reefs of the Solomon Islands. Long submerged barrier reefs are not too common in Solomon Islands.

Solomon Islands climate is characterised by a wet and dry season all year round. The mean temperature of 27°C (80°F) is experienced all year round with a few extremes of hot and cold temperatures. During the months of April – November the southeast trade winds (*ara*) blow continuously with varying intensity. From November –April the winds blow from west to northwest (*koburu*) which culminates with long periods of calm weather and heavy rain. Annual rainfall range from 3000 - 5000 millimetres. The occurrence of a fog across the coastal plains is unusual and can only be observed in the mountainous ranges of the main islands. Strong winds are caused by occasional tropical cyclones, occurring during the months of November to April.

B.Biodiversity of Coastal and Marine Ecosystems

Early coastal and marine biodiversity studies of Solomon Islands were sporadic and included a 1965 survey by the British Royal Society which examined biogeographical relationships between Solomon Islands and other western tropical Pacific Islands (Sulu et al. 2000 provided a review of these early studies, hence will not be repeated in this report). The first comprehensive baseline survey of the marine biodiversity of Solomon Islands (survey did not include Temotu Province which falls outside the Coral Triangle region and Rennell and Bellona) was conducted in 2004 (Green et al. 2006) and included a marine survey of nine main islands over a five week period.

Solomon Islands has one of the most diverse coral reef systems in the world (Green et al. 2006); Veron and Turak (2006) attributed this diversity to very diverse marine habitat types (some even within close proximity to each other) that is present throughout the islands rather than to the geographical position of the islands or anything to do with the corals themselves. A description of the biodiversity of the coral reefs of Solomon Islands based on Greet et al.(2006) and available research follows.

Seagrass

Seagrass beds are significant coastal habitats of Solomon Islands and occupy ~10,000 ha (Figure 3). They are found in habitats extending from the intertidal to subtidal, along mangrove coastlines, estuaries, shallow embayments as well as coral reef, inter-reef and offshore islands situations (McKenzie et al. 2006). Earlier studies (Womersley and Bailey 1970) reported the occurrence of 7 species of seagrass in Solomon Islands. McKenzie et al. (2006), however, confirmed the presence of 10 species which represents 80% of the known seagrass species of the Indo-Pacific region, the species are: *Cymodocea rotundata, Cymodocea serrulata, Halodule uninervis, Syringodium isoetifolium, Thalassodendron ciliatum,*

Fig. 3: Map showing seagrass habitats in the Solomon Islands.

Fig. 4: Photo of Mangrove forests in parts of the Solomon Islands (Photo: Senoveva Mauli)

Enhalus acoroides, Halophila decipiens, Halophila minor, Halophila ovalis and Thalassia hemprichii.

Seagrass beds serve important ecological functions in binding sediments and reducing erosion. Those which lie inshore of coral reefs help in coral reef protection by trapping sediments from rivers and streams, hence reduce sediment loads to corals. They are important feeding grounds for marine species including fish, turtles and dugongs and play an important role in the mangrove-seagrass-coral reef ecosystem interaction. Local human communities rely on seagrass beds for the local fisheries, for example, in Lau Malaita the annual rabbit fish (*Siganus* spp.) spawning aggregations occur on seagrass beds and serve as a very important protein source for the locals.

Algae

A total of 233 species of algae were recorded for Solomon Islands and comprised 14 Cyanophyta species, 121 Rhodophyta species, 27 Phaeophyta species and 71 Chlorophyta species in 1970 (Womersley and Bailey 1970). A French team from the Institute for Research and Development (IRD) in Noumea, New Caledonia conducted a second taxonomic survey in late 2004 and recorded similar distribution trends as those of Womersley and Bailey (1969; 1970) including at least two new species of Rhodophyta (N'Yeurt and Payri 2007; N'Yeurt et al. 2007; N'Yeurt and Payri 2008). When combining the total number of algal species for the two studies, the total number of algal species present in the Solomon Islands is 355 (Payri et al. 2005). It should be noted that the studies by Womersley and Bailey (1969; 1970) and N'Yeurt and Payri (2007; 2008) and N'Yeurt et al. (2007) were mainly on macroalgae and do not include microalgae and many cyanobacteria. At least 4 species of microalgae (Ceratium dens, Brachydinium capitatum, Pyrodinium bahamense var. compressum and Pseudo-Nitzchia) are confirmed to be present in the Solomon Islands (Duke et al. 2007; Albert et al. 2011). There is a strong probability that there may be more than 355 species of algae in the Solomon Islands.

Mangroves

Mangrove forests are well distributed across the Solomon Islands (Figure 5) and occupy a total area of about 65,000 ha (Warren-Rhodes et al. 2011). Pillai and Sirikolo (2001) reported the occurrence of 26 species of mangroves in the Solomon Islands, representing 43% of the worlds mangrove species (note: others have reported the occurrence of only 20 species, however Sirikolo who has worked extensively on mangroves of Solomon Islands reported that there are actually 26 species and 2 hybrids). The record of 26 species from 15 genera and 13 families was based on surveys of only a few places; in a survey of Choiseul in 2011, Sirikolo (Pers.comm) reported a new record

Fig. 5: Map showing mangrove habitats in the Solomon Islands

Solomon Islands have 485 known species of corals from 76 genera and possibly nine new species which brings the possible total number of coral species to 494. This makes the Solomon Islands coral diversity record second only to Raja Ampat (Indonesia) where a total of 535 species of corals were recorded (Veron and Turak 2006).

Fig. 6: Coral reefs encountered during the REA in 2004 (Photo: TNC)

for Solomon Islands bringing the total number of confirmed mangrove species to 27. It is highly likely that there are between 30-32 species of mangroves in Solomon Islands (Sirikolo, Pers.comm).

Mangroves serve important ecological functions as habitats for a variety of species, filtering and binding of land based sediments and in nutrient recycling. Many fish species use mangrove areas as nurseries and many species migrate regularly between mangroves and coral reefs. Mangroves play an important role in the lives of a lot of Solomon Islands communities (Warren-Rhodes et al. 2011) who rely on mangroves as fishing grounds, materials for construction of houses and firewood. Propagules of *Bruguiera gymnorhiza* are also consumed in many parts of Malaita.

Coral Reef Biota

Solomon Islands have 485 known species of corals from 76 genera (For a complete list, see Veron and Turak 2006) and possibly 9 new species which brings the possible total number of coral species to 494. This makes the Solomon Islands coral diversity record second only to Raja Ampat (Indonesia) where a total of 535 species of corals were recorded (Veron and Turak 2006). However, the level of coral endemism is probably low (*ibid.)*. Figure 6 shows some of the species of coral which occur in the Solomon Islands.

Fish collections have been done in the Solomon Islands since 1865 with specimens deposited in many museums around the world (Allen 2006). The total fish fauna of Solomon Islands based on the comprehensive survey of 2004 (Green et al. 2006) is 1,019 species belonging to 82 families and 348 genera, most of which are associated with coral reefs (Allen 2006). Fish community composition and diversity at a particular location was influenced by habitat type and food availability, the 12 richest sites for fish diversity were Njari (Gizo), Bio (Makira), Three Sister Islands (Makira), Komusupa (Malaita), Emerald (Choiseul), Cormorant (Guadalcanal), Uepi (New Georgia), Minjanga (New Georgia), Roviana (New Georgia), Tua (Shortland Islands), Mbili (New Georgia) and Poro Island (Choiseul) (*ibid.)*. It is obvious from this list that a majority of the sites are in the Western part of the Solomon Islands.

Information on the marine mollusc diversity of Solomon Islands is scant as there are only few publications on the molluscs of Solomon Islands and no checklist has been produced. The better known mollusc species are those that play important cultural, subsistence or economic purposes; these include 6 species of giant clams (*Tridacna gigas, T. derasa, T. squamosa, T. crocea, T. maxima* and *Hippopus hippopus)*, 3 species of pearl oysters (*Pinctada margaritifera, P.maxima and Pteria penguin*), 2 species of trochus *(Trochus niloticus* and *T. pyramis)* and 3 species of green snails (*Turbo marmoratus, T. setosus and T. argyrostomus)*. It is, however, easy to identify most conspicuous molluscs of Solomon

Fig. 7a: Giant Clam (Tridacna gigas) photographed at the Arnavon Islands reefs.
Fig. 7b: A reef fish photographed in the Arnavon Islands waters
Fig. 7c: Trochus commonly found in Solomon Islands water (Photos: Peter Ramohia)

Islands using popular coral reef guides as most of them also occur elsewhere, there currently being no known endemic mollusc species in the country.

General taxonomic counts of echinoderm species are also generally unknown. The only ones which are well known are the economic ones like the sea cucumbers. Nineteen species of sea cucumbers are recorded for Solomon Islands. Sea cucumbers are one of the most important commodities in the Solomon Islands as they are processed and exported to Asian markets (usually at prices that are only rivalled by shark fins); hence, they are important income earners for the rural communities. The lucrative price that it attracts is also a major contributing factor to their demise as they have been overfished in most locations in the Solomon Islands. In a benthic survey of macroinvertebrates, only 17 of the 19 recorded species of sea cucumbers for Solomon Islands were observed and those which command high prices were only observed in deep locations (Ramohia 2006).

Most sponges which occur in the Solomon Islands are those commonly found in the Indo-Pacific (Payri et al. 2005). Early studies (Bergquist et al. 1971) record a total of 30 species. The latest collection of sponges was made in 2004 (Payri et al. 2005) by a French team and a second one in 2005 by the University of the South Pacific and Queensland Museum of Natural History joint expedition.

All those collections were deposited at the Queensland Museum of Natural History in Brisbane; the status of the systematic analysis of those specimens is unknown. Hence, the sponge biodiversity of Solomon Islands cannot be ascertained. Major interest on sponges comes from persons and organisations involved in bioprospecting with the most recent (2012) collections made by the Institute of Applied Science of the University of the South Pacific. Examples of some of the coral reef biota of Solomon Islands are shown in Figure 7a-7f.

Cetaceans, Sirenian and reptiles

Based on an examination of various reports (Shimada and Pastene 1995; Goto et al. 1997; Leary and Pita 2000; Shimada and Miyashita 2001; Kahn 2006), it can be said that there are presently about 8 species of whales (*Balaenoptera edeni, Globeicephala macrorhynchus, Peponocephala electra, Orcinus orca, Mesoplodon sp., Balaenoptera sp., Physeter macrocephalus,* and *Megaptera novaeangliae).* Nine species of dolphins had been reported to occur in Solomon Islands (Leary and Pita 2000) and this has been perpetuated through many reports. However, only 6 species (*Stenella longirostris*, *Stenella attenuata, Tursiops truncatus*, *Tursiops aduncus*, *Grampus griseus,* and *Steno bredanensis)* have been confirmed sighted. Only 1 sirenian species (*Dugong dugon*) is present in Solomon Islands.

For the reptiles, 5 species of turtles (*Eretmochelys imbricata, Chelonia mydas, Dermochelys coriacea, Lepidochelys olivacea* and *Caretta caretta*) and 1 species of crocodile (*Crocodyllus porosus*) is known to occur in the Solomon Islands.

Although some research have been conducted on the biodiversity of Solomon Islands, it is clear that such information are scattered across different journals, reports and articles and have not been comprehensively compiled. An up to date checklist of the 'already studied' diversity of the marine flora and fauna may help in providing insight. There is clearly a dearth of knowledge on the marine biodiversity of Solomon Islands, even for some species which are economically important. For example, sharks are heavily exploited for the shark fin trade, yet we still do not know how many shark species are present in the Solomon Islands. Some of these species may be on their way to extirpation before it is even realised that they ever existed in Solomon Islands.

Fig. 7d (top): Sea cucumber species common in Solomon waters. Fig 7e (middle): Lobster sp. common in Solomon waters. Fig. 7f (bottom): Corals and Fish - Arnavon Islands (Photo: Peter Ramohia)

CHAPTER 3

Governance

A. Policy

Policies relevant to the protection and conservation of inshore marine habitats and resources (e.g. coral reefs, seagrass beds and mangroves), are embodied in the general government policies on fisheries and marine resources of successive governments (e.g. Anon. 2008; Anon. 2010a). Other government documents provide strategies for the protection of coral reefs and marine resources, such as the National Biodiversity and Strategic Action Plan (Pauku and Lapo 2009). Substantive policy documents which provide over-arching national strategies to support inshore fisheries management, conservation, climate change adaptation and ecosystem approaches to resource management are: the National Strategy for the Management of Inshore Fisheries and Marine Resources (Ministry of Fisheries and Marine Resources 2010), the Solomon Islands Coral Triangle National Plan of Action (Ministry of Environment Conservation and Meteorology & Ministry of Fisheries and Marine Resources 2010) and the National Adaptation Programmes of Action (Ministry of Environment Conversation and Meteorology 2008). The Solomon Islands government is also a party to several regional and international environmental agreements (Table 1) which obliges it to protect, sustainably utilise and manage coral reefs and marine resources.

Table 1: Multi-lateral environmental agreements to which Solomon Islands is a party (Reproduced and amended from Pacific Horizon Consultancy Group 2008).

Convention	*Status*	*Purpose/Aim*	*Agency Responsible*
Regional (South Pacific) Multi-Lateral Environmental Agreements			
Waigani Convention	Ratified 7/10/1998	Ban the importation of hazardous and radioactive wastes and to control the transboundary movement and management of hazardous wastes within the South Pacific region.	Ministry of Environment, Conservation, Disaster Management and Meteorology
Pollution Protocol for Dumping	Ratified 10/9/1989	Prevention of pollution of the South Pacific region by dumping.	Marine Division and Ministry of Environment, Conservation, Disaster Management and Meteorology
Pollution Protocol for Emergencies	Ratified 10/9/1989	Cooperation in combating pollution emergencies in the South Pacific region.	Marine Div and Ministry of Environment, Conservation, Disaster Management and Meteorology

Convention	*Status*	*Purpose/Aim*	*Agency Responsible*
Natural Resources and Environment of South Pacific (SPREP Convention)	Ratified 10/9/1989	Protection of natural resources and environment of the South Pacific Region in terms of management and development of the marine and coastal environment in the South Pacific region.	Ministry of Environment, Conservation, Disaster Management and Meteorology
Chemical Wastes and Marine Pollution			
Liability for Oil Pollution Damage	Ratified	Strict liability of a ship owner for pollution damage to a coastal state within a certain amount.	Marine Division
Marine Pollution Convention (London)	Ratified	Prevention of marine pollution by dumping of wastes and other matter.	Ministry of Environment, Conservation, Disaster Management and Meteorology and Ministry of Foreign Affairs
Biodiversity			
United Nations Convention on Biological Diversity	Ratified 3/10/1995	Conserve biological diversity through the sustainable use of its components and the fair and equitable sharing of the benefits arising out of utilizing genetic resources.	Ministry of Environment, Conservation, Disaster Management and Meteorology
United Nations Convention to Combat Desertification (UNCCD)	Acceded 16/4/1999	Agreement to combat desertification and mitigate the effects of drought in countries experiencing drought or desertification.	Agriculture Division and Ministry of Environment, Conservation, Disaster Management and Meteorology
Cartagena Protocol on Biosafety	Acceded 26/10/2004	Protection of human health and the environment from possible adverse effects of the products of modern biotechnology, especially the living modified organisms (LMO) while maximizing its benefit.	Ministry of Environment, Conservation, Disaster Management and Meteorology
Convention on International Trade of Endangered Species	Acceded 26/03/2007	Regulation and restriction of trade in specimens of endangered wild animals and plants through a certification system for imports and exports.	Ministry of Environment, Conservation, Disaster Management and Meteorology

Convention	*Status*	*Purpose/Aim*	*Agency Responsible*
United Nations Convention on the Law of the Sea	Ratified 23/06/1997	Defining of rights and responsibilities of nations on their use of the World's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources.	Ministry of Fisheries and Marine Resources, Ministry of Foreign Affairs and Attorney General's Chamber
World Heritage Convention	Acceded 10/6/1992	The protection of sites of outstanding Universal Value. Solomon Islands currently have East Rennell as World Heritage site.	National Museum and Ministry of Environment, Conservation, Disaster Management and Meteorology
Climate			
Kyoto Protocol	Ratified 13/3/2003	Reduce greenhouse gases especially carbon dioxide for the 39 industrial/ developed countries by an average of 5.2 % by 2012.	Ministry of Environment, Conservation, Disaster Management and Meteorology
United Nations Framework Convention on Climate Change	Ratified 28/12/1994	Set an overall framework for intergovernmental efforts to tackle the challenges posed by climate change.	Ministry of Environment, Conservation, Disaster Management and Meteorology
Montreal Protocol	Acceded 17/6/1993	Allows phase out of substances that deplete the ozone layer according to a fixed schedule.	Ministry of Environment, Conservation, Disaster Management and Meteorology
Ozone Layer Convention (Vienna)	Acceded 17/6/1993	Protection of the ozone layer through intergovernmental cooperation on research, systematic observation of the ozone layer and monitoring of chlorofluorocarbons (CFC) production.	Ministry of Environment, Conservation, Disaster Management and Meteorology and Energy Division

B.Legislation

Acts of the National Parliament which directly provide for marine environmental protection, sustainable utilisation and management of marine natural resources are: *The Fisheries Act 1998*, *The Wildlife Protection and Management Act (1998)*, *The Shipping Act 1998*, *The Environment Act 1998* and *The Protected Areas Act 2010*. *The Fisheries Act 1998* stipulates protection, sustainable utilisation, conservation and management of fisheries resources in general. *The wildlife Protection and Management Act 1998* was enacted with the main objective of complying with obligations under the UNCBD, particularly the trade (both export and import) in wildlife fauna and flora. *The shipping Act 1998* regulates matters pertaining to the protection of marine environment and prevention of pollution from marine vessels; the Act implements various IMO conventions, e.g., the Marine Pollution Convention. *The Environment Act 1999* provides for establishing integrated systems of development control, environmental impact assessment and pollution control. *The Protected Areas Act 2010* provides for the declaration and management of protected areas where special measures need to be taken to conserve biological diversity and regulates biological diversity and bio-prospecting research.

C.Compliance

Compliance to obligations under international treaties and conventions acceded/ratified

Solomon Islands have undertaken steps to comply with its obligations under the environmental conventions it has ratified through the enactment of necessary legislations. Regardless of these efforts, a series of national capacity self assessment studies (McDonald and Lam 2006; McIntyre 2006; Siho 2006; Thomas 2006; Thomas et al. 2006) funded by the GEF have identified that significant gaps still exist, which include:

(i) the lack of capacity (both financial and human resources) at the government level to address environmental issues, enforce the legislations or implement necessary local level actions and initiatives,

(ii) the general absence of `government' at the community level where most environmental issues and actions occur; most local level community resource management and conservation initiatives were driven primarily by non government initiatives and the churches, and

(iii) lack of relevant legislations or where present inherent inadequacies of the environmental legislations occur (McDonald and Lam 2006).

In recent years steps have been taken to address these shortcomings. The enactment *of The Protected areas Act 2010* was in response to concerns raised by McDonald and Lam (2006) about the absence of national legislation to establish protected areas for biodiversity conservation, and the lack of provisions within *The Wildlife Management and Protection Act 1998* for the in situ protection of endangered species. The Fisheries Act 1998 is currently being reviewed (The Fisheries Bill 2010) to cater for emerging fisheries related issues; one of the envisaged changes in *The Fisheries Bill 2010* will be the provision of a legal basis for the empowerment of local communities to manage their marine resources (Ministry of Fisheries and Marine Resources 2010) and the integration of principles of ecosystem approach to fisheries management (MFMR, Pers. comm).

Local scale compliance on conservation/ resource management efforts

Despite the existence of laws and regulations and the many conservation initiatives by government, nongovernment organisations and community-based organisations, local compliance remains a challenge. For example, it is common knowledge that dynamite fishing is prohibited by national laws, yet it remains a commonly practiced fishing method in Nggela, Malaita and Guadalcanal. Hunting and consumption of turtle is still common in many parts of the country although people are generally aware that it is prohibited under the fisheries regulations. Sea cucumber harvest closure which is currently in effect is still flouted as resident foreign nationals running businesses in the country continue to purchase illegally harvested beche-de-mer and find an opportunity to illegally export them out of the country (e.g. Inifiri and Marau 2012; Osifelo 2012). Compliance in community based MPA's remain a challenge (RJS, Pers.obs in Nggela). Even the Arnavon Marine Conservation which has fulltime rangers and is the best managed conservation area in the Solomon Islands still has compliance issues (J.Pita pers.comm).

On the ground compliance to conservation or resource protection and management laws, regulations and initiatives will remain a challenge for sometime into the future. Several reasons for this are: lack of enforcement; the need to meet daily subsistence needs and to generate income to meet personal needs and social obligations. Ignorance on the biological aspects of species and the rational for the environmental legislations and regulations may also be a contributing factor. Increased awareness may probably lead to informed compliance among resource users due to better understanding of the rationale for the fisheries regulations or of the biology and ecology of exploited species and the role of humans in conserving them or exacerbating their demise (Foale 2006).

D.

CHAPTER 4

Socio-economic Characteristics

A. Demography

The last population census was held in 1999 and since then the population has grown by about 107,000 people to reach approximately 516,000 (Solomon Islands National Statistics Office 2011). This is an annual growth rate of 2.3%; a reduction from the 1999 growth rate of 3.4%. There is, however, a significant difference in the annual population growth rate between urban and rural areas; the population growth rate in the rural areas is 1.8% per annum while in the urban areas it is 4.7%. A major contributing factor to such a high annual population growth rate for the urban areas is rural urban drift.

The geographical distribution of the population is uneven across the provinces; Malaita has a population of 137,596, Guadalcanal with 93,613, Western Province 76,649, Honiara 64,609, Makira 40,419, Choiseul 26,372, Isabel 26,158, Central 26,051, Temotu 21,362 and Rennell 3041. Solomon Islands population comes from natural births, as migration is not a main contributing factor (although there is some internal migration). Mean age at first marriage for males is 27.1 years while for females is 23.3 years, the national combined mean age at first marriage is 25.5. Solomon Islands have a relatively young population as more than half of the people are below 25 years of age. The sex ratio is 105 males to 100 females. Population density is 17 people per km²; an increase from the 1999 Figures of 13/km². An average household is made up of 5.5 individuals. Only 15.7% of the population is employed, with the rest categorised as either subsistence or unpaid workers. The population is largely rural based, with 80% of the population living in rural areas (Table 2). The majority of communities are coastally based, with others situated inland but having access to the sea.

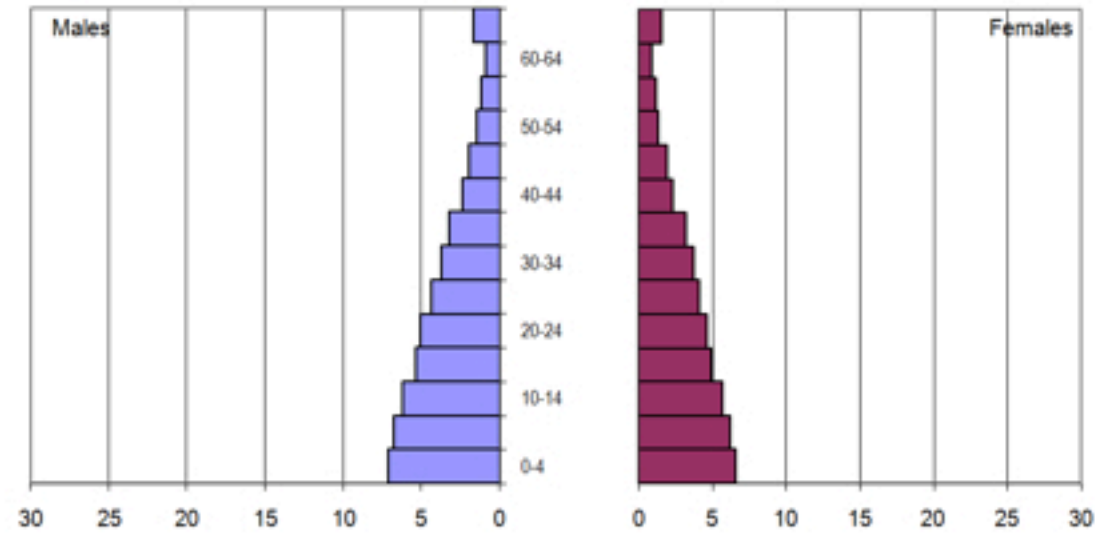

Figure 8: Population pyramid for Solomon Islands

Table 2. Urban vs rural demography (Solomon Islands National Statistics Office 2011)

	Urban	*Rural*
Population	101,798	414,072
Average Household size	6.5	5.3
Median age	22.3	18.9
Sex ratio (Male: Female)	111:100	104:100
Child-woman ratio	439:100	658:100

B. Traditional Management System

The main mechanisms of traditional marine resource management are: access control through customary marine tenure (CMT), the articulation of traditional ecological knowledge (TEK) (also referred to as indigenous ecological knowledge (IEK) in this paper) for resource management, prohibitions of access (and exploitation of resources) within culturally significant geographical space and the prohibition of the consumption of certain species. CMT regimes are inextricably linked with the wider social and cultural contexts from which they emerge (Hviding 1994). Hence, they are tightly embedded with the society's traditional ecological knowledge (TEK), traditional beliefs, access control and prohibitions, social/ governance structure and other customary practices (Hviding 1994; Ruddle 1994; Foale 1998b; Berkes et al. 2000; Hickey 2006).

Customary marine tenure (CMT) system is the main form of traditional property ownership and control and this is recognised by the Solomon Islands National Constitution 1978; more than 90% of inshore coastal areas, islands and islets are owned under the CMT system. Under the CMT system, particular groups of people (e.g. family units, clans or tribes) have informal or formal rights to coastal areas and their historical rights to access and use marine resources are, in principle, exclusionary, transferable, and enforceable either on a conditional or permanent basis (Ruddle 1996; Aswani 2005). Although CMT is the main form of marine property ownership system in the Solomon Islands, studies have been conducted in only a few locations: Lau lagoon, Malaita (Figure 1) (Akimichi 1978; Akimichi 1991), Marovo Lagoon, New Georgia (Figure 1) (Hviding and Baines 1992; Ruddle et al. 1992; Hviding 1993; Hviding and Baines 1994; Hviding 1996; Hviding 1998; Lidimani 2006), Roviana and Vonavona Lagoon, New Georgia (Aswani 1997a; i 1997b; 1998a; 1998b; 1999; 2002; Hamilton 2003; Aswani and Hamilton 2004; Aswani 2005; Aswani and Lauer 2006; Aswani et al. 2007; Aswani and Sabetian 2009) and Nggela (Foale and Day 1997; Foale 1998b; 1998a; 1998c; 1999; Foale and Macintyre 2000; Foale 2002; Sulu 2010).

In Lau lagoon, CMT rights within clearly defined boundaries inshore are owned by collective groups, not individuals, primary rights being patrilineally inherited and secondary and usufructory rights exist. Shallow areas which are limited in resources and the deep seas in Lau are subject to de facto open access use by the community, and were usually reserved for those who had no marine tenure rights. Akimichi (1991) described the Lau CMT system as tightly interwoven with the local traditional economy and local ecological knowledge. The main measures used for fisheries management were spatial closures (certain areas were closed off due to traditional beliefs) and temporal closures (fishing areas were closed for several months during the death of a chief or traditional religious priest). The advent of the market economy, however, has transformed the Lau CMT system, weakening the closure system and significantly increasing the harvest rates resulting in the decline of resources in Lau lagoon (Akimichi 1991).

Ownership of *puava* (marine areas) in Marovo lagoon is through collective groups called the *butubutu* via ambilineal cognatic descent. While the puava is a geographical space that has clearly defined boundaries, the butubutu on the other hand is fluid in nature as marriages and inter-relationships contextually define and re-define social boundaries, which ultimately affect rights and access people have over the puava. Life in Marovo was tightly interwoven with the sea as indicated by Marovo fishermen's fishing practices and extensive knowledge about marine species and their behaviours (Hviding 1996; Johannes and Hviding 2001). The Marovo CMT system employs several fisheries management methods, for example closures which are similar to modern methods of fisheries management (Hviding 1994). The Marovo CMT system is a flexible system that is rooted in the past but has evolved to adapt to the changing ecological, social and economic circumstances (Hviding 1993; Hviding 1998). Hviding (1998) provided examples where the CMT system has

successfully adapted to economic and development pressures such as mining, logging and industrial fishing.

The CMT system in Roviana and Vonavona lagoon is also based on collective ownership (based on tribes) of marine tenure rights that are inherited through ambilineal cognatic descent (Aswani 1999). Primary, secondary and usufruct rights also all exist within the Roviana and Vonavona CMT system. Endogenous factors, which are historical in nature have contributed to subtle local regional differences in the types of CMT regimes in Roviana and Vonavona. Endogenous factors include: local regional settlement patterns (historical movement of people within the local region as a result of marriages, political coercion or other social factors) and local historical processes of political expansion and contraction (as a result of internal political friction within a society, inter-tribal warfare and conquests) (Aswani 1999). In addition, exogenous factors aiding the afore-mentioned endogenous factors are changes in consumption (shift from subsistence economy to a reliance on cash to buy imported foods like rice, flour, tinned foods etc) and demographic (differences in population and ethnic composition as a result of inter-marriages with people from different islands and countries) patterns (Aswani 2002). Three types of CMT regime currently existing in Roviana and Vonavona due to endogenous historical processes and exogenous factors are: the territorial-enclosed entitlement regime, the mosaic-entitlement regime and the transitory-estates regime (Aswani 1999).

In a territorial-enclosed entitlement regime, territorial boundaries are circumscribed, jurisdictional power over territorial matters is centralized, and marine tenure entitlements are regionally recognized. The territorial-enclosed entitlement regime consists of various tribal groups dispersed in several villages under a single administrative authority. Members within the polity (the geographical area and the various tribes which fall under a single central chiefly authority) jointly use and manage marine resources. Territorial perimeters are well defined, and participants in the commons conceptualize their tenure rights as inalienable (cannot be transferred to others and needing to be inherited) (Aswani 1999:438). In the mosaic-entitlement model, territorial boundaries are disputed, authority over estates is decentralized and contested, and entitlements are regionally scattered across several polities (different chiefly authorities who oversee different territories). Participants in the mosaic-entitlement regime conceptualize their entitlements as incorporating other regional claimants' subsistence usufructory rights, but assert exclusive custodianship over their marine areas (Aswani 1999:442). The transitory-estates regime is a hybrid between the territorial-enclosed and the mosaic-entitlement regimes. Jurisdiction to marine areas is being conveyed and renegotiated as intermarriages between different polities occur, changing the flow of entitlements and claims (Aswani 1999:446). The subtle local regional differences in the 3 CMT regimes described above has different consequences in their role in inshore fisheries management (Aswani 1999; Aswani 2005); the most effective one for inshore fisheries management is the territorial-enclosed entitlement regime (Aswani 1997b). Territorial disputes in the mosaic entitlement regime and in the transitory estates regime cause social instability which subsequently results in environmental degradation (Aswani 1997b; Aswani 1999). Roviana and Vonavona culture is tightly inter-woven with the sea; fishers possess extensive indigenous ecological knowledge about the marine environment and marine species and their behaviour, which are useful in fisheries management (Aswani and Hamilton 2004; Aswani 2005; Aswani and Lauer 2006; Aswani et al. 2007).

Marine property ownership in Nggela is also based on collective ownership through matrilineal inheritance. The social structure is based on four clans which contains 7 sub clans each (Foale 1998b; Sulu 2010) . Hence, the main corporate entity through which marine resources access and use is through one of the 28 sub clans. Alternative means of acquiring land and marine tenure rights patrilineally, as a gift or for other significant transaction processes is through the *huihui* process, the closest meaning of *huihui* in English being 'unhook' or 'unlock'. In a huihui, those who are acquiring rights prepare food, pigs and traditional money (nowadays also modern cash and goods) and present them to those who own the land and marine tenure rights. On receipt of the goods at a public ceremony that must be witnessed by chiefs, the primary owners relinquish their rights. Land and marine tenure rights acquired through huihui are valid for only 3 generations through the patriline (3 generations of men). Unless another huihui is carried at this stage, land and marine tenure rights revert to the original subclan and clan. After huihui land/ marine ownerships rights can then be inherited matrilineally. Clan and subclan membership are fixed, there are no social processes to change clan and sub clan membership (Foale 1998b; Sulu 2010). Marine resource management using the CMT system includes serial prohibitions, and access control (Foale 1998b)

An examination of CMT studies in Solomon Islands reveal that the main methods of marine resource management were: limited entry, closed seasons, closed areas, size limits, species prohibitions and gear restrictions; methods which were also reported to be practiced elsewhere in the South Pacific (e.g. Johannes 1981; Cinner and Aswani 2007). Although the general principles of CMT are the same across the different locations in the Solomon Islands where CMT has been studied, the *modus operandi* of CMT varies between locations, and may do so within them (e.g. Aswani 1999). Each instance of CMT is embedded within particular historical, socio-economic and political contexts and is unique. Hence, applications of CMT to fisheries management and responses thereof vary between locations.

For all locations where CMT has been studies, access control and/or prohibition of exploitation of resources within a culturally significant geographical space or the prohibition of consumption of certain species are based on traditional belief systems and/ or cultural practices and they vary within and between different locations in the Solomon Islands. Although they are not intended for conservation practices, they have some conservation outcome (Johannes 1978).

The role of TEK in marine resource management is a bone of contention. Polunin (1984) and Aswani (1998a) argued that it is usually aimed at maximising fisheries production and could potentially contribute to resource depletion. For example, Hamilton (2003) reported a case where indigenous knowledge contributed to the depletion of the bumphead parrotfish *Bolbometopon muricatum* by Roviana fishers and Foale (2006) reported that Nggela fishers associated the subtle increases in trochus at times when the trochus spawn as good times for harvesting. However, TEK has a role to play when appropriately used in conjunction with conventional scientific data (Hamilton and Walter 1999). Traditional knowledge in resource management is especially important in circumstances where fisheries departments are ill equipped by governments to carry out fisheries research or generate knowledge needed for management purposes (Johannes 1978; Johannes 1998). Examples of cases where such knowledge was useful for fisheries management are summarised.

Hamilton et al. (2005) relied on indigenous ecological knowledge to identify grouper spawning aggregation sites, aggregation times and some aspects of the biological relationships of grouper spawning aggregation in Solomon Islands; information which would be useful for fisheries management purposes when integrated with modern scientific knowledge. These information were generated cost effectively mainly through interviews. Relying entirely on modern fisheries surveys would have meant significant financial costs. Aswani and Hamilton (2004) reported that studying the indigenous ecological knowledge of *B. muricatum,* provided important information on the historical changes in abundance of the species and the species need for protection, facilitated the understanding of how different habitats structure the size distribution of the species, helped identify sensitive locations and habitats that need protection and helped comprehend how lunar periodicity affects the behaviour and catch rates of the species. Aswani and Lauer (2006) used indigenous ecological knowledge to appropriately design and implement resource management strategies in a cost effective and participatory way.

Although traditional management systems offer advantages for inshore fisheries management in Solomon Islands, modernisation and socioeconomic changes have contributed to its ineffectiveness in some instances in the last 30 years. Some of the significant colluding factors include: declining respect for traditional leadership and authority (Wairiu and Tabo 2003), the influence of markets and the commoditisation of resources (Foale 1998a; Hamilton 2003), changing consumption and demographic patterns (Aswani 2002), adoption of new religion and the demise of traditional belief systems (Hviding 1996; Lidimani 2006) and the uptake of modern gears which are more efficient (Hamilton 2003). In some instances the effects of such factors have been so pervasive and overwhelming that CMT has not been able to control the decline of some species in sites close to urban areas, e.g. some finfish species (Sabetian and Foale 2006; Aswani and Sabetian 2009; Brewer et al. 2009), trochus (Foale 1998a) and the green snail *Turbo mamoratus* (Green et al. 2006) exported for use in the manufacturing of buttons and jewellery, *Holothuria* species targeted for the beche-de-mer trade (Kinch 2004), and *Tridacna* species which are targeted for their adductor muscles (a delicacy in Asia) and their shells for the curio trade (Sulu et al. 2000).

Despite several inadequacies which beset the effectiveness of CMT for inshore fisheries management, modern day pressures have not generally over thrown these forms of resource management (Hviding 1998). CMT systems continue to thrive as dynamic socio-political links between local human populations and marine environments and they remain a key dimension in any initiative in coastal resource development in Solomon Islands

(*ibid*); in some cases their dynamic and flexible nature meant that under modern day pressures they have undergone organisational innovation and reinforcement (*ibid*). Therefore, although not a panacea in itself, CMT systems still remain an important prerequisite for effective management of marine resources in Solomon Islands (Foale 1998b). What is required is a better understanding of how external factors (markets, new laws and legal systems, new forms of religion, new governance systems) impact CMT and secondly how the differences and congruencies between CMT and modern methods of fisheries management can facilitate adaptive management systems and at the same time meet community goals and needs (Cinner and Aswani 2007).

Integration of the CMT system with the modern legal systems for effective fisheries management (or natural resource management in general) is possible and has been done as there are relevant legal provisions in the national legislation which allows for this (for a general overview see the following papers: Kabui 1997; Lidimani 2006; McDonald 2007), for example, the Western Province Natural Resource Management Ordinance and the legal instruments associated with the establishment of the Arnavon Community Marine Conservation Area (ACMCA) allows the establishment of community byelaws for the purpose of resource management, such byelaws are enforceable by the magistrates court. The fisheries ordinance of the Central Islands Province which is currently (as at February 2012) drafted provides formal powers for the enforcement of customary management systems. While legal provisions allow such integration, the biggest challenge, however, is in mitigating the pressures of the cash economy in order to achieve compliance. According to John Pita (pers.comm) a conservation officer at AMCA, a major impetus for compliance in AMCA was the provision of alternative means of income generation through the establishment of seaweed farming to the Wagina community (see Kronen et al. 2010b) who rely solely on marine resources for their livelihood and income generation.

C.Gender issues

Weeratunge (2011) described gender participation in fisheries in Solomon Islands as being bounded by space to an extent. Men fish in the reefs and offshore zones of the marine environment while the women and children fish within the inshore environment, reefs close to villages, lagoons and mangrove areas. Spatially defined gender participation in fisheries in turn determines the fishing methods utilized to an extent. Men predominantly dive and fish with lines while women predominantly glean for invertebrates, target inshore reef species, harvest mangrove propagules (in locations where they are consumed) and collect seaweeds. Both men and women participate in aquaculture activities like growing giant clams, corals and seaweeds (Kronen et al. 2010b; Weeratunge et al. 2011). Within the industrial fishing sector like fishing factory and cannery, women make up the majority of labour force (Tuara-Demke 2006). Within the household own production sector women play an important role in post harvest processing, value adding of fishery products and in the sale or marketing of the fishery products (RJS pers.obs, Honiara markets)

Women theoretically play an important role in communities where land ownership inheritance is matrilineal. However, in reality it is the men (sons, brothers or husbands of inheritors) who make decisions over land matters, with women usually having very little voice (Japan International Cooperation Agency 2010; Weeratunge et al. 2011). According to Weeratunge (2011), gender relations and disparities play a significant role in fisheries-related rural livelihoods, access to marine and coastal resources, as well as decision-making around resource use. Despite a somewhat low key role of women in decisions making regarding land/fisheries matters, women have been reported to be important players in the management of fisheries resources within the environments where they exploit resources, e.g. shell beds in mangrove areas (Aswani and Weiant 2004).

D.Payment for Ecosystem Services

The use of payment for goods and services (PES) is an exercise in conservation whereby the payments for the ecosystem services contributes to improved livelihoods, climate mitigation and adaptation of local communities. This concept can also be defined as an incentive that allows appropriate compensation of a community or a group of people to maintain a certain level or quality of ecosystem service. Terrestrial examples within the Coral Triangle Area are; Bakun, Benguet Province in the northern Philippines whereby farmers are compensated on forest lands and continuing sustainable land management practices.

In the marine environment, PES – like applications exist, however, they are generally not well defined as

in the upland ecosystems (refer to KM 4 CTI Learning Notes). In literature they are considered as user fees and other forms of tourism contributions such as diving and snorkeling fees. Examples of PES marine sites within the Coral Triangle Area are; Bangrin MPA, Verde Island Passage' Dugong Fishery, Turtle Islands Wildlife Sanctuary.

In the Solomon Islands, PES programmes are a relatively new application. Hence, it is not applied in the local communities. The most recent and only study conducted that considers PES as the viable option for mitigating both rural poverty and climate change was conducted at three coastal communities: Buri, Ranongga, Western Province; Boeboe, Choiseul Province; and Talakali, Langalanga Lagoon, Malaita Province by Warren-Rhodes et al. (2011). They (Warren-Rhodes et al. 2011) concluded that mangrove ecosystem surveys are useful as tools for raising community awareness and input prior to design of PES systems. Furthermore, mangrove ecosystems are under threat and need to be protected due to the ecosystems goods and services they provide such as fish nursery habitat, and the subsistence and monetary benefits derived by local residents either directly or indirectly. Although mangrove replanting and conservation is a potential income earner for local communities through the carbon credit scheme, several challenges which need to be considered are: the need to integrate subsistence options; consideration of the highly complex and variable nature of land tenure systems; and an equitable and transparent system to enable equitable benefit sharing. The issues raised are not exclusive to mangroves and may also apply to other ecosystems where PES may be integrated. Other PES-related studies which are currently ongoing are two studies (one on coral valuation and one as a regional technical assistance) funded by ADB as part of the Coral triangle initiative in Solomon Islands.

E. Capture Fisheries

Subsistence fisheries

The subsistence economy is the mainstay of rural Solomon Islands, with coastal fisheries having a vital role. Fishing and gardening is the main livelihood of rural communities (Boso et al. 2009; Paul et al. 2009; Boso and Schwarz 2010). There are no figures on the actual extent of fishing activities in the country let alone subsistence fishing, however, it is estimated that nearly half of all women and 90% of men fish (Weeratunge et al. 2011) In most rural households, at least one member of each household is involved in fishing (Weeratunge et al. 2011). Fishing is mostly done in wooden dugout canoes, and motor powered fibreglass boats, using simple fishing gear like handlines, nets or spears.

Surplus garden and fishing products are often either shared with other community members or sold for cash income to purchase household necessities (Boso et al. 2009; Boso and Schwarz 2010). Depending on household needs, a greater proportion of fish catch (usually the best) will be sold either fresh or cooked at local markets. Other forms of cash-earning livelihoods are limited due to the lack of transport and processing infrastructure, and the non-existence of microcredit schemes that can be accessed by households in rural areas.

Small-scale fisheries

Most rural fishers sell their catch when their household needs dictate it. There are also fishers who fish to sell at urban areas around the country, predominantly at Honiara, although there are also some who sell at the provincial urban centres like Auki (Malaita), Gizo and Munda (Western Provinces respectively), Tulagi (Central Province), Kirakira (Makira) and even as far as Bougainville markets for communities near the Papua New Guinea border (Boso et al. 2009). These near shore fishing activities are what is referred to here as small scale fisheries. In 2006, it was estimated that 16% of households in self-employed commercial activity were engaged in the sale of fish and other seafood (Solomon Islands National Statistics Office 2006).

An analysis by (Brewer 2011) found a diverse fish value chain ranging from (1) fishers who directly sold their catch to the market, (2) through middlemen on to value adders, (3) directly to value adders, and (4) those who sold directly to private fish centres. The Ministry of Fisheries and Marine Resources (MFMR) established Rural Fisheries Centres (RCFs) in nine Provinces in the mid to late 1990's (funded by various donors). The aim of these RCF's was to stimulate rural development and income generation through fisheries development. The RCFs provide ice for fishermen and buy fish from fishers for sale elsewhere, in most cases for transport to Honiara where fish were sold at the Honiara market or directly to hotels and restaurateurs. Export trials to Australia were also conducted. In 2007, only 11 of the 30 RCFs were deemed reasonably successful (Lindley 2007). Major factors besetting the endeavour were lack of maintenance of the facilities at the RCF's and poor transportation between the RCF's and Honiara; where transportation was available the high transportation cost of fish from distant provinces made then uneconomical, especially when they had to compete

with fish from fishers from Honiara, Nggela and Russell Islands which are closer to Honiara. With support from various aid donors, several of RCFs are now undergoing repairs (Carlos, 2011, personal communication).

The RCF's were an important source of cash income for fishers as livelihood options are limited and more so when the important sea cucumber fishery that many relied on has been closed since 2010. While there are no real estimates for the total value of the fish from these RCFs and other private fishing centres, it is estimated that rural communities provide SBD$5 million dollars worth of fish to the capital city on annual basis (Lindley 2007). The total value of the inshore finfish fisheries could be as much as SBD$21 million dollars (Brewer 2011).

Invertebrate species that are mainly targeted by coastal communities are trochus and sea cucumber. They are easy to harvest and non-perishable, important factors as most coastal communities have poor storage facilities and transportation services. For the decade ending 2010, trochus and sea cucumber (during pre-ban times) earned the country approximately SBD$45 million in export revenue (MFMR unpublished data). There is, however, a current national ban on the harvest and export of sea cucumber following indications that the fishery is heading towards collapse. In 2006, records from the then Department of Fisheries and Marine Resources showed that beche-de-mer exports consisted largely of low value species (Nash and Ramofafia 2006). The trochus fishery is also showing similar trends, a study by SPC in 2006 at four sites in the country found low densities of trochus compared to other sites in the Pacific (Pinca et al. 2009). Declining catches of trochus over the last decades indicate overfishing in the fishery.

Commercial Tuna Fisheries

The commercial tuna industry is a vital industry for the Solomon Islands. In the last decade, it earned on average USD$ 4.5million annually in government revenue in licensing from its domestic and foreign fleets. This represented a growth in the industry as it had drastically fallen as a result of the ethnic tension the country experienced in 1999 and early 2000's. Pre-tensions, domestic production had reached the 50,000 metric tonnes (MT), decreasing to below 10,000 MT during the height of the ethnic tension in 2000, when the sector was affected due to the suspension and closure of the major fishing companies in the country: Solomon Taiyo, Solgreen Ltd and the downscaling of the National Fisheries Development Limited (NFD)(Central Bank of Solomon Islands 2001). The highest catch for domestic fleets since 2000 was recorded in 2006 with 29,615 MT (Figure 9). Foreign fleets recorded their highest catch in 2008 of 89,275 MT. Total catches increased in this decade as the number of foreign fleets grew (Figure 9).

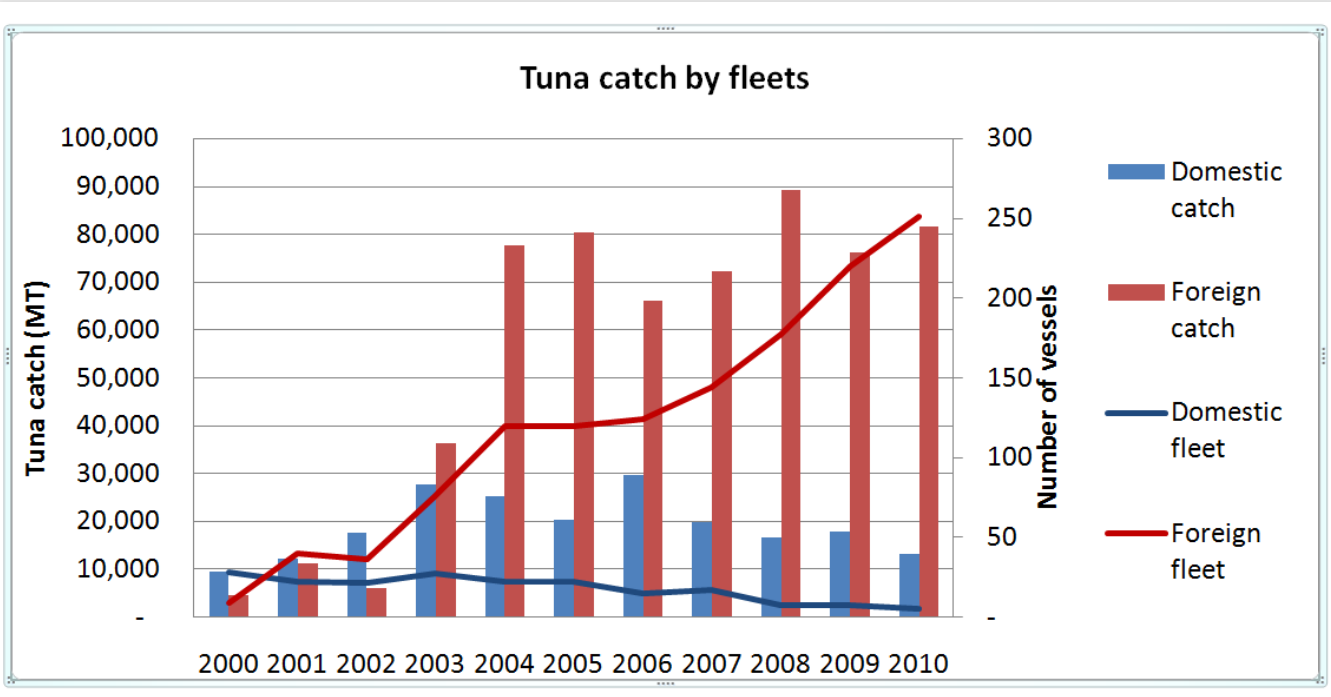

Figure 9. Tuna catch in Solomon waters by domestic and foreign fleets 2000-2010 (MFMR).

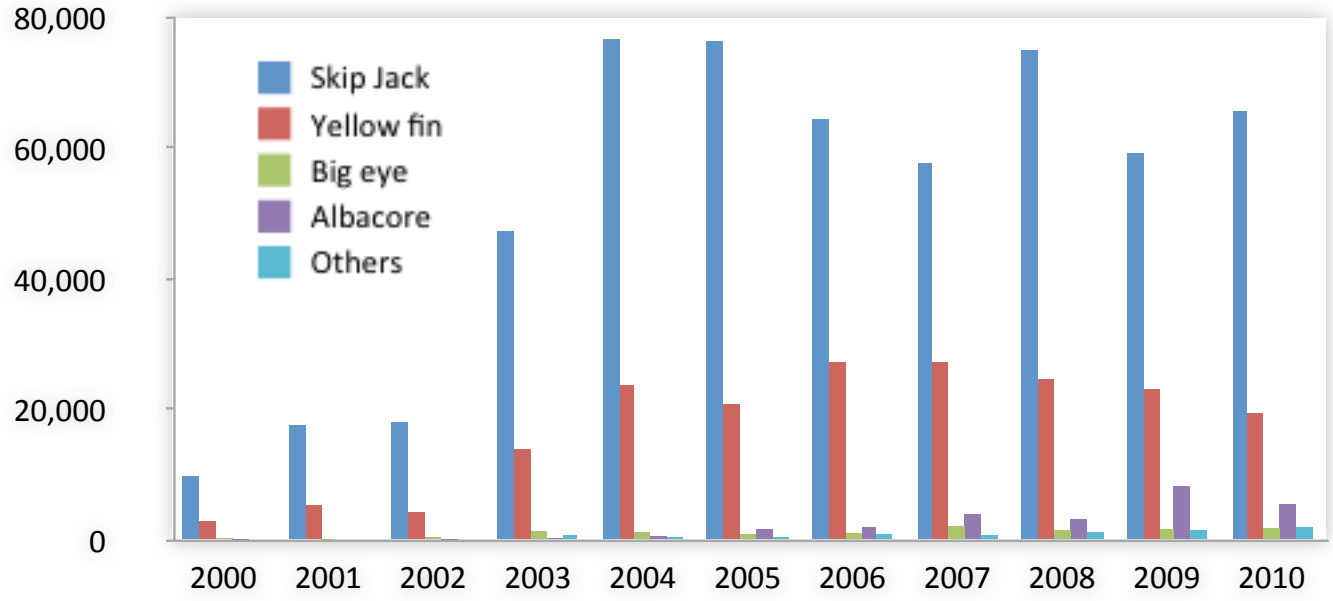

Figure 10: Tuna catch by species between 2000 - 2010

However, this has coincided with the decrease in the size of the domestic fleet. Tuna catch over the past decade have been dominated by skipjack tuna and yellow-fin tuna, the majority caught by foreign fleets (Figure 10)

Resource Use

Home production refers to the value of goods and services produced by the household to be predominantly consumed by the same household or as gifts, including goods like vegetables, fruits and fish (Solomon Islands National Statistics Office 2006), although there was no distinction between garden and fish products. More than half (56%) of rural households in the Solomon Islands rely on home production as the main source of income compared to only 5% in the urban areas (*ibid.*). There is, however, a contrast in the annual average food consumption expenditure spent on fish (see Table 3); urban residents spent more (17%) of the annual average food consumption expenditure on fish (including shellfish) purchases than residents in the rural areas who spend only 13% of the annual average food consumption expenditure on fish purchases. Furthermore, urban centres were more likely to spend more on fish purchases (including seashells) than those in the rural areas (*ibid.*).

Fish (includes shellfish and other inshore marine resources) plays a pivotal role in food security and income generation for Solomon Islanders. Solomon Islands have one of the highest per capita consumption rates of fish in the world. Although different estimates have been provided over time and by different sources (see Table 4), a recent study (Bell et al. 2009) estimated that the average annual per capita fish consumption (kg yr^{-1}) in urban areas was 45.5 kg yr^{-1}, in the rural areas it was 31.2 kg yr^{-1} while the national average was 33 kg yr^{-1} (90% of this consisted of fresh fish). However, these figures may be an underestimation (Weeratunge et al. 2011); based on a survey of 4 locations Pinca et al. (2009) estimated the annual per capita fish consumption to be in the range 98.6-110.9 kg yr^{-1}. Reef fisheries provides approximately $SBD21.6 million (Solomon Dollars) per annum in income to fishers and traders involved in the reef fisheries market (Brewer 2011). Note that Brewer's (2011) estimate was based on a fisheries that was predominantly composed of reef finfish fisheries and does not consider the marine ornamental trade, trochus fisheries or beche-de-mer fisheries (currently closed) which contribute significantly to income generation for Solomon Islanders, particularly those living in rural areas. The overall income value of the reef fisheries therefore could be considered substantial.

Table 3: Summary of information on fish use in the 2005/06 Household income and expenditure survey information

Source (HIES 2006)	*Urban %*	*Rural %*	*National %*
Food consumption expenditure on fish	16.90	12.98	14.49
Home production (refers to the value of goods and services produced by the household to be predominantly consumed by the same household or given as gifts. Such goods like vegetables, fruits, fish etc.)	4.81	55.89	36.9
% HHs in self-employment and related businesses engaged in sale of fish and other seafood	9.34	16.44	15.93

Table 4: Per capita fish consumption (kg/yr) Figures for Solomon Islands according to various sources

Year	*Per capita fish consumption (kg/yr)*	*Source*
1983	26	1983 Statistics Office Survey
1988	22 for fish, 12 for shellfish	Unpublished survey, Statistics Office Survey
1990	35	Skewes (1990)
2002	45.5	Solomon Islands SPC report
2009	31.2 for rural HHs, 45.5 urban HHs, 33 for national	Bell (2009)
2009	98.6-110.9	Pinca et al. (2009)

Although fishing is a main activity for many rural Solomon Islanders, fishing and fishing related activities only represent a small proportion in the formal employment and they are often aggregated with the agriculture sector in the formal records. It is therefore usually difficult to know for certain its actual contribution within the formal employment sector. Formal employment within the fisheries sector includes professional officers in fishing companies, fishers in industrial fishing boats, employees within the tuna cannery operations in Noro, Western Province and those employed within the MFMR and the Honiara based South Forum Fisheries Agency (fisheries managers, researchers, fisheries officers, observers, compliance officers etc).

Issues in capture fisheries

Balancing the need for economic development with the subsistence and cash needs of the people is a critical issue. Factors such as: heavy reliance on subsistence fishing as a main protein source, the need to generate income to meet personal needs and limited livelihood opportunities available to rural dwellers makes overfishing a major threat. Existing predictions indicate that coastal fisheries will not be able to supply enough protein to meet the country's nutritional needs (based on WHO recommendations) by 2030 (Bell et al. 2009). Coupled with the lack of livelihoods is the lack of development in rural areas. There is even less incentive for people to start livelihood initiatives as buying centres or markets are often located far from communities and so transport costs are usually very high making such operations unprofitable. While there are Rural Fisheries Centres (RCFs) located in a number of provinces providing a service for rural fishers for purchasing fish, only 46% of them were reported as working in a 2010 summary of RCFs (MFMR unpublished document).

F. Mariculture and Aquaculture

Mariculture and Aquaculture in the Solomon Islands is still developing. The importance of mariculture and aquaculture to household protein intake is minimal as there are currently no/limited contributions from that sector to the household protein intake. However, when considering the possible decline in fish supplies

in the future (Bell et al. 2009; Weeratunge et al. 2011), aquaculture and mariculture will be important vehicles to achieve the much required fish supplies.

At present aquaculture is limited to mariculture activities in seaweed and some culture of corals and clams for the marine ornamental trade. The latter is discussed in the next section. There was small amount of prawn (*Macrobrachium* and pennaied prawn) production in the 1980s and 1990's, but farms have since been inactive (WolrldFish Centre 2011). Research was conducted in the mid 1990s and early 2000s by WorldFish on the mariculture of black-lip (*Pinctada margaritifera*) and gold-lip oysters (*P. maxima*). Other research on potential commodities by WorldFish has included the pacific bath sponge, *Coscinoderma mathewsi,* a potential commodity for rural communities to earn income due to its non-perishable quality.

In its 2009-2014 Aquaculture Development Plan, MFMR prioritised the following commodities that can be produced most easily (Table 5), and profitably to help meet food and income requirements. The majority are species for mariculture.

Table 5. Potential aquaculture commodity ranking after prioritizations for Solomon Islands (MFMR)

Commodity	***Potential impact*** *(potential to make a positive impact)*	***Feasibility*** *(feasibility of successfully developing the commodity)*
Kappaphycus seaweed	High	High
Tilapia	High	Medium
Sea cucumber	High	Medium
Giant clam	High	Medium
Crocodile	High	Low
Trochus	Medium	Medium
Sponge	Medium	Medium
Pearl	Medium	Medium
Coral	Medium	Medium
Crustaceans	Medium	Medium
Live rock	Medium	Medium
Freshwater shrimp	Medium	Medium
Milkfish	Medium	Medium
Mudcrab	Medium	Low
Ornamental fish	Medium	Low
Eel	Medium	Low
Marine shrimp	Medium	Low

G.Mariculture

Seaweed (Kappaphycus alvarezii)

Seaweed culture in the Solomons began in 1988 at two sites in the Western Province. In 2000, seed stocks from the trials at these sites were collected for further trials in other sites in the Province e.g. Rarumana where an early report (Wale 2003) indicated that it was successful and provided important socioeconomic benefits. Although initiatives by the Rural Fisheries Enterprise Project (EU) in 2000 aimed at linking the sites up, this proved unsuccessful for various reasons. In 2004 with assistance from the 'Commercialisation of Seaweed Production in Solomon Islands (CoSPSI) Project', storage and marketing facilities for the product were set up in Waghina, Choiseul Province. This proved to be successful, and by the end of 2005, there were about 130 farmers in Western Province, about 300 in Choiseul Province and had expanded to Malaita and Makira province. By 2010, 14 seaweed sites had been established (see Figure 11). Based on estimates from MFMR, there were approximately 250-300 active seaweed farmers in 2011.

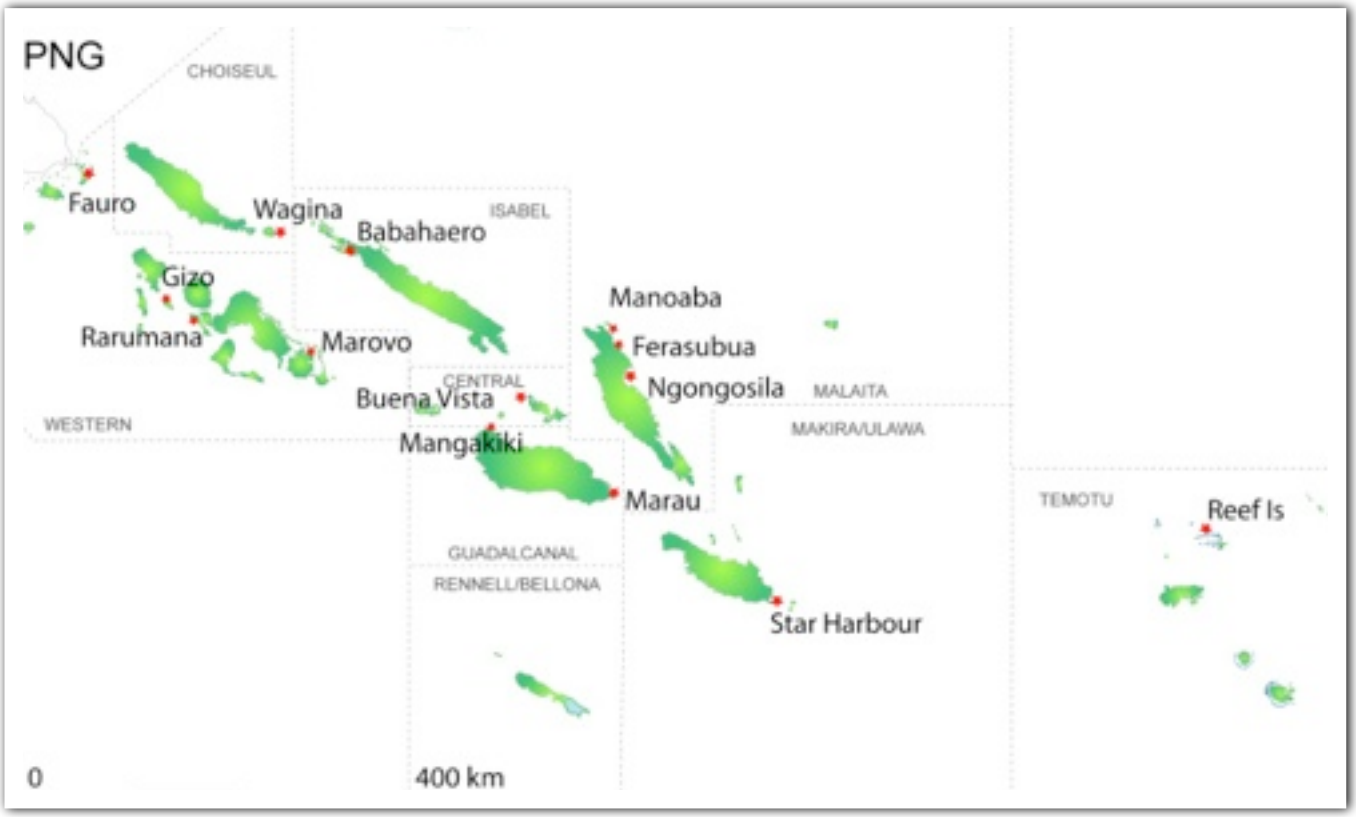

Fig. 11: Seaweed production sites in Solomon Islands 1988-2009, and potential sites.

There were, however, major fluctuations in the national seaweed production during these years owing to low prices, the presence of the fungal disease 'Egyptis' and high transport costs (Kronen et al. 2010a). Production reduced further after the tsunami in April 2007 which destroyed production sites, especially key seaweed farms at Wagina and Rarumana. In 2004 prices were reported to be at SBD $2/kg (USD$0.28/kg) (CBSI 2007). An enquiry at the only seaweed license holder and exporter in February 2012 showed a buying price of SBD$5.40/kg in the capital Honiara, compared to SBD$4.90/kg in the provinces. Figures obtained from MFMR for the period 2005-2010 indicated that annual production fluctuated between a minimum annual production of 84 tonnes to a maximum of 645 tonnes, with a value in 2010 of SBD$4.5million (See Figure 12).

Pearl oysters (*Pinctada sp*)

Historically, black, white and brown lipped pearl oysters provided an important cash commodity for rural communities until a national ban was imposed in 1994. Harvests occurred in pulses; the first one in 1968-1972 until the stocks became severely depleted it was uneconomical to continue and then a second pulse in 1987-1994 (Hawes 2008). At its peak in 1991, 45 tonnes of mother-of-pearl shells were exported with a value of SBD$600,000. In response to the depleting stocks, the then DFMR and WorldFish began research on the possibility of farming the black-lipped pearl oyster running from the early 1990s and continued on to the early 2000s, when the first batch of pearls were produced and sold. However, to date, no commercial farming of mother of pearl has occurred despite research showing positive possibilities for the country. This was due largely to the civil unrest in the late 1990s which in turn resulted in a lack of commercial investment. Participation from locals is probably hampered by lack of start up capital.

Pacific sponge (*C. matthewsi*)

Sponge mariculture has been present in the Western Pacific region for many years (Hawes and Oengpepa 2010). Regionally success has been limited, however, sponge mariculture is still suitable for farming in the Solomons as they occur naturally, are native to the country, easily processed to a non-perishable product, does not need to be transported live and are lightweight. These are quality attributes for village farming as transport services are a major obstacle to overcome for more delicate commodities like coral and clam farming for the marine ornamental trade. Research on sponge culture in Solomon Islands has investigated culture techniques to ensure environmental sustainability and producing sponges at appropriate sizes and shapes for the niche market. While simple techniques were identified and sponge samples produced for an initial market assessment by

(Tonnes)
(SI$)

New Zealand based marketers, recommendations were for the identification of niche markets that would provide better prices to sustain the industry.

Freshwater inland aquaculture

In 2009 the Ministry of Fisheries and Marine Resources (MFMR) published its 2009-2014 Aquaculture Development Plan, highlighting the importance of freshwater aquaculture in supplying fish for food in areas of limited access to inshore fisheries. Tilapia was one of four priority aquaculture commodities identified. Consequently in 2010 the Solomon Islands Tilapia Aquaculture Plan 2010-2015 was published, emphasizing tilapia as the preferred freshwater species to help meet national needs in terms of fish intake. While the Mozambique tilapia exists in the country, a national decision still needs to be made regarding the introduction of Nile Tilapia. In 2010, a project featuring MFMR, WorldFish and SPC as partners began the first phase of a project titled "Aquaculture and food security in the Solomon Islands (ACIAR project FIS/2009/061)" which looked at identifying the best mechanisms for the Solomon Islands Government to implement an inland aquaculture programme that will hopefully contribute to future food and nutritional security, focusing primarily on tilapia and milkfish.

The initial assessment found that whilst small backyard type ponds for tilapia can be found on several islands, the largest concentrations are on Guadalcanal and Malaita where there are between 50 and 100 household ponds, all characterized by low yields, and with a total production of less than 5 tonnes annually. Nearly all farmed tilapia are used for household consumption, including by women and children. Although pond yields are low, farmers are enthusiastic in culturing fish, and around 60% of households (n=178) surveyed in Guadalcanal and Malaita showed their interest in culturing fish. Results indicate that while there is market demand and existing opportunities for both species, considerable amounts of investments in research, learning, technology, infrastructure and funding is needed to get the initiatives off the ground. This project is currently in its second phase.

H.Marine ornamental trade

The marine ornamental trade in the country is limited to cultured clams, corals and aquarium fish.

Coral

The aquarium trade started in the country in 1995 (Kinch and Teitelbaum 2009) with the export of live corals beginning the same year by Solomon Islands Marine Export (SIME) and Aquarium Arts Solomon Islands (AASI), and Solomon Sea Stones (SSS) exporting dead coral. In 2003 the aquarium trade exports from the Solomons accounted for 4% of the international coral trade (Wabnitz et al. 2003.). In 2011, AASI was the sole exporter of live coral, and two companies, Halelo and Sea Abundance were exporting dead coral. Corals were mostly supplied by

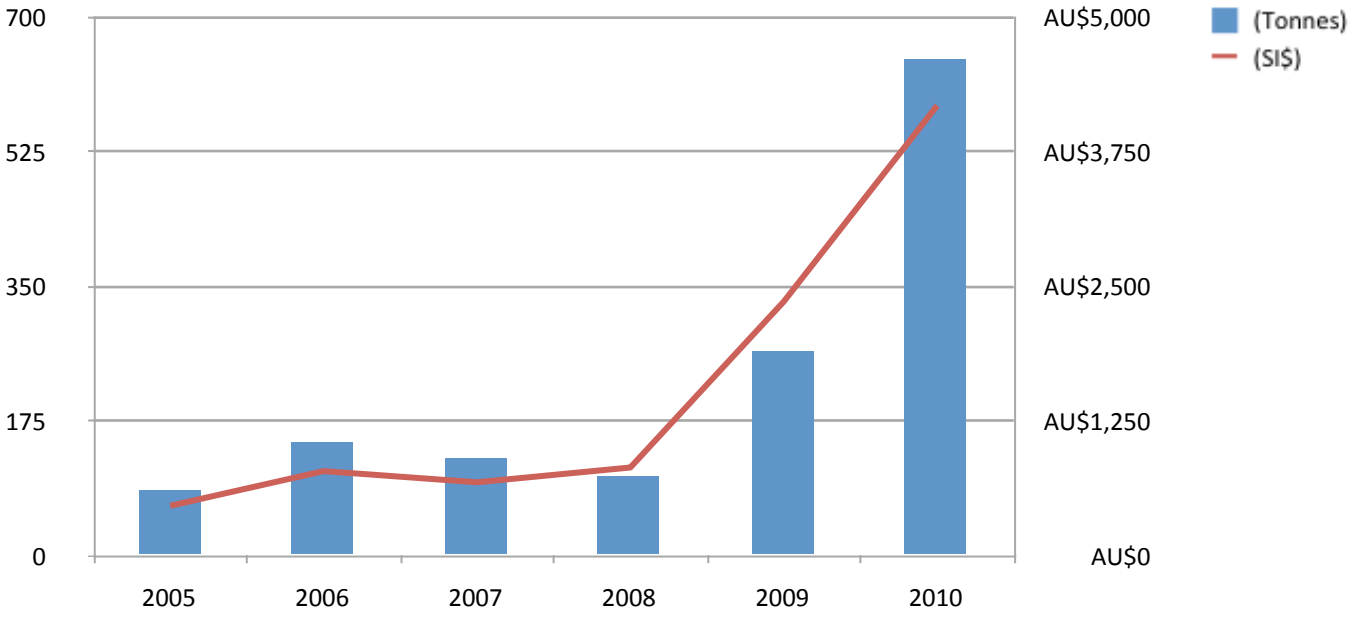

Figure 12: Annual seaweed production from 2005 to 2010 obtained from MFMR.

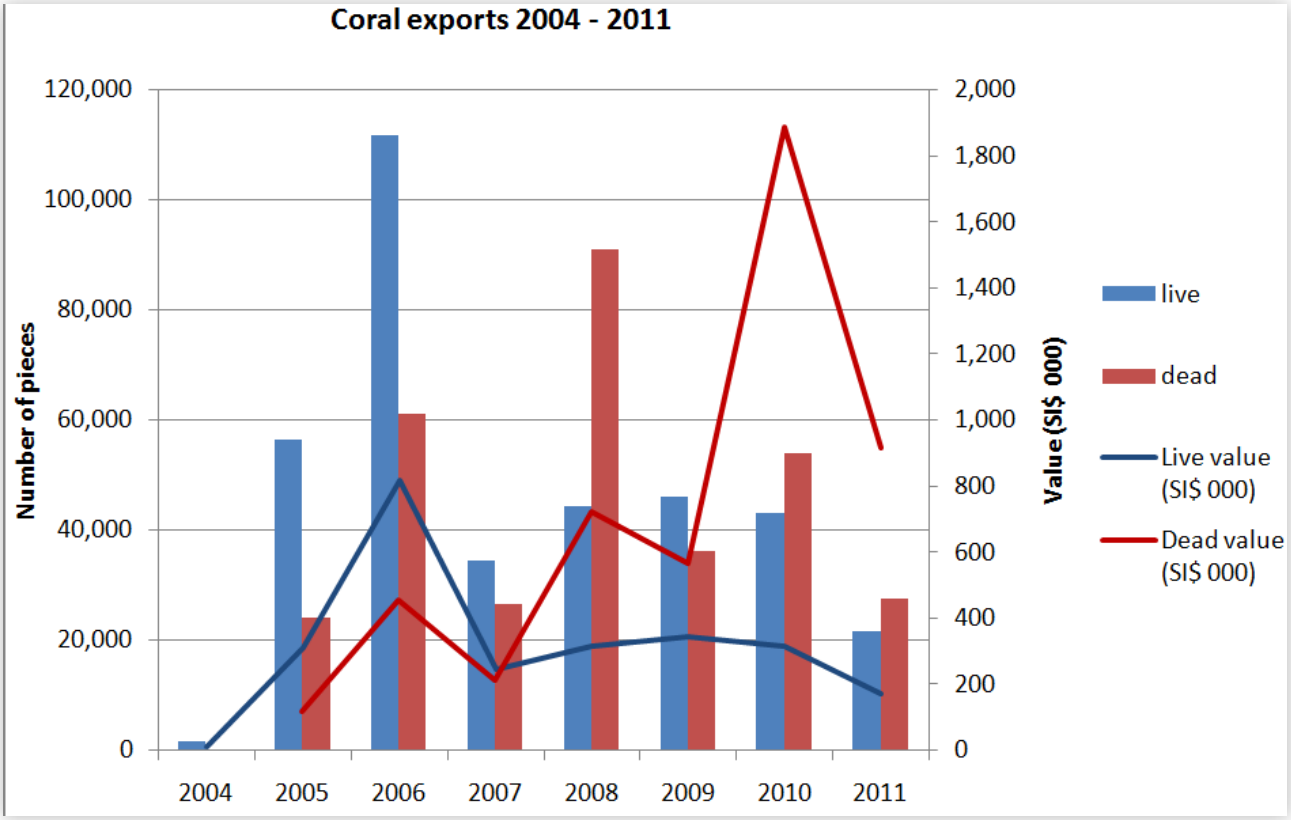

Figure 13: Live and dead coral exports and value for 2004 – 2011 (data from MFMR).

communities in the Central, Guadalcanal and Western Provinces. Lal and Kinch (2005) reported that approximately 75% of all coral exports came from the Ngella (Florida Islands) in the Central Province. Recent reports from MFMR are that licenses for exporters have not been renewed and are pending further considerations and assessments.

Indicative figures as provided by MFMR (Figure 13) in 2011 shows that while there was initially larger exports on live corals, the export of dead coral for the curio trade picked up in 2008. The value of the curio trade spiked in 2010 despite a decreased export volume. The reason provided by two curio exporters was that a better price was obtained with the assistance of MFMR. Previously, dead corals were exported in containers and sold by the container. A better deal was obtained whereby the corals were bought according to the piece and the species.

Curio trade

In 2005, Sea Abundance began operation, exporting dead coral for the curio trade. The trade picked up in 2009 after a brief lull with Solomon Sea Stones (SSS) restarting its exports with a license to export 19 species of coral. Recently, the Ministry of Fisheries and Marine Resources (MFMR) and the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) set up a quota system for select species from eight coral families (Table 6). In 2010, there was a total coral quota of 92000 pieces. In an assessment of the period between 2005 and 2011, approximately 79% of the products were destined for US based markets.

Table 6: Coral families with a quota system for export

Coral Families	*Total Coral quota 2010*
Acroporidae Sp.	32000
Pocilloporidae Sp.	28000
Milleporidae sp.	4000
Merulinidae sp.	8000
Agariciidae Sp.	8000
Helioporidae Sp.	4000
Tubiporidae Sp.	4000
Funggidae sp.	4000

I. Coastal Tourism

The coastal tourism industry, although not a large revenue earner, is a growing source of revenue for the country. More people visit the country for business compared to tourists visiting for recreational activities. In a 2006/07 international visitor survey, holiday/ vacation and scuba-diving visitors together made only 21% of visitors. Estimated expenditure based on calculations on total visitors show that the estimated expenditure for holiday visitors and scuba divers is approximately SBD$30 million.

The majority of tourism products are centered on coastal areas and activities. The major destination in the country, apart from the capital is to the Western Province. The major drawcards are the sun, surf and beach image of small islands, thus popular activities include snorkelling, scuba diving, surfing, mangrove tours and game fishing to name a few (Rachel Sibi, pers.comm, Min of Culture and Tourism). Village stays are also becoming a popular livelihood option for local people to earn money, allowing people to maintain the cultural way of living, an example which is building using local material and baking food in a stone oven (called a motu in the local Pidgin English). As most of the island tourist destinations are located in the provinces, accessibility becomes an issue. Most are accessible by plane and usually involves a short boat ride to the actual destination.

J. Minerals, Oil and Gas

The minerals, oil and gas industry in the country is not well developed. There are currently only two active mining companies in the Solomon Islands doing extraction. These are Allied Gold and Solomon Alluvial Mining Ltd and are doing extraction of gold and other minerals only in Guadalcanal Province. There are however, many submissions to the government through the Ministry of Mines, Energy and Rural Electrification (MMERE) for minerals prospecting tenements. According to the process for mining and prospecting tenements, a maximum timeframe for prospecting is given as seven years, after which the prospector may go into extraction or withdraw from the country.

In September 2011, a total of 15 companies submitted approximately 77 tenements for prospecting in the country, with 23 of these for offshore prospecting by two companies. There are indications that the number of tenements will increase awaiting decisions from the MMERE in mid November 2011. Copper, gold, silver

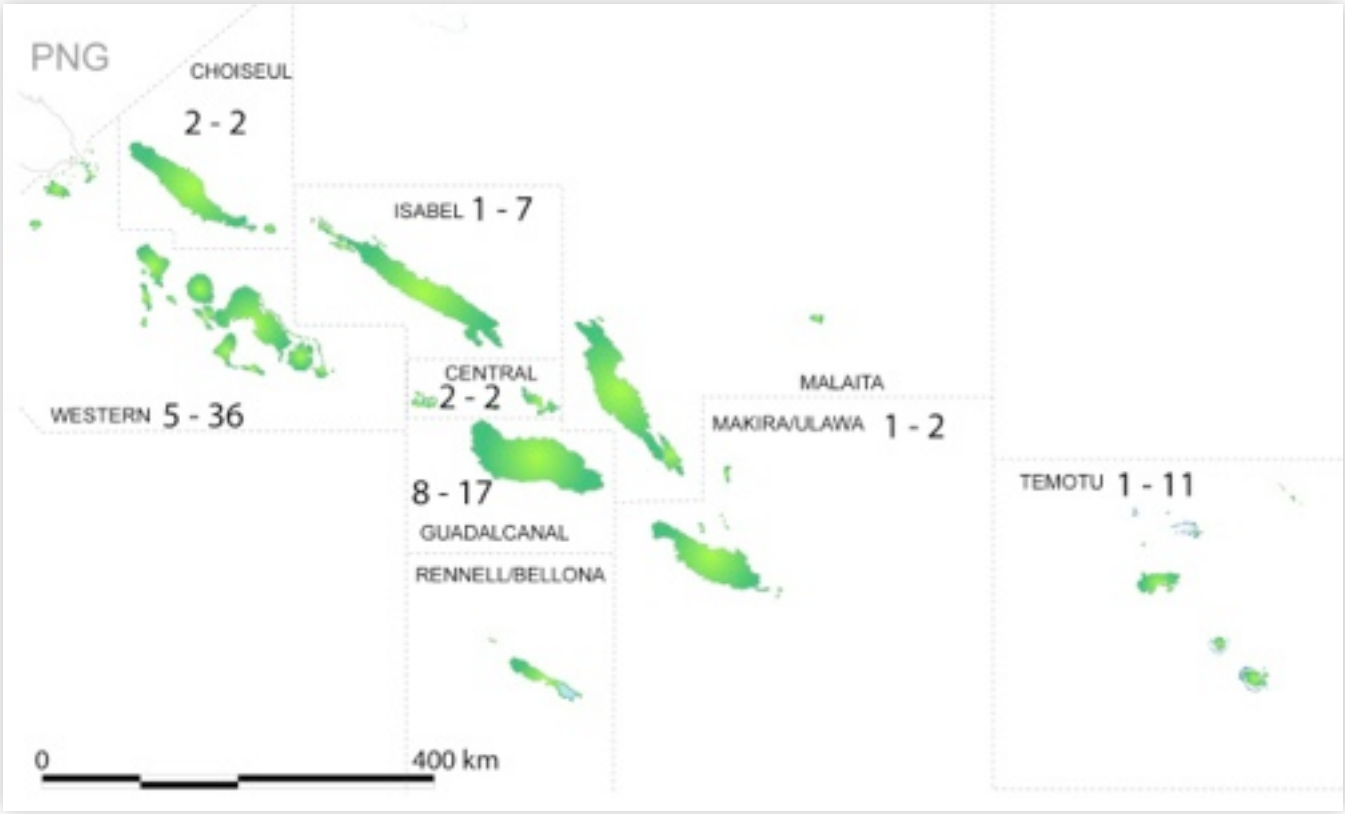

Fig. 14. Solomon Islands Provinces with the number of companies presently doing explorations in the Province (first number) and the number of tenements (second number) currently in place as at 23 September 2011.

and zinc are the minerals targeted for offshore exploration. Onshore prospected minerals include copper, gold, silver, zinc, iron, manganese, cobalt, arsenic, antimony, tellurium, molybdenum, nickel, bauxite and other minerals. The majority of the companies and tenements are situated within Western and Guadalcanal Provinces (Figure 2).

The country does not produce its own oil. A couple of petroleum explorations were done in the early 1980s to assess the country's prospects; these were based on geological land surveys and marine geophysical profiling (MMRE, Pers.comm). Results from the assessment indicated potential priority sites and gave recommendations for further surveys for full evaluation of prospects.

Issues in minerals oil and gas

The environmental issues with regards to mining and prospecting are many. The majority of current issues are based on mining impacts as reported by Guadalcanal communities downstream of extraction activities. A number of incidents had been reported and checked by the authorities. These were in relation to spilling of slurry, pipes damage which led to worries of cyanide leakage into the surrounding and waste oil spillage. Cyanide is dangerous as it is poisonous and can lead to deforestation and pollution of underground water and the marine environment. There have been reports of streams not being usable for human use after raw water from the tailing pipeline spilled into nearby rivers and streams and killed animals and degraded water quality.

One of the more concerning findings of the report was the lack of transparency surrounding the reporting and documentation of the environmental impacts of the mining activity itself. Discussions with the relevant authorities showed no actual documentation of impacts from mining activities despite on-site assessments often being carried out. This meant that the report had to rely on reports as published by the national newspapers for recorded events and environmental impacts.

K. Transportation and shipping

Domestic shipping

Domestic sea transportation is an important sector of the country. Owing to the geographic spread of the country, it is the main mode of transport for the majority of people. Nearly all of the nine provincial groups have shipping companies servicing the areas. Most services run from Honiara to provincial urban centres, while some call in at all villages along the coast. Regular services are provided for populous destinations like Gizo in Western Province, Buala in Isabel Province, and Auki in Malaita Province. For most destinations, services are not regular and often depend on the number of travelling passengers wishing to travel, with shipowners only making those trips which are profitable.

A wide variety of goods are transported to and from rural and urban areas. On routes travelling out from Honiara, cargo is mostly made up of imported food goods like rice, flour and biscuits and other products. These mostly supply shops in provincial urban areas and village canteens. Building materials are also main cargo items. On routes travelling back to Honiara, these are often filled with garden products and crops like betelnut, copra and cocoa that is to be sold at the markets or buyers in Honiara respectively. These can also include fresh seafood in large eskies and marine products for sale in Honiara.

International shipping

Internationally, sea transport is the chief mode of transport for the entry of overseas goods. Air transport is much costlier. Two main international

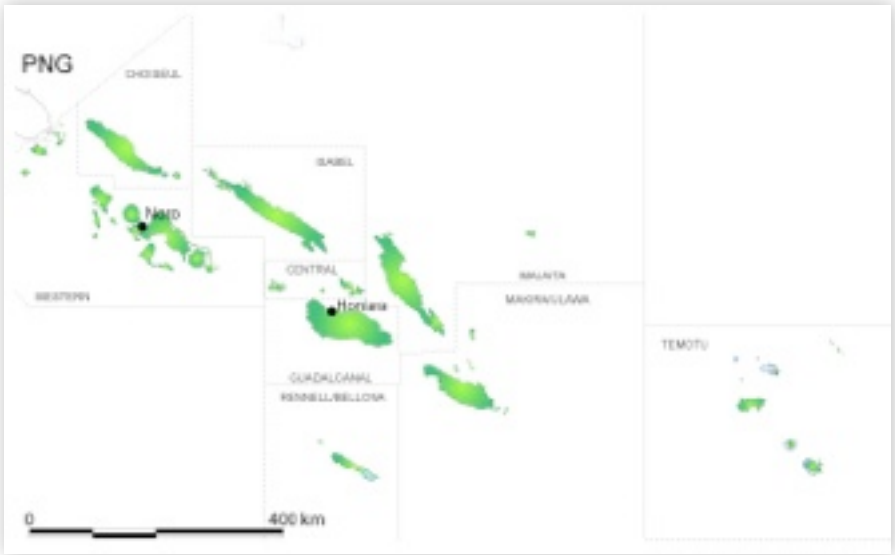

Figure 15: map showing locations of the two international shipping ports in the Solomon Islands

shipping ports are Honiara and Noro (Figure 15). The main fish export commodity tuna is usually exported from Noro port where the cannery is located. Logging ships also make direct routes to and from Logging points to collect logs for exports. While data on the shipping traffic into Solomon Islands are available with shipping agents and the Solomon Islands Ports Authority, for security reasons they are not made available for the writing of this report. However, maps of container and oil tanker shipping traffic into the Pacific by SPREP shown in Figure 16 and Figure 17 (Hay et al. 2003) shows that Solomon Islands lies within a major shipping route in the Pacific.

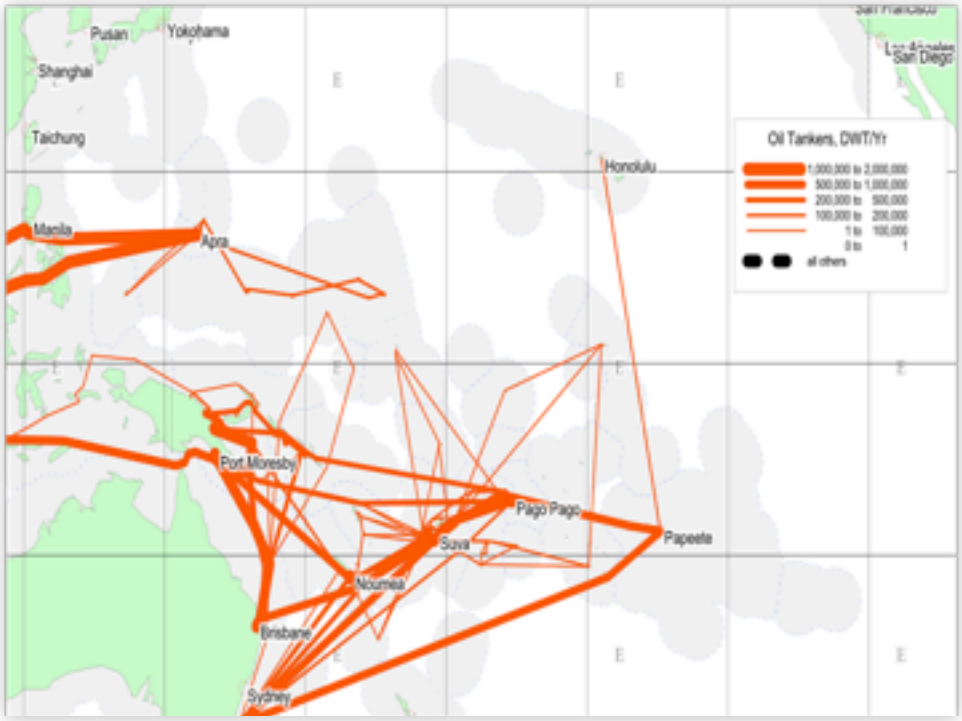

Figure 16: Map showing main tanker routes within the Pacific (From South Pacific Regional Environment Programme, 2003)

Figure 17: Map showing main container vessel routes within the Pacific (From South Pacific Regional Environment Programme, 2003)

CHAPTER 5

Threats and Vulnerabilities

A. Current Issues for Marine Resources Management

Fisheries degradation and food security

The central role of fish in the livelihoods of Solomon Islanders coupled with an average annual human population growth rate of 2.3 % per annum (Solomon Islands National Statistics Office 2011) means that pressures on marine resources have increased and will continue to increase. These pressures will inevitably contribute to threats of overfishing and subsequently the use of destructive fishing methods as fishers struggle to catch the last fish and/or to maintain catch levels. Newton et al. (2007) classified Solomon Islands coral reef fisheries as being either fully exploited or collapsed. In highly populated locations and locations close to markets, the need for consumption and to generate income has significantly increased fisheries exploitation (Sabetian and Foale 2006), resulting in the decline in catches and/or over exploitation of certain species, for example parrot fishes (Hamilton et al. 2005; Aswani and Sabetian 2009; Brewer et al. 2009), sea cucumber species (Kinch 2004; Kinch 2005; Anon. 2006), giant clams (Tridacnidae species) and green snail (*Turbo marmoratus*). Sharks (several species) which are usually casualties of the long line fishing industry and usually targeted for their fins to be exported to Asian markets may be more threatened than is currently realised.

The declining trends in fisheries do not bode well for the increasing trends in population and future projections of fish required for income, food security and good nutrition. According to Bell et al. (2009), the estimated production from entire national coastal fisheries resources will not be able to meet future demands of fish; estimated production based on coral reef area is 13,800 tonnes per annum while production estimates based on catches is 11,150 tonnes per annum. This is a significant shortfall when considered against the national demands of 25,500 tonnes per annum for 2020 and 29,900 tonnes per annum for 2030 required to meet food security and good nutrition requirements.

Destructive fishing practices

Destructive fishing practices involve both traditional and modern methods. There are anecdotal reports of the declining use of traditional fish stunning methods, e.g. the use of *Barringtonia asiatica* and sea cucumber extractions. However, the use of the leaves of Derris species (e.g. *Derris eliptica*) still remain a common traditional fish stupefying method in many parts of the Solomon Islands. The use of explosives (dynamite fishing) constructed from Second World War ammunition remains continues to be the main form of destructive fishing. Observed severe blast fishing incidences concentrate within Nggela, Langalanga Lagoon (Malaita) and parts of Guadalcanal (Burke et al. 2011), with anecdotal reports of some usage in Lau Lagoon in Malaita (John Bou, pers.comm). The main targets are the schooling species such as *Selar crumenopthalmus, Rastrelliger kanagurta,* Naso Species, Kyphosidae species and sometimes juveniles of Carangidae species which forage inshore (Sulu pers.ob).

Sulu (2010) studied some aspects of dynamite fishing in Nggela and reported that some of the main factors which perpetuate the practice in Nggela are: the the high catch returns per unit effort (especially those engaged in semi-commercial fishing), the general absence of enforcement of legislations prohibiting such practice and thirdly the declining respect for traditional leaders (Wairiu and Tabo 2003) who previously prohibit and enforce such prohibition at the community level.

A commonly held perception among both traditional leaders and dynamite fishers was that community leaders do not have the authority nor the protection of the law to enforce dynamite fishing prohibitions, hence they are powerless and cannot prosecute offenders. Apprehensions were generally quite low and in most cases only coincide with the occasional police patrol when fuel was available. Only 36 incidents of dynamite fishing (Figure 18) were apprehended by police in Nggela during the period January 2000 - May 2008, of which 15 were convicted. Addresing the problems of dynamite fishing requires a holistic approach that should involve the relevant structures of the modern governance system and local communities. One possible mechanism could be the empowerment of community level governance structures to enforce dynamite fishing prohibitions at the community level (Aswani 1997b; Lidimani 2006).

Threatened species

Turtles

Government surveys conducted between 1973 and 1982 reported that nesting grounds for three species of turtles (Hawksbill, Green and Leatherback) are scattered across the country (Figure 19). The Arnavon Community Marine Conservation Area (ACMCA) (Figure 20) was considered a very important turtle rookery. Shortland Islands and Ramos Islands (Malaita) were considered to be the main hawksbill and green nesting grounds. The Rusell islands, Helebar Islands (Marovo) and Santa Cruz (not within CTI region) were reported to be important Hawksbill nesting sites, while Sasakolo and Litogahira (Isabel), Rendova and Tetepare (Western) and Vacho and Sasamunga (Choiseul) were considered to be the most important nesting beaches for Leatherback turtle.

The ACMCA is the only nesting site in the country with consistent monitoring of nesting activities of hawksbill and green turtle since the early 1990's. The ACMCA (spread over three small uninhabited islands and which encompasses 40,000 acres) was declared a wildlife sanctuary in 1980 by the Solomon Islands Government owing to its importance as a common nesting ground for both turtle species (Figure 21 shows baby turtles descending into waters after hatching). For the last 20 years ACMCA was

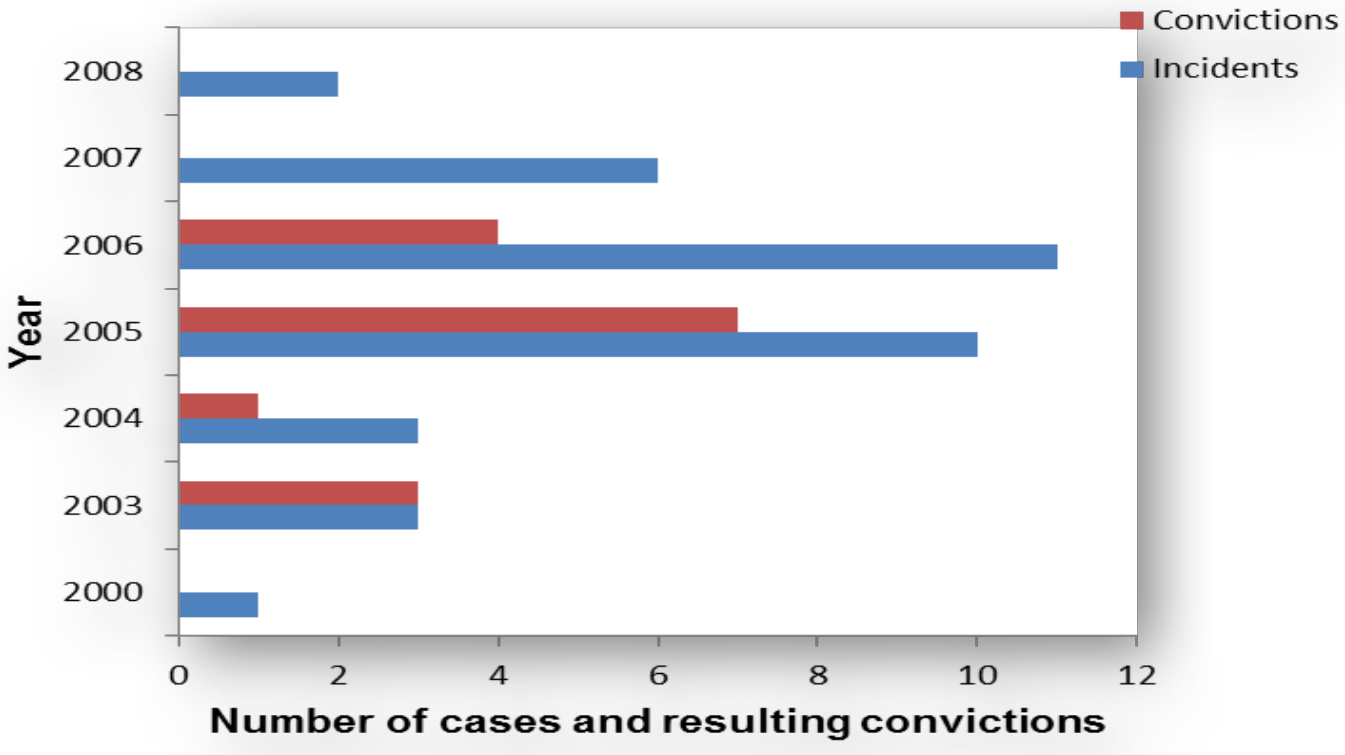

Figure 18: Dynamite fishing incidents and convictions in 2000 – 2008 (source: Tulagi Police Department), Sulu (2010).

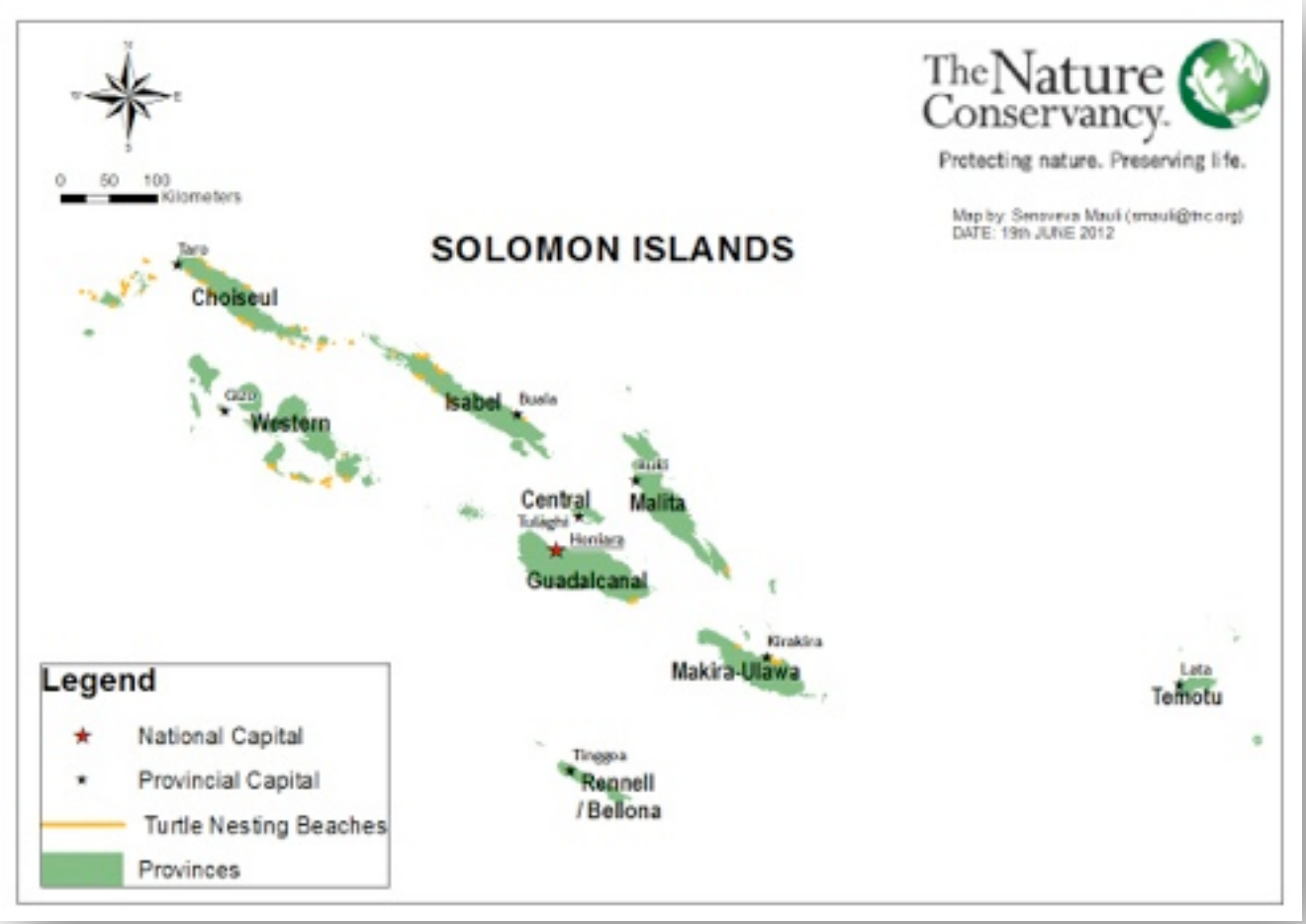

Figure 19: Important turtle nesting beaches in Solomon Islands

supported by The Nature Conservancy and in partnership with the MECDM (previously department of environment) and the MFMR (previously department of fisheries) monitored turtle nesting activities. Early reports by Vaughan in 1981 estimated that ACMCA supports about 600 nests (550 hawksbill and 50 green) per year. However, recent monitoring (Siota and Ramohia ,2006) reported that the ACMCA now supports up to 1800 nests (both species combined) each year.

Marine turtles historically play an important role in the lives of Solomon Islanders. This is evident in the turtle carving displays in the national museums, contemporary carvings and the many different local legends and beliefs. Turtle egg and meat still remain a delicacy during special occasions while shell and oil are used during cultural and traditional purposes. Local craftsmen and women make traditional ornaments such as rings, bangles and earrings from turtle shells and are sold at the local markets. The usefulness of turtles in their entirety therefore lends themselves to over exploitation by Solomon Islanders.

Figure 20: An aerial view of the Arnavon Community Managed Conservation Area (Courtesy of TNC)

To date, there is a total ban on exporting turtle shells and a closed harvesting season for all turtle species and turtle eggs from June to August and from November to January during nesting seasons since 1993. Although subsistence use of turtle continues at the local level, there has not been any commercial export of turtle shells since the fisheries regulations came into effect. Furthermore, the leatherback in

particular is an endangered species and recognized worldwide thus international efforts have been made to protect its nesting sites (Pacific Horizon Consultancy Group 2008). In the Solomon Islands the protection and conservation efforts are addressed through strong working partnerships with all stakeholders including local communities, the provincial and national government, community – based Organization (CBOs), non Governmental Organizations (NGOs), regional Organizations and donors.

Figure 21: Baby Hawksbill turtles descending into the waters after hatching (Photo: Peter Ramohia)

Dolphins

An estimated 9 species of dolphins occur within the waters of Solomon Islands (Leary and Pita 2000), however, the most common species are spinner dolphin *(Stenella longirostris),* common bottlenose dolphin *(Tursiops truncatus),* Indo-Pacific bottlenose dolphin *(Tursiops aduncus* and pan-tropical bottlenose dolphin *(Stenella attenuata)* (Kahn 2006; Oremus et al. 2011). Different researchers provided different rankings for the abundance of these common species; however, such differences were probably influenced by variations in geographical locations and the seasons when surveys were made by the different researchers. Goto et al. (1997) surveys were conducted in offshore waters within the area 4°S – 13°S and 155°E – 163°E, surveys by Khan (2006) were within the archipelagic waters spanning from Shortland Islands to Makira while the surveys by Oremus et al. (2011) focused within the waters between North Guadalcanal, Florida Islands, Eastern Santa Isabel and Malaita. Sighting frequencies and individual counts in Solomon Islands seem to indicate a low species diversity and abundance compared to Eastern Indonesia and northern Papua New Guinea (Kahn 2006). A cetacean distribution map within the central Solomon Island based on surveys conducted in 2009 and 2010 (Oremus et al. 2011) is given as Figure 22 below, *Stenella longirostris* were more frequent in Florida Islands and north Guadalcanal while *Tursiops aduncus* were more frequent in east Isabel; sightings of *T. aduncus* were less frequent in Malaita, however, the pods sighted were usually larger than those seen within the waters of north Guadalcanal (*ibid.*).

Some communities in Solomon Islands have a long history of hunting dolphins for the purpose of consumption as well as for their teeth which are used as traditional currency as well as to construct ornaments and jewellery (Dawbin 1966; Takekawa 2000). The utilisation and hunts for dolphin is particularly common in North Malaita, Langalanga, and the communities of Fanalei and Walande in South Malaita. In recent years only the communities of Bita'ama (north Malaita), Fanalei and Walande were active in the hunt drives. Hunting periods in Fanalei are usually between January–April which coincides with calm weather (Takekawa 2000; Kahn 2006). Available records of catches based on literature are shown in Table 7 below. The catches consisted mainly of pan-tropical spotted dolphins and spinner dolphins (Takekawa 2000).

Table 7: Dolphin catches at Fanalei

Year	*Total Individuals caught*	*Source*
1965	2000	Kahn (2006)
1994	865	Takekawa (2000)
1999	700	Kahn (2006)
2000	800	Kahn (2006)
2002	700	Kahn (2006)
2003	1200	Kahn (2006)
2005	600	Kahn (2006)

A new enterprise for dolphins started in 2003 - the live capture of dolphins (Tursiops aduncus), which were held in captivity in local pens and later exported to overseas aquaria and marine parks for public display purposes. In 2003 the Solomon Islands Government allowed the export of up to 100 live dolphins (regardless of species), although that quota was never reached. Dolphin exports and destinations between 2003 - 2011 are shown in Table 8.

Table 8 Dolphin exports from Solomon Islands (UNEP-WCMC 2012)

Year	*Number of animals*	*Destination*
2003	28	Mexico
2007	28	Dubai
2008	18	Singapore
2008	7	Philippines
2009	9	Malaysia
2009	11	Philippines
2011	25	China

The issue of dolphin hunting for export purposes attracted criticism from environmental NGO's, activists, intergovernmental groups and foreign governments. There were concerns that the absence of a dolphin management plan and the establishment of a quota (100 per year, which was considered unsustainable) when stock assessments have not been undertaken could possibly lead to the overexploitation of dolphin species in Solomon Islands waters (Reeves and Brownell Jr 2009; Oremus et al. 2011). The government subsequently reduced the maximum that could be exported to 40 per annum with a complete ban in the trade of live dolphins as from 2012. Studies on the abundance and distribution of dolphins within the central Solomon Islands which were started in 2009 are still ongoing, final surveys were conducted in late 2011 with final reports due in the near future (Oremus et al. 2011). A better understanding of the dolphin ecology and distribution within Solomon Islands, hence better conservation strategies should be generated by the end of that study.

Whales

Although Leary and Pita (2000) suggested the existence of 8 species of whales in Solomon Islands, other species not on their list which have been reported to be sighted are: *Kogia* sp.(Shimada and Pastene 1995; Goto et al. 1997), *Balaenoptera brydei* (Kahn 2006) and *Balaenoptera omurai*. Hence it is possible that more than 8 species of whales may be occurring in Solomon Islands waters. Figure 23 shows a *Balaenoptera* species on the coastal waters of Florida islands. Whales are currently not hunted (either for consumption or for other products) in the Solomon Islands and there are currently no whale watching programmes. There is still a dearth of information on the ecology, interaction with fisheries and general understanding of whales in Solomon Islands as only a few surveys (Shimada and Pastene

Figure 23: Balenoptera sp. sighted on the coast of Florida Islands, November 2010 (From Oremus et al. 2011)

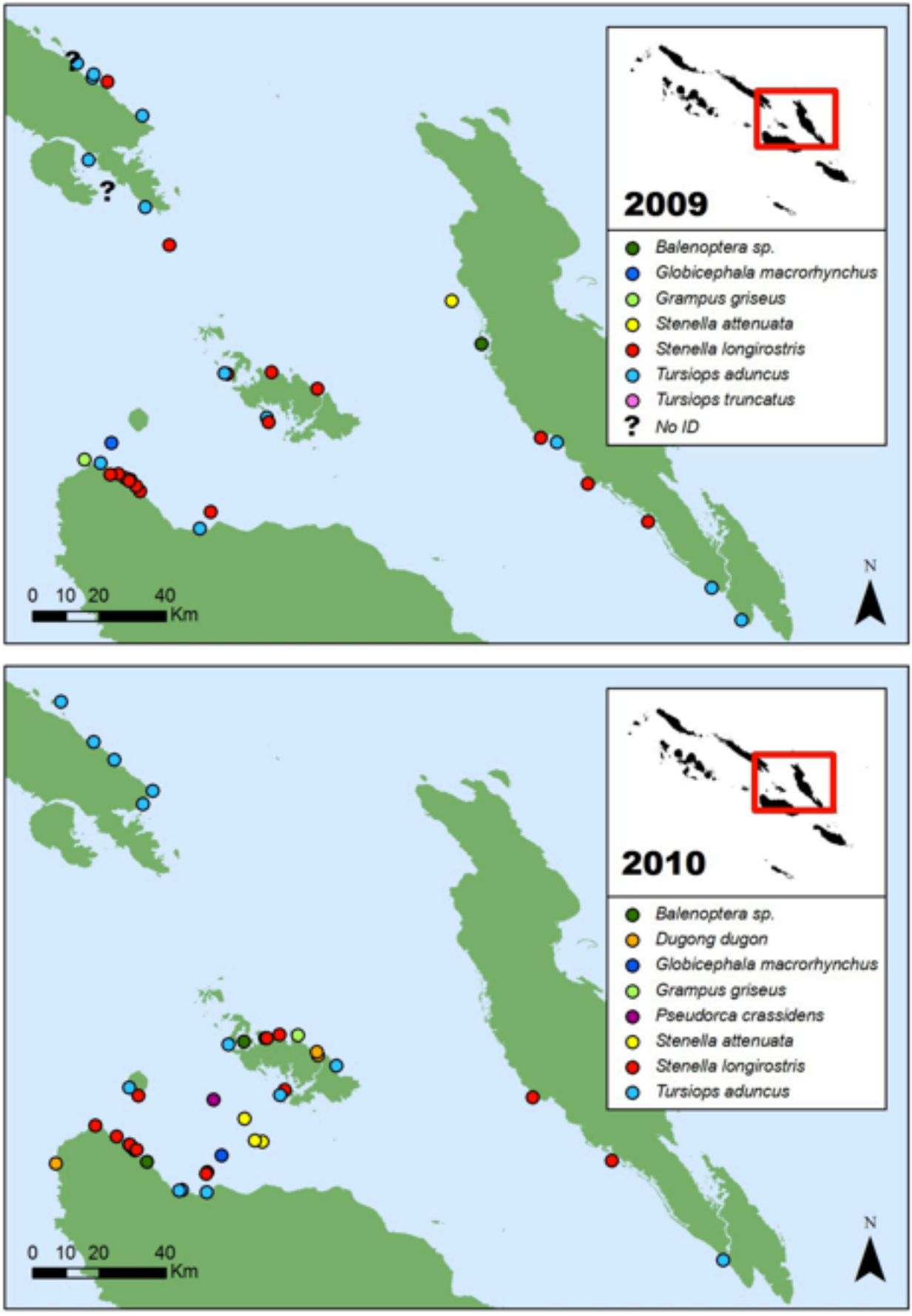

Figure 22: Geographic positions of marine mammal encounters in Central Solomon Islands (Oremus et al. 2011)

1995; Goto et al. 1997; Shimada and Miyashita 2001; Kahn 2006; Oremus et al. 2011) have been conducted to date. The Solomon Islands is an important migration corridor for both small and large cetaceans (Kahn 2006) and greater understanding of their ecology within Solomon waters may help towards their conservation and management.

Dugongs

The *Dugong dugon* exists in Solomon Islands particularly in areas which contain seagrass beds. Dugongs are hunted for consumption purposes in many parts of the Solomon Islands with anecdotal indications that it may be over exploited in some locations. No studies on the distributions and ecology of dugongs have been conducted as yet in the Solomon Islands. However, an interview survey of coastal communities in Makira, Guadalcanal, and Isabel was conducted in late 2010 and early 2011 to determine locations where dugongs have been sighted, local knowledge of the dugongs and general perceptions on the status of the species. Greater management initiatives coupled with comprehensive studies specifically geared towards informing conservation are currently required to protect the species.

Excessive nutrients and other pollution

Domestic pollution associated with excessive nutrients continues to be a problem since it was reported in the 2000 status of coral report by Sulu et al. (2000). There are no sewage treatment plants in Honiara or other semi-urban centres. In Honiara at least 75% of sewage still flows through a piped collection system directly into the sea without treatment. Locations such as the Ranadi Industrial site in Honiara, shipping slipways in Tulaghi, Aviavi and Taroniara in Nggela, Liapari in Vela Lavella and the fish processing factory at Noro in New Georgia probably contribute some level of pollutants to the marine environment, although no studies has been conducted to specify and quantify what these pollutants may be.

Logging and industrial scale plantations currently contribute significantly to excessive nutrients and sedimentation into the marine environment. Effects of excessive nutrients and sedimentation on coral reef systems include phase shifts to an algal dominated ecosystem and smothering of corals by sediment runoff from logged catchments. Logging operations currently occur in Choiseul, Vella Lavella, Kolombagara, New Georgia, Malaita, Nggela, Guadalcanal and Makira. Despite the environmental concerns of logging and industrial scale plantations, it is quite unlikely that they will slow down in the near future as they both make substantial contributions to the national revenue. Few studies on the effects of logging reported of the decline of benthic communities within river mouth environments of logged catchments (Morrisey et al. 2003). The most detailed study to date on the effects of logging on coral reef ecosystem is by Albert (2007) in Marovo lagoon. Anecdotal and historical evidence based on trace metal analysis of *Porites* corals indicate that changes in water quality of coral reef systems within Marovo lagoon coincided with the initiation of logging within the catchment areas (Albert 2007). Furthermore, water quality changes coupled with low levels of herbivory due to the intense fishing of herbivorous fishes, has resulted in shifts to an algae-dominated coral reef system in some parts of the lagoon (*ibid.*). Further clear felling in catchments may result in the complete transition of the entire Marovo lagoon to an algae-dominated system (Albert 2007). No studies have been conducted on the effects of logging in other parts of the Solomon Islands; it is possible that the effects would be similar to those reported by Morrisey et al. (2003) and Albert (2007) for Kolombangara and Marovo lagoon.

Coastal development: tourism development projects

Tourism in Solomon Islands is minuscule when compared to the level of tourism in other Coral Triangle (CT) countries. All the 6 major hotels are located in the capital, Honiara. Most tourism accommodation facilities in the provinces are small-scale with capacity of 4-20 for those based in the rural areas to 6-50 for those based at the provincial headquarters. There are currently no ongoing large scale tourism related coastal developments, however, there are future plans for large scale development at Anuha on Nggela and Kennedy Island in the Western province.

A growing concern with regard to coastal development is the issue of coral mining; corals (predominantly *Porites*) are mined from reefs and used to build coastal seawalls, seaward extensions of land and artificial islands. This will continue to be a problem in the future as coastal dwellers seek and undertake actions to adapt to sea level rise and coastal erosion. The only limits to such practice will be the non availability of corals from accessible reefs to collect from.

Natural disasters

Solomon Islands is situated on the `Pacific Ring of Fire' belt as well as within the `warm pool' region of the South Pacific Convergence zone; it is therefore

prone to natural disasters arising from plate tectonic movements and tropical cyclones. Possible natural disasters that may occur due to plate tectonic movements include: volcanic eruptions, earthquakes and tsunami. Active and dormant volcanoes occur in Solomon Islands; two active volcanoes are the Kavachi submarine volcano South of Vangunu in Eastern New Georgia and the Tinakula volcano far to the east in the Santa Cruz Group. Dormant volcanoes that still emit fumes are Savo Island between Nggela and Guadalcanal, Simbo volcano on Nusa Simbo Island and Paraso volcano on Vella Lavella. The volcanoes have not yet caused any major natural disaster. Earth tremors and earth quakes occur very frequently, however they do not always cause significant natural disasters. A recent major plate tectonic related natural disaster was by a mid ocean earthquake (focus: 10 km deep, 40km South-South East of Gizo) and the ensuing tsunami which occurred on 2nd April 2007. The aftermath included interior and coastal landslides, coral damage, (McAdoo et al. 2008) and dramatic uplift of coral reefs up to 3 m at some locations (Albert et al. 2007) by the earthquake and loss of lives and property by the tsunami (McAdoo et al. 2008).

Tropical cyclones are an annual event with Rennell, Bellona, Makira and Southern parts of Guadalcanal especially vulnerable to cyclonic impacts. Between 1969/1970 - 2009/2010 cyclone season 41 cyclones passed within 400 km of Honiara, an average of 1 cyclone per season (Abbs et al. 2011). Tropical cyclones were more frequent during the El Nino season with 1.3 cyclones per El Nino season than during the La Nina and neutral seasons; there were 0.6 cyclones and 0.9 cyclones respectively for La Nina and neutral seasons (Abbs et al. 2011). Current research and data analysis indicated that there will be fewer tropical cyclones in the South Pacific (which includes Solomon Islands) in the future; however, there will be an increase in the proportion of the number of intense tropical cyclones (Abbs et al. 2011; Australian Bureau of Meteorology and CSIRO 2011a). Impacts of cyclones vary, with no effects for low intensity cyclones to significant damage from wind shear, heavy rainfall and storm surges by intense cyclones. Although tropical cyclones occur frequently and impact coral reef ecosystems, the effects are usually not monitored, hence, not documented. While it may be argued that since tropical cyclones are frequent natural disturbance and could have potentially influenced the physical and biological structure of reef ecosystems in Solomon Islands, hence their resilience to such events, the contrary may be the case with intense cyclones.

Rehabilitation, restoration and restocking efforts

The Foundation for the People of the South Pacific International (FSPI) has been involved with ecosystem rehabilitation initiatives in some communities in Langa Langa Lagoon. The first project was the rehabilitation of coral reefs destroyed by dynamites and other forms of destructive practices which were done in 2003 – 2004. Good coral growth rates were observed at Laulasi and Gwaunaofa while progress at other sites was hampered by poor water quality (Hugo Tafea, Pers.comm). No further updates are available on the state of the coral rehabilitation project since FSPI stopped being involved in the project in 2004.

A second rehabilitation project was the Loa mangrove rehabilitation project also at Langalanga Lagoon, Malaita. This project was initially started by a Kalagwata community member, Mr Tisa in 2001. Mr. Tisa initially planted cocoa (*Theobroma cacao*) within a section of a wetland area which was devoid of mangroves (due to over harvesting for firewood and construction of houses). The cocoa plants, however, died so Mr Tisa resorted to planting and tending the mangrove species *Bruguiera gymnorhiza* instead within the area (*Bruguiera gymnorhiza* is an important species within the area as the propagules are consumed and wood used for firewood and construction of houses). The success of Mr. Tisa's efforts which several years later saw the utilisation of the planted mangroves by his family (use of seeds for food and the use of pruned branches as firewood as well as to generate income through the sale of firewood) became an impetus for other community members to replant areas that were devoid of mangroves. As at 2007 communities that were involved were Loa, Kalagwata, Dawn Break, Kukuli and Loa. Following community initiatives, FSPI assisted the communities to apply for assistance from the European Union (EU) sustainable forest project in 2007/2008. The European Union support was through a contribution of SBD$30,000 towards the construction of an office/information centre; disagreements on funding arrangements between the European Union and the community resulted in the cessation of the support in 2008. As at 2009, 7.75 hectares of mangroves have been planted with the remaining 12.25 hectares still to be planted. The WorldFish Centre (WFC) has also contributed to the project through the provision of technical support and training (Collin Gereniu, Pers.comm).

The Solomon Islands Government and ICLARM (now WorldFish Centre) were involved in the establishment

of a coastal aquaculture research facility at Aruligo on Guadalcanal in the 1990's to rear in captive the overfished giant clams (*Tridacna gigas*) and sea cucumbers (*Holothuria scabra*) with the aim of reef restocking as well as for the aquarium trade and aquaculture industry. Giant clams and sea cucumber were successfully reared and some reefs were reseeded. A project funded by Overseas Fisheries Cooperation Foundation (OFCF) of Japan to re-seed trochus (*Trochus niloticus*) and green snail (*Turbo marmoratus*) was also conducted at the facility, however, all these initiatives abruptly ended when the facility had to be closed due to the ethnic conflicts in 2000-2003. Besides these early efforts, there is currently (i.e. as at 2012) no restocking initiatives.

B.Emerging Issues for Marine Resource Use

Transboundary Issues

Solomon Islands share its borders with Papua New Guinea (PNG), Australian, Vanuatu, Fiji and New Caledonia. The nearest is that with Papua New Guinea on the north western end where people also share kinship ties across national borders; particularly between communities of Shortland Islands (Solomon Side) and Bougainville (PNG side) and Lord Howe and Pelau atolls (Solomons side) and Nukumanu and Tasman Islands (PNG side). Proximity of the borders coupled with kinship ties across national borders pose several resource management challenges. The first is with regards to transport of prohibited commodities across borders so that they can be sold. There are anecdotal evidence that sea cucumbers which are closed from exploitation are harvested in the Solomon Islands side (Lord Howe and Pelau) of the border and then transported to be sold on the PNG side of the border (to Tasman and Nukumanu then onto Kavieng and Rabaul before being sold to Asian markets). Similarly there are anecdotal reports of trochus and sea cucumbers harvested from Bougainville and transported to be sold on the Solomon side of the border during periods prior to the sea cucumber closures. The only way this can be managed is to synchronise resource closures/management between the neighbouring countries, unfortunately this is usually not easy given differences in national priorities and resource management regimes.

The second issue is with regard to migratory species which move between different national maritime zones, for example turtles which may nest in a different national maritime zones and forage at a different national maritime zone (Benson et al. 2011). Non synchronisation of resources and species management between countries may pose challenges for the overall protection and management of species which move between different national maritime boundaries. A concerted effort between different countries is therefore required in order to protect and manage species which migrate between the borders of Solomon Islands and other countries.

Mariculture

Mariculture and aquaculture development in Solomon Islands occurs on a very small scale. Early (but rather crude) attempts of aquaculture began in the 1950's when Mozambique tilapia *(Oreochromis mossambicus)* was introduced into fresh and brackish waters around the country (which included big water bodies like Lake Tengano in Rennel and Lees Lake on Guadalcanal). The Mozambique has become established in many fresh and brackish water creeks, pools and lakes around the country. Mozambique tilapia is harvested for consumption by locals with some culturing the species in small backyard ponds and has become an important food security commodity and protein source in some inland areas (WolrldFish Centre 2011). Other more conventional aquaculture/mariculture undertakings were the culture of shrimps at Ruaniu (West Guadalcanal) in the 1990's which was disrupted and has ceased operations since the ethnic conflicts in 2000. Mariculture of the seaweed *Kappaphycus alvarezii* was started in 2001 and it is still ongoing with the main production sites being Waghina (Choiseul), Rarumana (Western Province) and parts of Malaita.

The small-scale nature of mariculture and aquaculture in the Solomon Islands means that there are currently no environmental impacts of the practice. However, this may change. Solomon Islands has been identified as one of the countries in the Pacific which will not be able to meet its future fish supply demands for food security purposes (Bell et al. 2009; Weeratunge et al. 2011); one possible vehicle to meet future food security demands is mariculture and aquaculture (Bell et al. 2009). This means a possible increase in the scale and intensity of mariculture and aquaculture in the future. The WorldFish Centre and the Solomon Islands Ministry of Fisheries & Marine Resources (MFMR) are currently undertaking feasibility studies to culture the locally occurring species *Chanos chanos*; a popular mariculture species in Philippines, Indonesia, Taiwan and other Southeast Asian countries. *Chanos chanos* can survive in waters ranging from freshwater to salty water; however, it can only reproduce in salty water of

between about 33-35ppt. It is cultured either in land-based dugout ponds containing freshwater or in cages in the marine environment. Although measures can be taken to prevent environmental impacts by such practices, it is important that regulations and strategies are in place to prevent environmental impacts. Environmental impacts of mariculture and aquaculture may include: heavy consumption of plankton or benthos by caged or enclosed farmed organisms and consequent reduction of availability of food to adjacent natural communities, a focal point from which pathogens and parasites are spread, eutrophication problems from animal waste and unconsumed feed (Munro 1994) and subsequently algal or microalgal blooms which can increase biochemical oxygen demand; problems which the unregulated and uncontrolled *Chanos chanos* cage culture industry in Philippines have already witnessed (Anon. 2010b). A further issue with regards to mariculture and aquaculture is the possible introduction of exotic species for mariculture and aquculture purposes. It is important that comprehensive import risk assessments are done to prevent possible unwanted ecological consequences and detrimental impacts on native aquatic species.

Harmful algal blooms (HAB)

The extent of harmful algal blooms in Solomon Islands is unknown as no research on HAB has been conducted. However, people usually complain of headaches, body aches, general weakness for several days, illusions and strange dreams when consuming fish or shellfish collected from certain locations during certain periods of the year (Duke et al. 2007; Albert et al. 2011). It is possible that these symptoms are associated with HAB as the toxic red tide dinoflagellate species *Ceratium dens, Brachydinium capitatum* (Duke et al. 2007: 50), and *Pyrodinium bahamense* (Albert et al. 2011) are present in the Solomon Islands. In June 2011 a large fish kill occurred in Marovo Lagoon (Albert et al. 2011; Albert and Moore 2011) which was associated with an algal bloom of these species and a resultant deoxygenation of seawater; a natural event that was exacerbated by multiple local (increased nutrient input) and global (climate change) environmental pressures (Albert et al. 2011). One of the possible major contributors to the fish kill was the blooming of the toxic diatom *Psuedo–nitzschia (ibid.)*. According to Albert et al. (2011), there are no known records of *Psuedo–nitzschia* being naturally present in the Solomon Islands and that it is possible that it may be a recent introduction from log ships ballast water. The absence of baseline data on plankton of Solomon Islands (hence identification of newly arrived exotic invasive species) however, makes it difficult to ascertain such an assumption.

Ballast water, hull fouling and marine invasive species

The ports of Solomon Islands do not receive the huge volumes of ballast water that are discharged in various ports such as San Francisco, Chesapeake Bay or Melbourne. Solomon Islands ports are quite small and most of the ships that visit them are small to medium sized fishing boats, reefers and container vessels plus the odd luxury liner. However, there are some bulk handling ports, particularly the log exporting ports in Western Solomon Islands, Guadalcanal (includes Honiara), Makira and Malaita. No measurement or estimates of the amounts of ballast water that are introduced to these ports have been made, but since most log carriers arrive heavily ballasted to load logs and timbers, it is known that the volumes are significant enough to give cause for concern.

So far Solomon Islands do not appear to have had spectacular outbreaks of foreign aquatic exotic species in ports comparable with what has been recorded in Australasia, North America and Europe. There are no case histories quite like the spread of the zebra mussel throughout the Great Lakes and now the rivers of North America; the Pacific Sea Star which was introduced to Tasmania; the Asian kelp *Undaria* which ships brought from Japan and Korea to New Zealand, southern Australia and Argentina; or the myriad of species that have taken up residence in San Francisco Bay.

This does not mean, however, that these species are not arriving in the country. As James Carlton, one of the authorities on invasive species, has frequently stated, what you find depends very much on the number of people who are looking; currently no one is looking in the Solomon Islands. Although there are anecdotal reports of sighting of 'never before seen' species by lay persons and fishers, identifying the species usually requires the presence of a research organisation like a natural history museum to make the correct identification. So having enough marine ecologists and taxonomists on hand is very important. Unfortunately people with such skills are relatively rare in Solomon Islands. Even in Suva, which hosts the main campus of the University of the South Pacific, the number of experienced marine taxonomists is very small. Hence, there is a considerable need in the Solomon Islands for port

surveys in the major ports and for us to employ more marine taxonomists. Unfortunately marine taxonomy seems to have been a casualty of restructuring and semi-privatising research organisations in metropolitan countries such as New Zealand, Australia and the UK over the last thirty years. Ironically this preceded a period when monitoring biodiversity is suddenly in vogue in funding circles.

There are species that are probably introduced to our ports as fouling organisms. Many of the vessels operating in Solomon Islands are fishing boats from Japan, Korea, Taiwan, the Philippines and other parts of Asia. Some arrive with very fouled hulls, and they tend to remain in the area for long periods. In Honiara, for example, there are several Korean vessels that are semi-residents. Many of these vessels come from subtropical and tropical home ports, so the species on their hulls are likely to find the water temperatures of Solomon Islands to be compatible. Just how many species have been introduced by this means is unknown.

If the species that have been introduced directly to our ports via ballast or as fouling species is unknown, and even greater unknown, and probably a greater cause for concern are the species that may be introduced when ships travelling from Asia or North America to Australasia make so-called mid ocean ballast water exchanges. There is a perception, perhaps, that these mid or deep ocean exchanges are made hundreds of miles from any coast. But in the South Pacific in general this is not the case. If you look at a map of the Pacific you will see that there is a myriad of islands in the western and central Pacific. The only really empty parts are far to the east and in the far north (north of Hawaii) and in the far south east of New Zealand Chatham Islands.

Most trade with Australia and New Zealand is with Asia, and the ships that ply these routes travel through Indonesia, the Philippines and through the chains of Melanesian Islands like the Bismarck Archipelago, Solomon Islands, Vanuatu and New Caledonia. These islands semi-enclose several seas such as the Bismarck Sea, the Solomon Sea, the Coral Sea and also the Arafura Sea between Australia and New Guinea. Ships travelling from say Japan to NZ and Australian ports often travel south through Malaysian, Indonesian and Philippines waters and are often within sight of land. In the Solomon Islands, for example, some large bulk carriers travel through the double chain of islands which in WWII was called the Slot. Mid-ocean exchanges are made in these seas because in some cases it is the best opportunity for the ship's master to make the exchange especially when the surrounding islands afford some protection from the full force of open ocean swells. What this means, of course, is that much of the ballast water from Japanese, Korean, Chinese and other Asian boats that is exchanged for tropical water as the ships head for Australian and NZ ports ends up very close to or on our door step.

Fortunately few of our islands have anything resembling a continental shelf. Many are just the tips of submarine mountains. This may reduce the risk of foreign species establishing on our shores. Also, fortunately much of the ballast water that is exchanged probably comes from temperate Asian shores, so arguably the temperate species in the discharged ballast may not survive in the tropics. But by no means is all the ballast water of temperate origins. As the Cawthron Institute in New Zealand has shown when it monitored ballast water exchanges on ships travelling between Asia and New Zealand, ballast may be taken on in several ports some of which are subtropical or, as in the case of Singapore, are fully tropical. There are also ships that discharge ballast that has been taken on in tropical and sub tropical ports in the Indian Ocean in India and from the Arabian Gulf for example. These ships are very likely vectors for spreading tropical and subtropical species from subtropical regions north of the equator to the south, from the Indian Ocean to the Pacific and eventually to Solomon Islands. If no immediate efforts and actions to address the issue of ballast water and hull fouling is not addressed then events like the June 2011 fish kill in Marovo may be the beginning of future similar events. Legislations relating to this issue (e.g. Shipping Act 1998 which prohibits pollution of the marine environment) should be reviewed and if necessary, relevant clauses written in to take into account present issues and challenges of dealing with ballast water and hull fouling. While the necessary laws may be written, passed and gazetted, one of the main challenges, however, will be ensuring that the letters of the law are actually followed on the ground. While anecdotal reports of environmental malpractice may be present, the general absence of scientific whistle blowers based in universities and government-funded research organisations may make it difficult to provide the necessary evidence.

Climate change impacts

Trends in climate parameters for Solomon Islands are consistent with those generally observed for the Pacific Islands region (Ministry of Environment Conversation and Meteorology 2008). Air temperatures for the period 1951-2009 have been gradually rising, resulting in a similar rising trend for sea-surface temperatures;

sea surface warming rate since the 1970's was 0.12°C per decade. Sea level rise since 1993 is about 8mm per year, which is higher than the global average of 3.2 mm per year (Australian Bureau of Meteorology and CSIRO 2011b). Contrary to air temperature and sea level trends, annual rainfall for the period 1950-2005 have been following a downward trend with prospects of long dry spells associated with the warm phase of the El Nino-Southern Oscillations (Ministry of Environment Conversation and Meteorology 2008; Australian Bureau of Meteorology and CSIRO 2011b).

Current climatic trends do not bode well for Solomon Islands and the impacts are beginning to be evident in some locations around Solomon Islands. Impacts include the disappearance of some small low lying islands, saltwater intrusion of freshwater lenses, saltwater inundation and disappearance of coastlines and coastal vegetation (Ministry of Environment Conversation and Meteorology 2008). Future projections on the effects of climate change remain pessimistic (Brokovich and Schwarz 2010). Climate change will impact negatively on agricultural food production (Ahmed et al. 2011), biodiversity (Brokovich and Schwarz 2010) as well as on fisheries and aquaculture production (Bell et al. 2011; Pickering et al. 2011; Pratchett et al. 2011). Projections by Bell et al. (2011) predict changes in the distribution of Tuna with a resultant decline in the western Pacific and a resultant increase in the eastern Pacific as tuna move eastwards due to the effects of climate change - tuna supplies within waters of Solomon Islands will decline. Moderate increases in temperature and changes in water circulation will affect reproductive output, development and survival of corals, fish and other associated species which are important for coastal fisheries (Pratchett et al. 2011). All of these will significantly affect the supply of fish for food security as well as to generate income by individuals as well as by the government.

Ocean acidification

Ocean acidification is caused by the uptake of carbon dioxide (from emissions) by the oceans resulting in the formation of weak carbonic acid and a resultant a decline in the ocean pH. This consequently reduces the availability of dissolved carbonate ions required by many marine calcifying organisms (particularly corals, other invertebrates and coralline algae) to build their shells or skeletons (Pratchett et al. 2011). Aragonite ($CaCO_3$) saturation state in the Solomon Islands has declined from about 4.5 in the late 18th century to an observed value of 3.9 by 2000; seawater saturation state of above 4 is required for optimum coral growth and healthy reef systems (Australian Bureau of Meteorology and CSIRO 2011b), the prospects for Solomon Islands coral reefs are obviously on the gloomy side.

CHAPTER 6

Plan of Action, Initiatives, and Future Plans

The Solomon Islands National Plan of Action (SI-NPOA): Coral Triangle Initiative on coral reefs, fisheries and food security (Mininstry of Environment Conservation and Meteorology & Ministry of Fisheries and Marine Resources 2010) is the main document which provides visionary guidance for the management of coral reefs in Solomon Islands and is complemented by other related documents, e.g. the strategy for the management of inshore fisheries and marine resources (Ministry of Fisheries and Marine Resources 2010). The SI-NPOA was developed to be consistent with the 'Coral Triangle Initiative on Coral Reefs, Fisheries and Food security' Regional Plan of Action (CTI-CFF RPOA). However, its design seeks to take into consideration the local situations and circumstances which were raised by national Government agencies, NGO stakeholders including community-based groups and individuals during the consultation phase of its development.

The plan was envisaged to guide Solomon Islands Government and other stakeholders in implementing activities under the Regional Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI CFF), identifying national priority areas, objectives and specific activities under the CTI-CFF. This should be directed towards accomplishing the five goals agreed upon at the SOM1 (Senior Official's Meeting 1), which are: priority seascapes designated and effectively managed; ecosystems approach to management of fisheries and other marine resources fully applied; marine protected areas (MPAs) established and effectively managed; climate change adaptation measures achieved; and threatened species status improved.

In June 2008, a national CTI technical committee, comprising of major government agencies (MECM, MFMR, MNPAC and MFAT) and NGO partners (TNC, WWF, FSPI and WFC) was formed to work on this Action Plan. Guided by the Draft CTI Regional Action Plan, the team identified linkages between past/current/future programs in country that can serve as a basis for a CTI National Action Plan. An indicative list of national activities (Annex II of the CTI-CFF RPOA) was formulated and with the final adoption of the CTI RPOA in May 2009 by the CTI Leaders Summit, these activities were used as the *building blocks* for a comprehensive national framework.

With technical support by the USCTI Support Program, the lead Ministries (MECM and MFMR) re-examined national priority areas, objectives and specific activities under the CTI-CFF objectives. A Visionary National Stakeholder Workshop was held mid 2009 with the following recommendations: (i) *MECM and MFMR to be the focal points of the CTI-CFF implementation; (ii) Establishment of a Multi-stakeholder National Coordination Committee; (iii) Establishment of a CTI Unit within MECM and (iv) Formal endorsement of the draft SI NPOA by Cabinet* (CTI Visionary National Stakeholder Workshop Draft Report, 2009).

In early 2010, the Solomon Islands officially endorsed the Solomon Islands National Plan of Action on Coral Reefs, Fisheries and Food Security (PMOC, 2010). The five-year NPOA suggests a national strategy for the CTI-CFF Implementation through community based approaches in resource management with supporting themes of legislation and policy, data and information management and education and awareness raising (Mininstry of Environment Conservation and Meteorology & Ministry of Fisheries and Marine Resources

Figure 24: The Bismarck Solomon Sea Ecoregion

2010). The Ministry of Environment, Climate Change, Disaster Management and Meteorology (former MECM) and Ministry of Fisheries and Marine Resources remain the lead agencies of its implementation.

A. Monitoring and Evaluation Baselines with Indicators (and Management Issues)

Goal 1: "Priority seascapes"— improved governance and effective management

Solomon Islands prioritized the Bismarck Solomon Seas Ecoregion (or BSSE) as a suitable 'Priority Seascape". This marine area of approximately 2 million km² stretches from Vogel (Doberai) Peninsula of Papua, Indonesia, across the Admiralty and Bismarck archipelagos of Papua New Guinea to Makira Island of Solomon Islands (Figure 24). The area hosted populations of the critically endangered Western Pacific leatherback turtles *(Dermochelys coriacea) [Anon, 2007, IUCN Red List 2006]*. With the aim of conserving the endangered turtle species, an MOU was signed in 2006 declaring this trans-boundary partnership [i.e. Tri-nations Agreement on Leatherback Turtle Conservation in the Bismarck Solomons Seas Ecoregion]. Development of a regional leatherback BSSE action plan commenced to allow the three countries to improve conservation of the endangered leatherback turtle through information sharing, data exchange and research. It also plans to establish MPA networks within key critical habitats that support the Western Pacific leatherback turtle conservation efforts (Anon., 2007a).

National efforts were attempted to align activities with the BSSE program. However, ad hoc coordination, limited funding allocations from Government and other stakeholders, multiple authorities and users etc. prove ineffective implementation of the BSSE action plan (Horokou, pers comm., 2011.; Bilateral Brief for PNG/SI Bilaterals 2008/9). Characterized by its transboundary nature, implementation may often require high-level political initiatives by governments, local groups or third-party interventions by NGOs, academic institutions or international conventions (IUCN-WCPA, 2008).

With the established CTI platform, the BSSE program potentially can be revitalized to include broader CTI goals. Bilateral discussions over 2009 and 2010 had Solomon Islands engaged with PNG and Indonesia to discuss options for expansion of the existing BSSE Tri-nations Agreement. With the support from Solomon Islands Ministry of Foreign Affairs and External Trade, CTI agenda was included in 2 previous Bilateral Talks (2009 in Bouganville and 2010 in Gizo, Solomon Islands). In 2010 a bilateral discussion was held in Jakarta between Solomon Islands and Indonesia. These placed BSSE as still a potential priority seascape.

The Conservation International Seascapes Guidelines 2011 may add value to future Seascapes initiatives that

Solomon Islands may want to explore. Other potential seascapes sites may be explored such as the Coral Seas Program with Australia and the seascapes between Solomon Islands and Vanuatu.

Goal 2: Ecosystem Approach to Fisheries Management (EAFM)

There are currently no confirmed policies and regulations on ecosystem-based fisheries management (EAFM). However, this does not mean that the principles of EAFM are completely absent in Solomon Islands. Some principles of EAFM are reflected in the Fisheries Act 1998, fisheries regulations and within the management plans of some resources for which management plans exist (e.g. Live Reef Food Fish Trade Management Plan, Beche-de-mer management plan). Many environmental NGO's (e.g., The Nature Conservancy) currently working in the country to a certain extent help provide awareness, training and guidelines on EAFM to communities and assist in integrating EAFM principles in Community based resource management initiatives. The only EAFM policy which is currently being developed is that for the tuna fisheries (Pacific Islands Forum Fisheries Agency and Ministry of Fisheries and Marine Resources 2011). The Fisheries Act 1998 is currently being reviewed and it is envisaged that EAFM principles will be integrated into the revised Act (Permanent Secretary-Ministry of Fisheries and Marine Resources, Pers.comm.)

Goal 3: Improving management of MPAs

In Solomon Islands, Locally Managed Marine Areas (LMMAs) are common tools for resource management and conservation. As Hugh Govan highlighted, the LMMAs approach is widely accepted in Solomon Island as it builds on local and traditional strengths in resource management and captures communities' perceptions of likely benefits. This includes recovery of natural resources, improved food security, improved governance, access to information and services and the list goes on. Communities opt to manage and benefit from their own resources (http://lmmanetwork.dreamhosters.com/whatwedo/whyuseanlmma).

The Solomon Islands CTI National Plan of Action recognizes customary ownership of marine tenure, significantly implying that the people must be the primary beneficiaries of their resources and they should be provided the capacity to manage and adapt to looming threats such as climate change (Mininstry of Environment Conservation and Meteorology & Ministry of Fisheries and Marine Resources 2010). Therefore, this section of the report will highlight a brief status of LMMAs in Solomon Islands; however, the focus will be on the progress of management over the years.

Most LMMAs are established or formalized with support from partner-non government, academic institutions or government agencies. An effort to

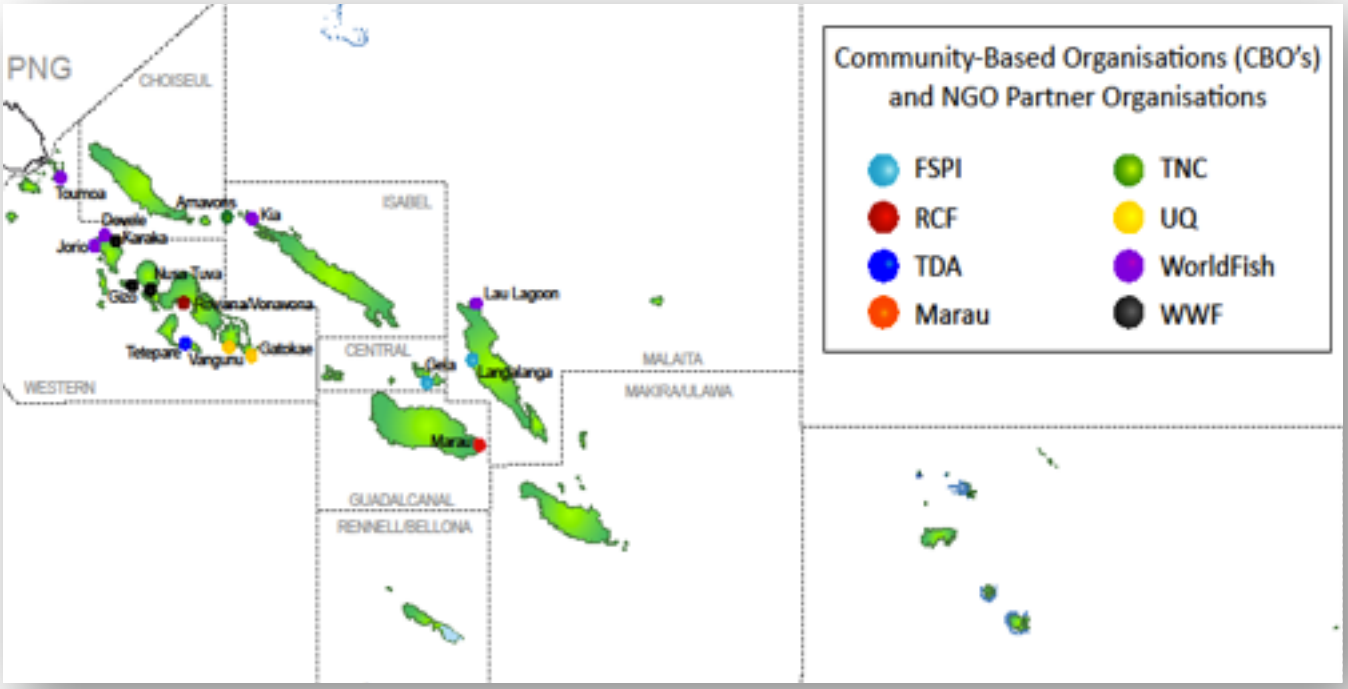

Figure 25: Locations of Locally Managed Marine Areas in Solomon Islands & supporting agencies

coordinate management of marine resources in Solomon Islands is through the establishment of Solomon Islands Locally Managed Marine Area Network (SILMMA) in 2003 and was later transitioned to the Government under the Ministry of Fisheries and Marine Resources (MFMR) in 2008. SILMMA is *a group of projects and practitioners including NGOs, government and communities who have joined together and are working to improve the success of their conservation and fisheries management efforts* (Solomon Islands Locally Managed Marine Area Network Strategic Plan 2009).

The map provided below shows the number of LMMAs in Solomon Islands and their supporting agencies.

Efforts to improve management in LMMAs in Solomon Islands

The establishment of SILMMA to coordinate and link efforts of technical experts, NGOs, practitioners and communities in resource management is a huge step in ensuring all efforts support a common national purpose. Acknowledging this purpose, the CTI NPoA recognized SILMMA as the coordinating point for all MPA or LMMA related activities. Thus, to ensure capacity is improved to manage LMMAs and MPAs the activities undertaken are listed in Table 9.

Systems for Management effectiveness

Since most of the LMMAs are supported by non-government organizations or academic institutions, a lot of their systems to monitor or improve management of LMMAs vary from each other. In an effort to ensure monitoring is standardized to supply statistically sound data for management the protocols/ guidelines listed in Table 10 were developed for SILMMA.

Table 9: Trainings and Workshops undertaken to improve management of LMMAs and MPAs

Level	*Location*	*Activity*	*Number of People trained / attended*	*Funding*
Regional Exchanges	Phuket, Thailand	Marine Protected Area Regional Exchange that focused on the design and operation of MPA networks and systems	4	USAID
Regional Exchanges	Batangas, Philippines	A Regional Exchange/Workshop on Monitoring and Evaluation for Improving MPA Management Effectiveness in the Coral Triangle countries	4	USAID
Regional Exchange	Denpassar, Indonesia	Regional Exchange and Workshop in Support of the Coral Triangle Initiative (MPAREX) – Designing and Supporting National and Regional MPA Systems in the Coral Triangle Countries	3	USAID
Regional	Nadi, Fiji	Locally Managed Marine Area Trainings	SILMMA Coordinator	LMMA
National	Gizo, Solomon Islands	Standardized Monitoring Protocol by TNC in May 2010	~20	Supported by TNC under CTSP funding
National	Gizo, Solomon Islands	Community Based Resource Management Guidelines Workshop by WWF in October 2010	~80	CTSP/USAID
National	Honiara, Solomon Islands	Community Based Resource Management Training of Facilitators by World Fish Center in 2010	~10	CTSP/USAID
Communities	Arnavons Islands, Solomon Islands	Look and Learn Visit for Gizo Marine Conservation Area Executive in 2011		CTSP/USAID

Table 10: SILMMA activities undertaken to ensure standardised monitoring protocols and guidelines

Activity	*Focus*	*Output*	*Funding*
TNC/SILMMA Community Monitoring Workshop, May 2010	Review and discuss monitoring protocols used by communities in SILMMA network Discuss objectives and goals of community monitoring.	Manual of Community-based monitoring protocol focusing on 2 monitoring methods; Underwater Visual Survey (UVS) and Catch per Unit Effort (CPUE)	TNC/CTSP
Guidelines for Community Based Marine Monitoring in Solomon Islands	Overview and review existing biological/ecological monitoring methods currently used in Solomon Islands	Draft Guideline for Biological and Ecological Monitoring.	WWF/CTSP
Proposed Development of Management Effectiveness System for Solomon Islands	In discussion	Guideline for Management Effectiveness Monitoring Tool	TNC/CTSP

Ways forward in improving of locally managed marine areas

Solomon Islands had for centuries practiced resource management traditionally and culturally. Changes brought by development to society impacts on the people and their resources but so much progress had also been done locally and nationally to meet these changes, to ensure people are able to adapt but still manage and benefit from their resources in order to ensure the people of Solomon Islands have improved fisheries, livelihood and food security.

Goal 4: Climate Change Adaptation

The global community have accepted and recognized that climate change is happening. Increased human activities – burning of fossil fuels, overexploitation of land and sea resources etc - will have serious consequences on the economies, social and physical sectors of countries especially the Least Developed Countries as Solomon Islands (Ministry of Environment Conversation and Meteorology 2008). For Solomon Islands in particular, coral reefs and subsistence fisheries are essential. Food and livelihood will dwindle with destructed coastal habitats, coral deaths and ocean acidification. These will add pressure to already complex financial, physical and social issues such as growing populations, health problems, high food prices, waste management issues faced by the country (Australian Bureau of Meteorology and CSIRO 2011b)

In the 2009 National Programmes of Action framework, Solomon Islands prioritized key vulnerable sectors in: agriculture and food security; water supply and sanitation; education, awareness and information; human settlements; human health; waste management, fisheries and marine resources; infrastructure and coastal protection. The Climate Change Division within the MECDM has the role to coordinate climate change adaptation activities. A number of climate change adaptation projects are currently in progress and are coordinated/managed by churches, non-government organisations and by several government agencies. A complete list of all those involved is, however, understated due to limited information and coordination of climate change adaptation programmes initiated by non-state organisations and/or civil societies.

Under the CTI auspices, efforts were made to coordinate and oversee climate change adaptation activities especially in the marine and coastal sector. A summary of national CTI activities on climate change and adaptation is as follows:

- Solomon Islands is Vice-Chair for the CCA Technical Working Group of CTI
- In April 2011, hosted the 2nd CCA Regional Exchange in Solomon Islands supported by the USCTI Support Program and the Western Provincial Government. More than 40 regional CT6 participants attended. Regional Exchanges arranged at the CTI Regional level boosted participation and understanding of climate change challenges by NCC agencies and NGO practitioners.
- Seven prioritized actions were listed in the recent REAP-CCA (p12. 2011) as Solomon Islands prioritized early actions. Collaboration with Climate Change Division and other partners are in

progress to assist the CTI program in its implementation.

1. Review NAPA (marine and coastal fisheries sector) to develop a Solomon Islands NEAP for marine and coastal sector CCA early action measures.
2. Continue vulnerability and adaptation assessments in priority sites and identified 'most vulnerable' sites including vulnerability and adaptation mapping.
3. Continue with the development of standard guidelines and criteria of conducting vulnerability and adaptation for marine and coastal sector including developing comprehensive baseline survey of coral reefs and socio-economic indicators.
4. Conduct national, provincial and community-level education and awareness of climate change issues. Create communication linkages for climate change news and updates at all levels – national, provincial and community.
5. Explore options to stream-line data (sea level rise, storminess, temperature, rainfall, cyclones etc) from disaster management, meteorology, climate change, fisheries and conservation activities for CCA efforts.
6. Identify and develop simple CCA measures for community livelihood options.
7. Explore options to align or integrate CCA and Disaster Risk Reduction efforts within MECDM.

- Trainings: Two targeted trainings (Rhode Island and PNG Training of Trainers) for CT6 participants on climate change adaptation were attended by Government officers, NGO and field practitioners. Supported by the USCTI Support Program. Both trainings resulted in a national training held in November 2011 for more than 40 youth environment volunteers on a CCA Local Early Action Toolkit. Volunteers were then deployed to five Provinces to raise awareness on climate change issues.
- Nine Provincial Governments have committed in a Joint Premiers and Mayors Communiqué declared in Gizo Western Province, September 2011 to integrate climate change considerations into their Provincial Plans and Programs. The USCTI Support Program through its CTSP program supported this Roundtable. This commitment will be used by future CTI projects (Australia or GEF/ ADB projects) to further work at the provincial or community adaptation projects.
- Vulnerability and Adaptation assessment standardization activity. With the USCTI Support Program, national V&A guidelines are tested out for marine and coastal sectors. Field activities were undertaken in Central Islands Provinces. Community adaptation measures may be identified and prioritized.

National CTI activities should focus on community-based adaptation needs and priorities using the community-based resource management principles outlined in the NPOA aligning with the newly established Climate Change Adaptation Policy.

Goal 5: Improving the conservation status of threatened species

Solomon Islands has attempted through national, provincial and local levels to address the issues of threatened marine species. An array of national and international frameworks and strategies which aims to protect threatened species are: Convention of Biological Diversity; Wildlife Protection and Management Act 1998, Regulation 2008; Environment Act 1998, Regulation 2008; Protected Areas Act 2010, Regulation 2012; Fisheries Act 1998; draft Species Management Plans for sea cucumbers, trochus, and Live Reef Food Fish Trade (LRFFT); Crocodile Ban; Dolphin Quota setting; regulation of Wildlife trade and Marine Turtles Strategic Action Plan.

No formal national red listing was done for Solomon Islands. Thus there is a dependance most times on traditional knowledge and local sightings. The IUCN Red List is used as a baseline to inform management decisions and interventions into the protection of threatened species, e.g., leatherback turtles, hump-head wrasse etc. A nation-wide survey for each species would require significant support with technical expertise and financial support. Solomon Islands with limited resources often depend on external support to conduct such activities. The only comprehensive document to date is the rapid assessment which was conducted in 2004 by Solomon Islands Government and The Nature Conservancy giving an overview of the marine and coastal richness and diversity. Detailed assessments and studies to build on the findings of the rapid assessment would greatly enable the protection and management of threatened species in particular the dugongs and sharks which currently do not receive any attention in terms of detailed assessments.

Detailed assessments on dolphins is currently on going (Oremus et al. 2011).

Most Marine Protected Areas or locally managed marines areas involve management for specific threatened species. Besides food sustenance and re-stocking within LMMAs/ MPAs, species protection is one of the objectives undertaken by several community-based conservation sites. Examples of some MPA's and types of species targeted for protection are given in Table 11 below.

Table 11: Examples of MPA's and species protected

Site/ Organization	*Type of Marine Species*	*Management Interventions*
Arnavons Community Management Conservation Area	Marine Turtles (green, leatherback and hawksbill)	Protection of nesting beaches Relocation Education and Awareness/ Look and learn Research
Roviana/ Vonavona MPA Network	All species including threatened species	Management Rules – open/ closed seasons Total Ban on all species
Tetepare Island	All species including threatened species	Ban on harvesting Size restrictions

The Regional SPREP Marine Program strategy for 2008-2012 Whales and Dolphins, Marine Turtles and Dugong highlight the regional efforts undertaken to address the threats faced by these species. As a member, Solomon Islands has aligned national species programmes to mirror these regional activities. National species programs are discussed in point form below.

- Marine Turtles: A Marine Turtle Strategy and Action for 2008-2012 was developed for marine turtles work in county. A previous survey of nesting beaches of green turtles was updated to show distribution of the species (see Figure 19 above). Field surveys, however, are due to ground truth this.
- Dolphin and whale work in Solomon Islands has gained interest by the global and regional community fuelled by reports of traditional dolphin hunting and dolphin exports. National surveys of dolphins and whales were undertaken from 2009-2011 by the Ministry of Fisheries and Marine Resources, Ministry of Environment, Climate Change, Disaster Management and Meteorology in partnership with the South Pacific Whales Consortium. The study selected four Provinces to do genetic sampling and observations – Malaita, Central Islands, Guadalcanal and Isabel. A finalized report on the survey was expected to come out in late 2011. No report was submitted during the write-up of this report.
- Dugongs: *Dugong dugon* is listed as "Vulnerable" in the IUCN RED List. Limited information is available in country for the species range and stock. Local anecdotal sightings were reported. However, biological surveys are needed to estimate its occurrence and population. Under the Convention on Migratory Species, (although not a party to), Solomon Islands in 2010 signed an MOU on Conservation of dugongs and its habitats.

B.Other Management Issues

Capacity building

The MECDM through the Department of Environment and Conservation (ECD) serves as a focal point for CTI program in country and shares the role with MFMR. Overall CTI coordination is done through two CTI National Coordinators (one from MECDM and one from MFMR), supported by the National Coordination Committee - a multi-stakeholder team (National Coordinating Committee (NCC)) consisting of around 15 core members (with representatives from related government departments, NGO's and tertiary education institutions). Both Permanent Secretaries for the lead agencies serves as Co-chairs to the NCC.

The NPOA implementation requires capacity-building programs at all levels to achieve both national and regional targets. An array of measures used by the NCC to meet capacity gaps for executing CTI focused activities include:

1. CTI Coordination within ECD [CTI program]. The use of one government officer to serve as National Coordinator. CTI Co-coordination by use of one national coordinator by MFMR under its Inshore Fisheries Division. Both officers will play the role to provide national coordination of both RPOA and NPOA activities as well as Secretariats to the NCC. Since 2008, both Ministries have put time

percentages for time allocated besides other Ministerial duties

2. Staff recruitment: In 2009, with anticipated expansion for the USCTI Support Program in national implementation, a National Liaison officer was employed. This is a 3 year position support by USCTI Support. The position currently sits within the ECD (MECDM). The TOR serves to support Coordinators for NPOA implementation, focusing on the five-year CTSP implementation in-country. This approach was replicated with the support through the Australia CTI Support Program for an 18 months volunteer to fill capacity gaps. Guidelines for communication, M&E, and implementation planning are part of the TOR.
3. Use of existing MECDM/MFMR staff: NPOA options for implementation: With the absence/ limited presence of Environment Officers Provincial based fisheries officers would serve as provincial contacts. Targeted trainings for implementation will include them. In parallel, efforts are undertaken through other programs to initiate and establish Provincial Environment officers in Provinces. With the expansion of MECDM, meteorology, climate change and disaster management officers in provinces may serve as conduits to delivery of CBRM.
4. NCC members: Technical Teams or Working groups were formalized within the NCC on a needs basis or a thematic focus. Partners are also partnered to use provincial or community contacts ,e.g., CTSP Partners, TNC, etc., including a capacity building focal point – Ms Lysa Simeon, and a Capacity Building Technical Working Group.
5. Youth Environment Program: MECDM has, since 2010, initiated in partnership with UNDP a Youth Environment Program with a long-term view of providing capacity to youths to engage in environmental activities. To date there are 55 volunteers in the program.
6. Partnerships and Networks: CTI goals and targets are shared by other projects. Advocating and promoting CTI themes with other government agencies and creating partnerships and networks are useful for integration and mainstreaming with other projects/programmes. E.g., SILMMA networks (MMAs or MPA sites); CTI Website hosted by SICHE –SNR; Provincial Governments Networks; and NCC members networks etc.

Financial considerations (Status of sustainable financing)

Sufficient financial resources are needed to establish, develop and maintain community based resource management and conservation work. Fund raising and sourcing of funds have become important components of projects or programmes. Various sources of funding are explored and tapped to meet the project's/programmes' implementation. Both the private and public sectors can be utilized in this regard. Examples include corporate fundraisings, External Aids, Multilateral Banks, Government grants. More recently, in the Solomon Islands, long-term financing mechanisms such as user fees, payment of ecosystems and trust funds were discussed or trialed.

Table 12 attempts to briefly report on the status in country of various types of fund raising (as suggested by Hinz, 2006).

Table 12: Status of the different fund raising mechanisms for resource management and conservation in Solomon Islands.

Type of Fund-raising	*Status or progress*
Major Donor (Large Gift) Fund raising: actions to pursue a gift of more than 500 Euro (per year or single gift).	Most locally-based organizations use this mechanism
Legacy Fund raising: actions taken to procure a gift through a person's will or estate.	Uncommon in Solomon Islands
Membership (Small Gift) Fund raising: actions to pursue a gift of less than 500 Euros per year.	Most locally-based associations e.g. Youth or Church-based usually find this mechanism useful
Merchandising : selling items such as t-shirts, stickers and calendars that are produced for organizations etc.	Commonly used by most conservation organizations.

Type of Fund-raising	*Status or progress*
Corporate Fund raising: pursuing a relationship with a company that involves a gift, commitment of support, or other monetary transfer	At the national level, corporate funding is not well planned or managed. Relationships with companies needs to be improved
Business and Industry Engagements: pursuing a relationship with a company where their actions directly help achieve conservation goals (carbon reduction, water management, etc.).	Not fully utilized. The Public-Private partnerships concepts have emerged recently under the CTI program. This can be explored at the national level.
Government and Aid Agencies (GAA) Fund raising: Entering a contractual funding program relationship with a government donor agency, including both bilaterals (e.g., AusAid) and multilaterals (e.g., World Bank, GEF), and their decentralized offices.	Most common utilized. The national level planning and project matching needs improvements as well as coordination of achievements.
Foundation Fund raising: Pursuing funds from a foundation, trust, or other private funding organization	Most conservation NGOs have utilized this mechanism for their projects and programmes. E.g MacArthur Funding Packages etc.

The NBSAP 2008 (Pauku and Lapo 2009) outlines Sustainable Financing as a one of its priority for biodiversity management and implementation. Sustainable financial mechanisms should be identified and set in place to ensure effective and sustainable management. The MECDM with the support of MamaGroun and CTSP (through TNC) have established a one-year position of a Sustainable Planner for Protected Areas. A Sustainable Financial Framework is being developed and is anticipated to be completed by the end of April 2012.

The Protected Areas Act 2010 intends to establish a 'Trust Fund' however legislation and policy as well as institutional arrangements gaps exist.

The ADB Knowledge Management project adds further capacity and support to explore opportunities to engage Payment of Environmental Services and other sustainable financing mechanisms.

Public Awareness

In country, there are a lot of awareness programs carried out by partner non-government organisations and the Government itself through the MECDM and MFMR. However, these efforts are uncoordinated and are occurring without a plan. But the areas where awareness programs are conducted, the communities and people are generally appreciative of the Coral Triangle Initiative and its goals. For example, in Honiara, the CTI Program runs a television spot aired nationally. During the Premiers Conference co-hosted by the CTI Program and Ministry of Provincial Government and Institutional Strengthening (MPGIS) a Premier reflected '...the first time I learn about the CTI Program is when the child in the TV explained what CTI is, and now during this forum I fully understand CTI and its intention'. A taxi driver exclaimed when asked if he knew about CTI, '...yes I know CTI, Solomon Islands and 5 other countries working together to manage their marine resources'.

In Western Province, Gizo Islands, WWF and WorldFish Center supported by USAID funding are conducting awareness programmes in the communities and people are aware of how their resources and management efforts contribute to the Coral Triangle. So generally, we can say that certain communities with access to information from Partners or Government are appreciative of CTI and its efforts to pursue safeguarding the marine resources.

Although awareness programs are carried out in various areas throughout the Solomon Islands, there is a need for a coordinated and strategic approach to deliver the CTI message across the entire Solomon Islands. The plan must consider that;

- ~80% of the national population is rural based; therefore, materials designed for them must be simple to understand and preferably more graphics than text.
- The ~20% Honiara dwellers have a huge influence in relaying messages to their 'wantok' in the villages. Therefore, messages designed must ensure they understand fully and be able to spread the correct message to their 'wantoks'. Efforts must be put into putting out clear key messages on CTI themes to ensure that accurate information is relayed to the general public and 'wantoks'.

- Isolation and remoteness of some islands, e.g., outer lying atolls of Malaita- Ontong Java. They too have significant resources management issues such as overharvesting of their island resources but logistics, centralized awareness plans and limited funding often limit attention to reach them
- Youths make up around 70% of the Solomon Islands population, therefore, messages scripted must suit this youthful audience. The youths are 'impressionable' and if we can strategize and engage them to consciously think about their resources, we will have a population that appreciates CTI and its efforts and plans.

The SI NPoA agrees that Education and Awareness Raising is important to achieving the NPoA and RPoA goals. This realisation provoked NCC to establish a Communications Working Group. The Communications working group is responsible to develop a Communications Plan that should strategically guide the CTI Program and its Partners to deliver awareness outcomes in a more coordinated manner aligned with the implementation of CBRM. It will also consider multiple media that are suitable to reach the remote islands and messages that target the rural, urban and youth audiences.

Whilst the Communication Plan is a work in progress, this does not hinder the CTI Program to conduct awareness programs; this included a TV spot broadcasted nationally and production of various fact sheets banners and brochures delivered during community consultations and Public awareness programs, e.g., World Environment Day. In addition to this, the WWF, WorldFish, TNC and FSPI are key partners in delivering the CTI and resource management messages to their piloted communities in Western and Central Solomons, namely, Choiseul, Western, Isabel, Central Islands, Malaita and Guadalcanal Provinces. It is anticipated that very soon the CTI and CBRM message will reach the eastern Solomons and eventually nation-wide. People and communities will be informed and engaged to carry out Community Based Resource Management in the communities.

CHAPTER 7

Supporting Documentation

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