



Solomon Islands

SOE

state of the environment report

By
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Solomon Islands 1993



Leary, Tanya

Solomon Islands ; state of the environment report /
Tanya Leary.

1. Environmental auditing 2. Marine resources—
Solomon Islands 3. Environmental policy—Solomon
Islands I. South Pacific Regional Environment
Programme II. Title

33.71
ISBN

AACR2

Prepared for publication by the South Pacific Regional
Environment Programme, Apia, Western Samoa.

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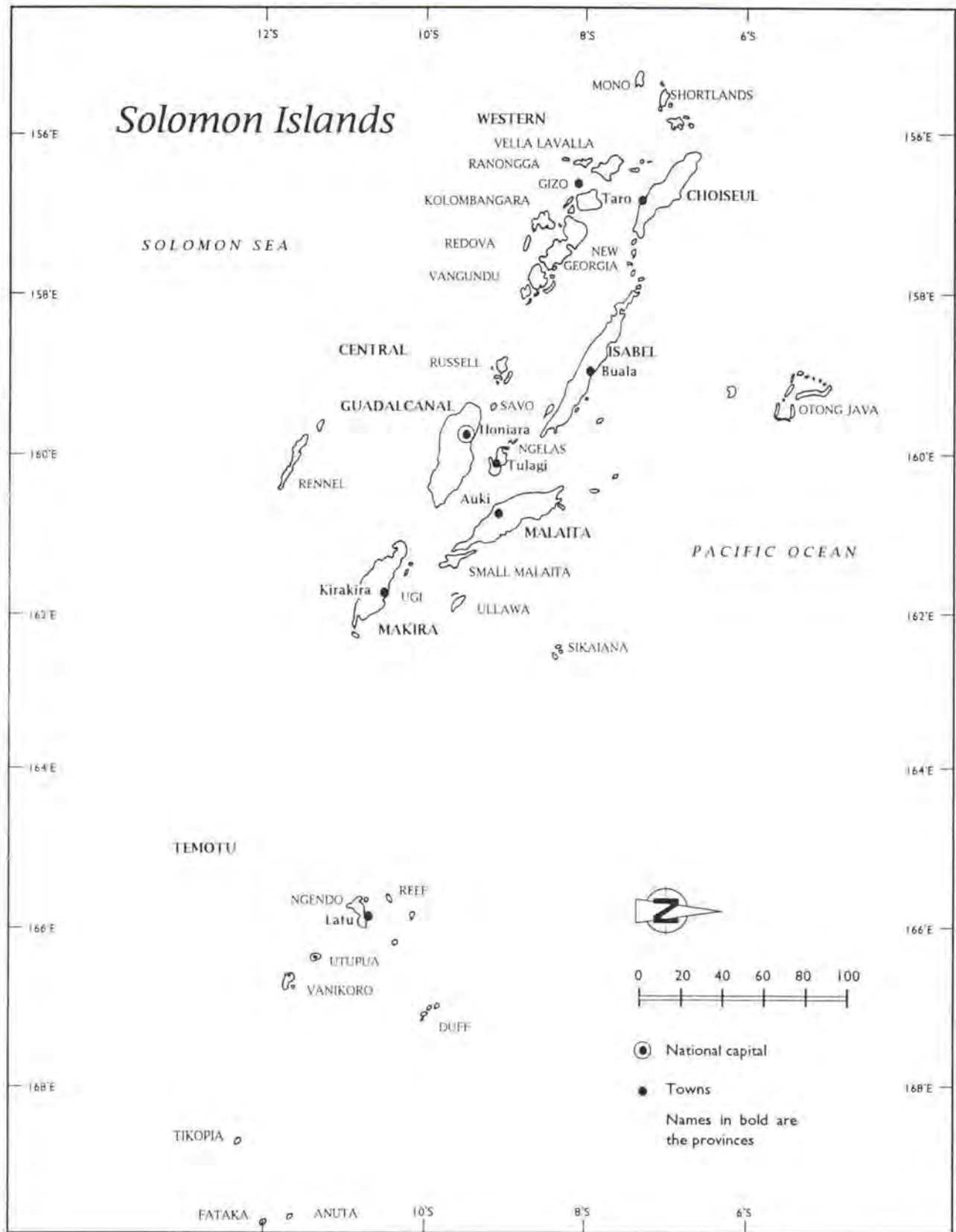
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Foreword

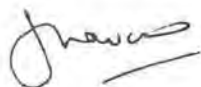
This document represents a concise report on the State of the Environment for Solomon Islands. It was prepared as a major element of the Regional Environment Technical Assistance (RETA) Project, one of the largest environmental projects implemented in the Pacific. The RETA Project has been made possible through the generous financial and technical assistance of the Asian Development Bank and the World Conservation Union. This assistance is gratefully acknowledged.

The main aim of the RETA Project is to develop National Environmental Management Strategies (NEMS) in a number of Pacific countries. The NEMS is a practical document which aims to identify the major environmental issues in Solomon Islands and the priority environmental programmes required to address them. The emphasis has been on ownership of the document by the Government and people of Solomon Islands. The process which has resulted in the preparation of the NEMS has involved many people and has been directed by a Task Force on Environmental Management and Sustainable Development, comprising relevant government and non-governmental organisations in Solomon Islands.

The State of the Environment Report for Solomon Islands was a major background document for the preparation of the NEMS. This report summarises the current state of knowledge about the environment of Solomon Islands in areas such as geology, vegetation, fauna and marine resources. It represents a comprehensive reference document which formed the major background paper to the National Environmental Seminar, held in Honiara in November 1991. The preparation of this report has also provided an important vehicle for raising awareness at the state and national level of the importance of environmental issues and how they could be integrated into decision-making processes.

I would like to pay particular tribute to the work of Tanya Leary, the RETA Local Consultant for Solomon Islands, who prepared its State of the Environment Report. Its comprehensive nature is a tribute to her efforts.

SPREP looks forward to working with Solomon Islands and with other regional and international organisations in tackling the environmental issues identified in this State of the Environment Report.



Vili A. Fuavao
Director

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Executive summary

This State of the Environment Report is produced as a part of the Regional Environmental Technical Assistance (RETA) Project, co-ordinated by the South Pacific Regional Environment Programme (SPREP) and funded by the Asian Development Bank. The RETA Project aims to strengthen the capabilities of a number of Pacific Island nations to achieve environmental management goals and hence deal effectively with environmental issues. A major output from the RETA Project in Solomon Islands is the development of a National Environmental Management Strategy (NEMS) which will reflect key environmental issues and define clear priorities for action. The NEMS will identify training and programmes to be implemented under the RETA Project.

As the environment is affected by all resource development, the NEMS will be cross-sectoral, and is being developed in consultation with relevant resource management and provincial authorities. This State of the Environment Report is one input into the development of the NEMS and will, along with the sectoral and provincial reports which shall identify environmental issues relevant to each authority, provide background for the NEMS seminar to be held in November 1991.

This State of the Environment Report does not attempt to provide new information about the Solomon Islands environment, but rather to synthesize what is already known of its natural resources and environment. It assesses the current state of Solomon Islands' environment, and the last section highlights some of the environmental issues and problems facing the country. These will be dealt with in more detail during the process of formulating a NEMS.

Solomon Islands is made up of six major and approximately 992 smaller islands, atolls and reefs. They range from large and rugged islands, clothed with primary rainforest, to small, bare sand and coralline atolls.

Solomon Islands forms part of the Pacific "Ring of Fire" lying at the boundary of the Australian and Pacific tectonic plates and there is therefore constant seismic activity, including earthquakes and volcanoes. Solomon Islands is geologically very young. The larger islands are almost entirely of volcanic origin. There are many mineral deposits, but the only ones likely to be of economic potential are gold, nickel and bauxite. There are also five good prospects for petroleum.

Forests and forest resources are of importance to most Solomon Islanders. They provide food, medicine, timber, housing materials, fuel, fishing materials, carving and weaving materials and have various agricultural uses.

Forests and woody vegetation communities covered up to 2.5 million ha of Solomon Islands in 1972. However the current extent and condition of the forests

is largely unknown. This has been a major constraint to planning for forestry and agriculture developments, and a National Forest Resource Inventory Project has commenced to address this issue.

There is much uncertainty about the extent of remaining commercial timber resources. The uncut productive forest was estimated at only 184,000 ha in 1978, but since then logging and clearing for cultivation have been taking place at upwards of 6,000 to 8,000 ha per year. There has been much concern expressed at the rate of forest utilisation and a number of estimates for the life of accessible timber resources have been made, all of which have been based on very limited or outdated data. The most optimistic estimate is 36 years, the least is 15. In 1990 there were 15 licensed logging companies (only 10 of which were operating) and 17 licensed sawmillers operating. All provinces with the exception of Central Province have been or are subject to logging operations.

A major concern is the shortfall between the rate of exploitation and the rate of replacement by reforestation plus the growth increment in the logged remnant forest. The low level and virtual lack of reforestation on customary land where 95 per cent of the current logging is carried out is of concern. The majority of reforestation projects are carried out on government land, averaging under 1300 ha in total per annum.

Solomon Islands animal life is of international importance. It has a greater diversity of animals than any other Pacific Island nation. There are approximately 223 species of bird, 52 species of native mammal, 61 species of terrestrial reptile, and 17 species of frog. Solomon Islands fauna is also unique. A large proportion of the animals are endemic (i.e. they are not found anywhere else in the world). Of its fauna, 82 per cent of the birds, 50 per cent of the mammals, 41 per cent of reptiles and 41 per cent of frogs are endemic.

Many animal species are only found on one or two islands, making them more vulnerable to extinction from large-scale habitat changes. If Solomon Islands endemic animals are lost, they are not just lost from their own country, but from the whole world. Many of these species already appear to be threatened. Nine species of bird, four species of reptile and four species of mammal may already be extinct. A further four species of bird, twenty species of mammal and four species of frog appear to be vulnerable to or are threatened with extinction.

Despite Solomon Islands' wealth of animals, very little is known about their distribution, status, ecology and habitat requirements and it is therefore difficult to assess the potential threat of large-scale habitat changes.

The reliance of Solomon Islanders on marine resources is reflected by one of the highest per capita rates of seafood consumption in the world. Yet the status of Solomon Islands marine habitats such as coral reefs, mangrove and seagrass beds

and many marine resources is not well known. An assessment of the stocks of many marine resources (with the exception of finfish) has not been made. But there are indications that bêche-de-mer, green snail, trochus, blacklip, goldlip, crocodiles and turtles are being harvested at unsustainable rates.

The population of Solomon Islands is predominantly Melanesian (94.2 per cent), with 3.7 per cent Polynesian, 1.4 per cent Micronesian and the remaining 0.7 per cent of Chinese or Caucasian descent. Linguistic evidence has revealed that at least 65 languages are still spoken in Solomon Islands. There is a rich and diverse culture, traditions and custom, much of which is still relatively intact.

The population growth rate of 3.5 per cent is one of the highest in the world. Some small islands now have very high population densities. These are islands where considerable pressure is or will be felt on limited land resources for subsistence agriculture and development needs, and are likely to be areas with growing environmental concerns.

The Solomon Islands economy is largely subsistence. This is reflected in the small proportion of wage and salary earners, who make up only 8.3 per cent of the total population. Land resources are extremely important to most people for their livelihood.

The agriculture sector is the largest contributor to Gross Domestic Production at around 36 per cent, followed by the forestry and fisheries sectors making a combined contribution of around 11 per cent. External trade plays a significant role in the country's overall economic activities. Exports are confined to a narrow range of primary and processed products, while imports vary over a wide range. Fish and timber have traditionally been the two largest export earners, generally contributing to over 60 per cent of export earnings.

The Central Bank predicts a scope for growth in export earnings of about 50 per cent over the next five years. Tourism is predicted as a major area of growth with great potential for improving the balance of payments, alongside fisheries and forest products and probably ahead of agriculture and minerals.

An overview of environmental issues in Solomon Islands is provided. In developing a National Environmental Management Strategy, the current RETA Project is further reviewing, identifying and prioritising environmental issues and problems, and developing strategies for addressing them. This process is being undertaken in conjunction with the relevant national resource management sectors and provincial authorities. It is not the intention of Chapter 6 to pre-empt this consultative process, but to provide a brief overview of environmental issues relevant to Solomon Islands which will act as a starting point for the national seminar to be held in November 1991.

Environmental issues discussed include: population growth; lack of environmental information; lack of institutional capabilities; threats to terrestrial flora and fauna; degradation and over-harvesting of coastal and marine resources; pollution; waste disposal; peri-urban issues; land degradation; pesticides and other chemicals; and mining.

Solomon Islands does not yet have many of the environmental problems of some other nations, but it is currently at the "crossroads" for deciding the fate of its environment. Development decisions and resource management actions taken now will dictate the natural heritage left for future generations to use and enjoy.

chapter 1 ♦

Introduction

1.1 Background & scope

In February 1990, the South Pacific Regional Environment Programme (SPREP) requested technical assistance from the Asian Development Bank to strengthen the environmental capabilities of a number of Pacific Island countries. This resulted in the formulation of the Regional Environmental Technical Assistance (RETA) Project over a two and a half year period.

One of the main outputs from the RETA Project will be the development and implementation of a National Environmental Management Strategy (NEMS) in five Pacific Island countries: Solomon Islands, Tonga, Republic of Marshall Islands, Cook Islands and the Federated States of Micronesia.

There are a number of tasks involved in the development of the National Environmental Management Strategy for Solomon Islands. These include:

- 1) a review of the State of the Environment of Solomon Islands;
- 2) preparation of reports for each of the relevant resource management sectors, to identify environmental issues relevant to each sector and means of addressing them;
- 3) preparation of reports for each province identifying environmental issues pertinent to each province, and means of addressing them;
- 4) a review of legislation pertinent to environmental management in Solomon Islands; and
- 5) a review of existing administrative requirements to implement the NEMS.

These will provide inputs for the National Environmental Management Strategy seminar to be held in Honiara from 19 to 21 November 1991. Development of the

NEMS will involve all relevant sectors and provincial representatives and there will be over 40 participants at the national seminar.

The output from the national seminar will be the NEMS with an appropriate implementation schedule. The NEMS will reflect key environmental issues and will define clear priorities for action. The NEMS will also identify appropriate training in environmental management and protection and appropriate environmental management projects. These will be implemented over the remaining period of the RETA Project.

This State of the Environment Report does not attempt to provide new information about the Solomon Islands environment, but attempts to synthesise what is already known of its natural resources and environment. In many cases, this is very little and deficiencies in essential information are highlighted.

This report assesses the current state of the Solomon Islands environment, and the last section highlights some of the environmental issues and problems facing the country. These will be dealt with in more detail during the process of formulating a National Environmental Management Strategy, and it is not the intention to preempt the consultative process. In essence it provides a background to the development of the National Environmental Management Strategy which will link environmental management with sustainable development.

1.2 Geography

Solomon Islands lies in the south-west Pacific roughly between latitudes 5°S and 12°S and longitudes 152°E and 170°E. There are now eight provinces, each with its own provincial government: Central, Choiseul, Guadalcanal, Isabel, Makira, Malaita, Temotu and Western. The boundary for Choiseul Province has not yet been gazetted. Solomon Islands consists of a double chain of six major islands with approximately 992 smaller islands, atolls and reefs peripheral to and intermingled with them. The islands range from large, rugged and mountainous islands, clothed with luxuriant primary rainforests, to small, bare sand and coralline atolls.

The islands contain a diversity of landforms and life forms, and all have their own individual beauty. The natural resources of Solomon Islands are part of the future wealth and natural heritage of all its citizens. The environment and natural heritage of Solomon Islands is something which all should be proud of, and play a part in ensuring that the environment is well managed and its natural resources used wisely.

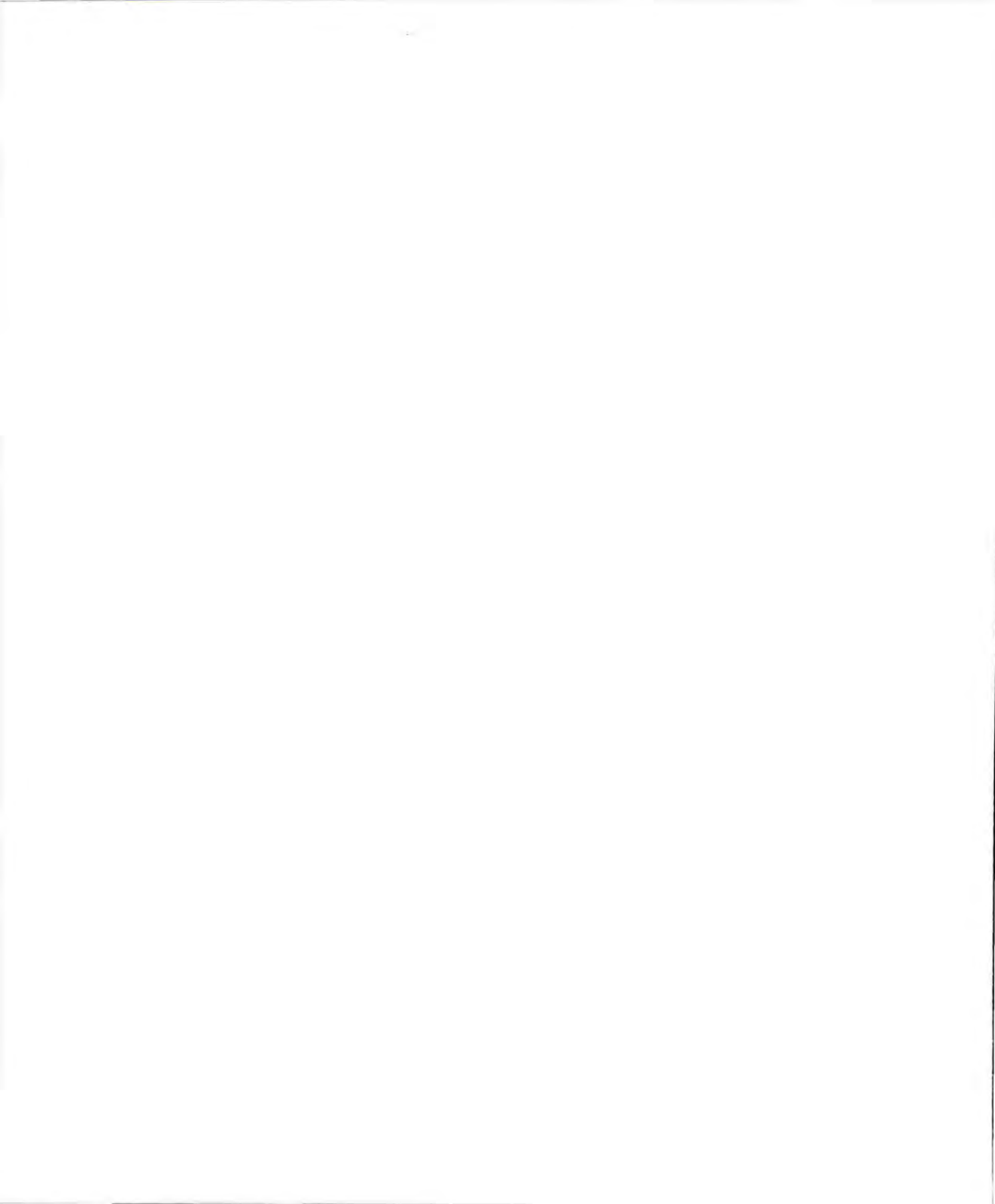
1.3 Climate

Solomon Islands' proximity to the equator gives it a typically tropical climate with a relatively high and uniform temperature, high humidity and abundant rainfall. Almost all of Solomon Islands, except for the area from northern Guadalcanal to the Nggelas and possibly southern Isabel, can be classed as "continuously wet" (over 40 weeks per year with more than 5 cm rain per week) (Hansell & Wall 1976). The mean annual rainfall is from 3,000 to 5,000 mm but there is much variation depending on topography, latitude and orientation of the islands to the prevailing winds. The south-east of most of the larger islands, which are backed by high mountains, are generally known as "weather coasts" and tend to have higher rainfall. From May to October the south-east trade winds blow, and during this time the weather coasts of Guadalcanal, Malaita and Makira have a rainfall peak. The lee side of the islands experiences a drier season at this time.

From November to April the wind is predominantly from the north-west, bringing heavy rains and cyclones. Very strong winds are associated with cyclones and entire swathes of forest can be completely defoliated and villages destroyed (Hansell & Wall 1976). An average of 1.2 cyclones passes through Solomon Islands each year, but not all of these cause damage.

The temperature is relatively uniform, ranging from 22°C to 31°C throughout the year. Daytime temperatures usually range from 26°C to 29°C with an average maximum of 31°C. Inland temperatures tend to be higher but temperature also decreases with altitude.

Relative humidity shows little seasonal variation but has a marked diurnal fluctuation. Humidity is highest in the mornings and regularly reaches 90 per cent.



chapter 2 ♦

The terrestrial environment

2.1. Geology & geomorphology

2.1.1 State of knowledge

Vedder and Coulson (1986) review previous geological investigations and the following is drawn largely from that source. Before the establishment of the British Solomon Islands Geological Survey in 1950, very little was known of the geology of the islands. The Geological Survey initiated a programme of reconnaissance geological mapping at a scale of 1:200,000 in a collaborative effort with the University of Sydney. In 1962, this reconnaissance work was compiled into the first geological map of Solomon Islands (Coleman 1965; Coleman et al. 1965).

From 1963 to 1975 a regional geological mapping programme at a scale of 1:50,000 was undertaken. By the end of 1975, south Malaita, eastern Outer Islands (Temotu Province), north-west San Cristobal (Makira), Savo, the Russell Islands and Mborokua, western Florida and Ulawa were mapped at 1:50,000. Between 1976 and 1979, geological maps of Shortland Islands and Choiseul were finished. Mapping of New Georgia was completed in 1983, and Isabel in 1990. Four 1:100,000 and one 1:250,000 map sheets for Isabel and the map for the eastern Floridas are yet to be published. Northern Malaita and large parts of San Cristobal (Makira) remain to be surveyed and mapped and constitute a significant gap in the knowledge of island geology. A survey programme for north Malaita commenced in 1990, and is scheduled to commence in Makira around 1994 following completion of the Malaita work.

Topical research complementary to the mapping programme has been done by a number of workers.

2.1.2 Palaeogeography & geology

Solomon Islands forms part of the Pacific "Ring of Fire", lying at the boundary between the Pacific and Australian tectonic plates. At this plate junction there is constant seismic activity including earthquakes and volcanoes. There are three land and at least two submarine volcanoes, plus areas of thermal activity.

At present two plates are converging, with the Australian plate being drawn down or subducted beneath the Solomon Islands archipelago along a trench which lies to the south of the islands. The interaction between the Pacific and Australian plates has resulted in the uplift and deformation of segments of the ocean floor which are elevated above sea level, together with their overlying sediments. Intermittent volcanic activity has also contributed substantially to the land masses which now constitute Solomon Islands.

Solomon Islands is geologically relatively young. The larger islands are almost entirely of volcanic origin and consist of lavas ranging from picroite basalts to basaltic andesites. Because of their recent emergence most islands are surrounded by uplifted coral terraces.

The country's major geological features have been described by Coleman et al. (1965), Coleman (1965; 1970) and Hackman (1973), and the individual islands in more detail by a number of others. It is not the intention of this section to reiterate these works, but to summarise in broad terms the general structure and lithology of the islands. Traditionally, Solomon Islands has been divided geologically into three main provinces:

- 1) the Pacific Province (Malaita, Ulawa, and north-east Isabel). This province consists of basalts erupted under submarine conditions, overlain by thick sequences of limestone originally deposited in deep water on the ocean floor.
- 2) the Central Province (a belt extending from San Cristobal through to Choiseul and invading Florida, San Cristobal and most of Guadalcanal, Santa Isabel and Choiseul). It too consists of a basement of submarine basalt lava and these have been in part metamorphosed (mineralogically altered). The lavas are overlain by limestones and clastic land-derived sediments which accumulated during the Oligocene and Miocene eras. Volcanic rocks and intrusions of this age are locally common, and the associated volcanoes supplied much of the detritus found within the sediments, either directly as volcanic ash, or indirectly through erosion; and
- 3) the Volcanic Province (New Georgia, western Guadalcanal, Savo, the Russell Islands, parts of central and south-eastern Choiseul and the Shortlands). It consists of lavas and fragmental volcanic rocks derived from a series of volcanic centres which have as a group been active along the south-western margin of

Solomon Islands since the end of the Miocene. This volcanic activity is related to the subduction and partial melting of the Australian Plate.

A fourth province is sometimes recognised: the Atoll Province (Rennell, Bellona, Indispensable Reefs, Ontong Java and Sikiana). The Atoll Province consists of upraised coral atolls and does not form part of the main Solomon Arc.

The Santa Cruz group is at the northern end of the New Hebrides Island Arc and shows features comparable to the Central and Volcanic Provinces of the Solomon Islands Arc (Hackman 1973).

2.1.3 Minerals

Arthurs (1979) states that during the late 1960s and early 1970s Solomon Islands experienced something of a claim rush by mineral exploration groups, however results were generally not encouraging and commercial prospecting activity declined in the late 1970s. There has been a more marked decline in prospecting activities in the past three years, with only two licences current and neither of them active.

There are many types of mineral deposits in Solomon Islands, but the only ones likely to be of economic potential are gold, nickel and bauxite.

Gold has long been known in veins in the Gold Ridge volcanics of central Guadalcanal. This area is most likely to be the site of the first open-cut mining in Solomon Islands. Investigations at Gold Ridge have ceased but the Government is hopeful that future tender operations will bring in a suitable investor. Alluvial gold in the Chovohio River which drains Gold Ridge on Guadalcanal is the only residual deposit currently being worked.

Nickeliferous laterites cap some of the ultramafic rocks in Solomon Islands, however moderately large tonnages of low-grade nickel have only been reported from eastern San Jorge, Jejevo and Tataka in Central and southern Isabel. The San Jorge, Tataka and Jejevo deposits are currently subject to a proposal by Bugotu Mining Co. for open-cut mining. The company holds a prospecting licence for San Jorge and Tataka areas and is currently under obligation to carry out a feasibility study.

Bauxite clays form in three different environments in Solomon Islands but those formed on upraised reef limestones of west Rennell, Waghena, Santa Cruz, and Munda in New Georgia are the most likely to be economically viable. Bauxite mining was proposed on Rennell by Mitsui in the mid- to late 1970s but the proposal was dropped due to failure of negotiations with landowners and environmental concerns.

2.1.4 Construction minerals

Maranzana (1969) recommends that the limestones of the Wairokai district of Malaita be considered for use in cement manufacture. Volcanic ash with pozzolanic properties which could be used for the manufacture of highly resistant cement occurs on western Guadalcanal, Gizo and Choiseul (Grover 1965). Some gravels and sands are extracted near Honiara for local construction purposes and recent reef limestones are used for subgrade on roads and airstrips. Currently there are proposals to extract reef rubble from beaches for use in aquariums.

2.1.5 Petroleum

No petroleum extraction has been undertaken in Solomon Islands, however onshore exploration began in central Guadalcanal in early 1960. Offshore seismic exploration by various companies began in 1969 and is summarised by Coleman (1989). About 25,000 km of sea bed has been surveyed in Solomon Islands territories, of which half is of fair to excellent quality (Coleman 1989). Coleman (1989) states that the following five areas have good prospects but require additional seismic reflection survey before a full evaluation of their petroleum potential can be made. These areas are:

- a) Mbokokimbo Basin and marine extensions, eastern Guadalcanal;
- b) flanks of Iron Bottom Basin, north of Honiara and between Guadalcanal and Florida;
- c) south-western flank of the high between Florida and San Jorge Island and possibly also the north-eastern flank;
- d) Manning Strait between Isabel and Choiseul;
- e) parts of the shelf and upper slope area, Choiseul to Shortlands.

The document produced by Coleman (1989) was specifically designed to convince petroleum geologists that Solomon Islands waters are an intrinsically attractive target for petroleum exploration. Solomon Islands Government (SIG) is keen to encourage further exploration. No companies have yet shown interest.

2.1.6 Soils

Twenty-seven groups of soils are recognised from Solomon Islands, and have been mapped by Hansell and Wall (1976) and Wall et al. (1979) using U.S. soil taxonomy. A variety of soils is found in Solomon Islands, some specific to certain geological and landform conditions, but will not be described in detail here. The most agriculturally important soils are the recent alluvial soils found only on the north Guadalcanal plains. They are the most fertile of all Solomon Islands soils.

As a whole the soils are rich in nitrogen, phosphorous and organic carbon, but relatively poor in potassium and magnesium. Phosphorous is most abundant in soils on limestone and least abundant in those on basic and ultra-basic rocks. Organic matter is an important component in the topsoil where the bulk of the soil nutrients are held. Generally, the soils have good structure, are well drained and usually deep. The upland soils tend to be high in clay (Lees 1990).

2.2 Vegetation

2.2.1 State of knowledge

Relatively few people have worked on the flora of Solomon Islands. Major publications include Walker (1948), Whitmore (1966; 1969a; 1969b), the Danish Rennell and Bellona Expeditions (Wolff 1958), the Royal Society Expedition (various authors), Hansell and Wall (1976), Lewis and Cribb (1991), and Henderson and Hancock (1988).

The national collection at the Honiara herbarium holds about 30,000 plant specimens. These collections were largely made by Forestry Division workers (1965-1972), the Royal Society Expedition of 1965, T. C. Whitmore (1962-1964), E. S. Brown from the Agriculture Division (1954-1956), Geoff Dennis (1965-1972) and D. Glenny and M. Qusa (1990-1991). The collections are mostly of vascular plants, and the tree flora are better represented than other groups.

The vegetation cover of Solomon Islands was analysed by Hansell and Wall (1976) and vegetation maps showing the distribution of the major formations have been published, but the formations were based on the interpretation of aerial photographs. Schmid (1978) states that from the botanical point of view the number of formations is too few and does not always show clear distinction in floral composition or in some environmental factors. In addition these maps are now very much out of date with much land clearing and several cyclones having occurred. The National Forest Resources Inventory Project plans to update information on vegetation types in Solomon Islands. The main objectives of the National Forest Resources Inventory Project are to:

- 1) improve the Forestry Division's capacity for practical and reliable planning for commercial and village level utilisation in the short and long term;
- 2) make it possible for the Division to update forest resource information; and
- 3) improve the capacity of the Forestry Division to make rational decisions concerning the issue of logging licences.

Further environmental objectives of the National Forest Resources Inventory Project are to:

- 1) identify, describe and map the major ecological domains;
- 2) identify and map major centres of biodiversity and areas of particular biological significance which SIG should consider for some form of protection; and
- 3) list those areas where restraints upon logging operations are needed in order to conserve a range of values.

2.2.2 Diversity & endemism

Henderson and Hancock (1988) list a total of 3,210 species of vascular plants, with 1,077 genera and 205 families. They estimate that the true total may lie in the vicinity of 4,500 species when unrecorded species are included. However there are a large number of synonyms and mis-identifications in their list, and these figures should be taken with caution. The components of the flora are given as: dicots 1,941 species; monocots 880 species; gymnosperms 22 species; and ferns 367 species (Henderson & Hancock 1988).

Solomon Islands flora has its strongest affinities with that of Malesia (the area including Papua New Guinea, Malaysia, Indonesia and the Philippines), but has fewer families, fewer genera and fewer species because it is geologically recent and was never linked by land to any other continent (Whitmore 1969b). There are no endemic families (found only in Solomon Islands) recorded and only three endemic genera: *Kajewskiella* (Rubiaceae), *Allowoodsonia* (Apocynaceae) and *Homolacladum* (Polygonaceae) (Whitmore 1969b). There is no estimate available for endemism in the vascular flora taken as a whole at species level. The estimate given in Henderson and Hancock (1988) is incorrect as their definition of what is endemic is confused.

There seems to be little endemism within the islands, the best-known case being the tree genus *Dillenia* (Whitmore 1966). The islands with the highest rates of endemism appear to be Santa Cruz and Guadalcanal (D. Glenny pers. comm.). In the case of Guadalcanal this may be a reflection of more intensive collection.

Schmid (1978) compares the floras of New Caledonia, Fiji, Solomon Islands and Vanuatu. He concludes that New Caledonia is richest in species, followed by Solomon Islands, Fiji and Vanuatu. The level of endemism is likewise compared and he suggests that New Caledonia is the highest, although the rate is fairly high in Fiji and perhaps Solomon Islands, but falls to around 15 per cent in Vanuatu.

The percentage of endemic species in some well-known genera and groups appears to be very variable. Table 1 provides an example of that variability.

Table 1 Percentage of endemic plants in some well-known genera and groups

Genus or group	Total no. of species	No. of endemic species	% endemic
<i>Freycinetia</i> (climbing pandan)	20	16	80 ¹
<i>Boerlagiodendron</i> (gwalifunu)	7	5	71 ¹
Palms	33	19	58 ²
Orchids	277	28	10 ³
<i>Canarium</i> (ngali nuts)	7	0	0 ⁴
<i>Barringtonia</i> (cut nuts)	5	0	0 ⁵
<i>Cyrtandra</i> (a shrub genus)	11	7	64 ⁶
Eleocarpaceae (a tree family)	14	4	29 ⁷
<i>Terminalia</i> (alite nuts)	14	2	14 ⁸
Ferns	340	34	10 ⁹

Sources

- ¹ Whitmore 1969b ⁴ Leenhouts 1959 ⁷ Coode 1981
² Dowe et al. 1989 ⁵ Payens 1967 ⁸ Coode 1978
³ Lewis & Cribb 1991 ⁶ Gillet 1975 ⁹ D. Glenny pers. comm.

2.2.3 Vegetation communities

One of the major constraints to sound environmental planning for forestry and agriculture is the lack of recent information on vegetation communities; this also limits an understanding of the habitat preferences of fauna. The existing level of division of vegetation types is too broad to be useful for describing the habitat of fauna of known distribution.

Despite the geographical spread of the islands, the climax vegetation types show remarkable similarity in appearance between islands (Whitmore 1969b). Whitmore (1969b) states that in primary lowland rainforest there are 12 very common tree species which form the top of the forest canopy. The Kwara'ae names and scientific names of these species are: **ba'u** (*Calophyllum kajewskii*), **gwarogwaro** (*C. vitiense*), **ketekete** (*Camptosperma brevipetiolata*), **mudi** (*Dillenia salomonensis*), **milo** (*Elaeocarpus sphaericus*), **a'asa** (*Endospermum medullosum*), **arakoko** (*Gmelina moluccana*), **isiksiki** (*Maranthes corymbosa*), **one one** (*Parinari salomonensis*), **dawa** (*Pometia pinnata*), **beabea** (*Schizomeria serrata*) and **kako** (*Terminalia calamansanai*). All these species with the exception of **mudi** are found throughout the country. The lowland forest contains fewer large tree species than, for example,

south-eastern Malaysia; the canopy is mostly irregular, with height varying between 30 and 40 m with emergents mainly of *Terminalia calamansanai* or *Burckella obovata* and giant banyan figs of the genus *Ficus* commonly reaching 45 m (Whitmore 1969a). Climbers and epiphytes are more abundant than in west Malesia.

The predominantly *Themeda australis* grasslands are believed to be human-induced and maintained by frequent burning, and it is likely that the area of these has also increased since the work of Hansell and Wall (1976). These grasslands cover extensive areas of the northern plains and foothills of Guadalcanal and are found in the Nggela islands and to varying degrees on other islands.

Table 2 Vegetation communities of Solomon Islands

Total area of Solomon Islands	28000 km²
Forests	24200 km²
Mangrove	650 km ²
Swamp forest	970 km ²
Forests on ultrabasic rocks (open formations of <i>Casuarina</i>)	527 km ²
Formations peculiar to calcareous terrain	1,150 km ²
Various communities at low & medium altitudes on basalts or andesites	20,000 km ²
Forests containing <i>Agathis</i> (Santa Cruz)	200-300 km ²
Montane forests	600 km ²
Climax shrub formations	800 km²
On calcareous sites	500 km ²
On ultrabasic rocks	50 km ²
On swampy ground (<i>Pandanus</i>)	83 km ²
Grass savannas	200 km²
Reed swamps (<i>Phragmites</i>)	53 km ²
Savannas on well-drained soils (<i>Themeda</i>)	147 km ²
Heathlands (fern communities)	50 km²
Crops & bush-fallow	2500-3000 km²

Source Schmid (1978) after Hansell & Wall (1976)

Table 2 provides a breakdown of the vegetation communities from Schmid (1978) which is derived from Hansell and Wall (1976). These figures are probably out of date by now because of forest clearance.

Forests and woody vegetation communities covered up to 2.5 million ha of Solomon Islands in 1972 (Schmid 1978; Hansell & Wall 1976). However the current extent of forest is largely unknown as much clearing for gardens, logging and cyclone damage to forests has occurred since that time. The National Forest Resources Inventory Project, which commenced in late 1990, will provide better information.

2.2.4 Rare, endangered & introduced plants

There has been no assessment of rare or endangered plant species in Solomon Islands. A species known from only one or two records need not necessarily be rare, but rather may merely reflect the amount of collecting done. It is therefore impossible to provide an overview of the country's rare and endangered plants.

Similarly there has been no assessment of the impact of introduced plants, many of which appear to have spread following disturbance of natural forest. Hibberd and Schenk (1991) suggest that the spread of introduced weeds such as *Mimosa* spp. and the paper mulberry (*Broussonetia papyrifera*) may make regeneration of natural forest more difficult.

2.2.5 Timber resources

During the last 30 years a timber extraction industry has developed in Solomon Islands and timber has been one of the major export revenue earners for a number of years. Since 1990 it has been the largest export revenue earner, contributing on average between 20 and 35 per cent of the country's foreign exchange earnings.

The extent of remaining potential commercial timber resources is uncertain: in 1978 it was estimated at only 184,000 ha (or 7.6 per cent of the total forested land), nearly 70 per cent of which was in Western Province. Since then logging and clearing for cultivation have been taking place at upwards of 6,000 to 8,000 ha per year (SIG 1989). Concern has been expressed at the rate of forest utilisation and a number of estimates for the life of accessible timber resources have been made, all based on very limited or outdated information. The most optimistic estimate (CSIRO 1987) for the life of the accessible timber resource (i.e. technically and economically feasible to log) is approximately 36 years if logged at current levels, or 15 years if the maximum allowable cut (under timber licence agreements) is taken. The National Forest Resource Inventory currently being undertaken should allow a better estimate to be made.

The timber industry has produced an average of over 300,000 cubic metres of log exports and 25,000 cubic metres of sawn timber for both export and local markets annually for the last 10 years (SIG 1989). The total allowable annual cut has been 400,000 cubic metres and this limit has not changed over the past few years.

In 1990 there were 15 licensed logging companies (only 10 of which were operating) and 17 licensed sawmillers operating. All provinces with the exception of Central Province have been or are subject to logging operations.

Table 3 shows the log production by island for 1990.

Table 3 Log export production by island in 1990

<i>Island</i>	<i>No. of companies</i>	<i>Log volume (cubic metres)</i>	<i>% of Total log export production</i>
New Georgia & Rendova	3	187,034	49
Choiseul	1	55,952	15
Guadalcanal	2	45,277	12
Shortlands	1	39,107	10
Makira	1	31,291	8
Malaita	2	26,465	6
Total	10	385,126	

Source Forestry Division statistics

The largest log volume in 1990 came from New Georgia and Rendova, with three companies operating there. The amount of sawn timber produced in 1990 was 21,831 cubic metres from a volume input of 49,393 cubic metres i.e. with a conversion rate of about 44 per cent (Forestry Division statistics).

At present the Solomon Islands Government relies largely on the honesty of timber exporting companies for provision of accurate information on production and revenue. In recognition of the need to increase monitoring of logging practices and adherence to licensing provisions by timber companies, SIG commenced an AIDAB-funded Timber Control Unit Project in 1991. The primary objectives of that project are to:

- 1) Expand SIG's capacity to monitor logging operations throughout Solomon Islands to ensure:

- (i) that environmental damage is minimised in logging practices;
 - (ii) that wastage is minimised and timber rights agreements adhered to;
 - (iii) that information on the utilisation of the resource is regularly and reliably updated;
 - (iv) that information on production and revenue and the invoicing on manifests is correct.
- 2) Train and assist customary landowners to ensure:
- (i) that they negotiate logging contracts on a more informed basis;
 - (ii) that they have a better awareness of the environmental dangers of logging;
 - (iii) that they are able to monitor logging on their own land (AIDAB 1990).

A major concern is the shortfall between the rate of exploitation and the rate of replacement by reforestation plus the growth increment in the logged remnant forest. There is little information on the rate of natural regeneration of forests in Solomon Islands after logging. Research in this area is needed. There is also a need to develop sustainable management procedures with regards to logging, natural regeneration and reforestation.

The low level of reforestation on customary land (where 95 per cent of the current logging is carried out) is of concern. Most reforestation projects are carried out on government land, averaging in total less than 1300 ha per annum (SIG 1991).

A New Zealand-funded customary land reforestation project being carried out by Forestry Division conducted pilot trials of various options for reforestation. The trials were successful on Malaita and the programme is now established and is currently expanding to Guadalcanal, Makira and Western Province. In 1990 the project replanted 41 ha on customary lands in Malaita. Customary land areas in Santa Cruz have previously been replanted by the Forestry Division. The funds allocated to the existing customary land reforestation project are only a small fraction of those needed to balance forest exploitation.

Logging companies are required to pay a reforestation levy to the government of 7.5 per cent of FOB and export duty calculated on a sliding scale to 17.5 per cent of FOB. This is collected at the same time, and in 1990 the government collected nearly \$SI 13 million in export duties and reforestation levy (CBSI 1990). Bennett et al (1991) calculated that in 1990 the reforestation levy accounted for about \$SI 4.4 million of this combined total. Bennett et al. (1990) state that the reforestation levy by itself could cover Forestry Division's recurrent budget of \$SI 400,000 and a development/reforestation budget of \$SI 4 million. In theory the levy is meant to be used for reforestation but in practice it goes straight into central revenue.

2.2.6 Other non-timber forest resources

Henderson and Hancock (1988) identify 119 species of native plants that are important for food for villagers in Solomon Islands, and 64 plant species that are of agricultural value (crop protection, fencing and animal medicine). Subsistence agriculture, including arboriculture (managed forests in which particular species are farmed by partial clearing and planting) is the way of life in most villages and the people depend on the forest resource in many ways. A total of 313 plants has been identified as being important for timber for housing and canoe building, fuel, and a variety of traditional uses such as fishing materials, carving, dyes, weaving and making tools. A further 143 plant species have been identified as having medicinal uses for a wide range of ailments. These species identified do not represent all plants which have customary and traditional values. Further documentation is needed and it is intended that this will be addressed to some extent in the National Forest Resources Inventory Project.

2.3 Fauna

2.3.1 Birds

State of knowledge

The birds of Solomon Islands are by far the country's best-studied animal group. Leary (1990b) cites 149 references for birds in the "Bibliography of Solomon Islands Terrestrial Fauna". The Whitney South Seas Expedition from 1927 to 1930 gave rise to 38 publications alone.

Ornithological exploration of Solomon Islands began in the 19th century and reached a peak when the Whitney South Seas Expedition visited every major island. Since then, the Templeton Crocker Expedition, Poncelet, Wolf and Braddley-Smith, Beecher, Donaggho, Filewood, Hadden, Lang, Parker, Sibley, Tedder and Virtue have each observed or collected specimens on one or a few islands (Diamond 1987).

Despite the level of study and the fact that island distribution is relatively well known, much remains unknown on the ecology and the status of many species. This is of particular concern in the cases of the white cockatoo (*Cacatua ducorps*) and the cardinal lorikeet (*Chalcopsitta cardinalis*), which are currently being exploited for the wildlife trade.

Diversity & endemism

Solomon Islands has the most diverse avifauna of all the Pacific oceanic islands. It has approximately 173 valid species of land birds which breed there (Leary 1990c). This does not include sea birds, shore birds or birds which are occasional visitors

or migrants (a further 50 species). Diversity is much greater than that of other Pacific Island countries (Vanuatu 60 species; New Caledonia 68; Fiji and Tonga combined 67; Micronesia 57; the two Samoas 35) (Mayr 1978) — Solomon Islands has more than twice the number of bird species of any other Pacific Island country.

Solomon Islands has both a wide diversity of birds and a high level of endemism (i.e. birds unique to it). Forty-four per cent or almost half are endemic at species level. A further 38 per cent of the bird species occur elsewhere in the world but are represented in Solomon Islands by unique subspecies or races. In fact, only 18 per cent of Solomon Islands birds are identical to birds living elsewhere in the world (Diamond 1976). Diamond (1976) adds that there is no other place in the world, not even the Galapagos Islands, where the biological phenomena of speciation and population variation among birds are so obvious. Many biology textbooks illustrate evolution by examples from Solomon Islands. One such case is the white-eye (*Zosterops*) which has developed populations with different appearances and songs on Rendova and Tetepari, and on Gizo and Vella Lavella, even though these islands are only a few kilometres apart (Diamond 1976). Solomon Islands avifauna, because of its uniqueness and diversity, should be regarded as being of international value and significance.

Rare & endangered species

In the International Council for Bird Preservation (ICBP) check-list of globally threatened birds (Collar & Andrew 1988), 18 Solomon Islands species are considered threatened (Table 4).

Table 4 List of globally threatened birds recorded from Solomon Islands

<i>Common name</i>	<i>Scientific name</i>
Beck's petrel	<i>Pterodroma becki</i>
*Solomons sea eagle	<i>Haliaeetus sanfordi</i>
*Imitator sparrow-hawk	<i>Accipiter imitator</i>
*Woodford's rail	<i>Nesoclopeus woodfordi</i>
*San Cristobal mountain rail	<i>Gallinula sylvestris</i>
Nicobar pigeon	<i>Caloenas nicobarica</i>
*Yellow-legged pigeon	<i>Columba pallidiceps</i>
*Thick-billed ground dove	<i>Gallicolumba salamonis</i>
*Santa Cruz ground dove	<i>Gallicolumba sanctaerucis</i>

Table continued over-page

Common name	Scientific name
*Solomon Islands crowned pigeon	<i>Microgoura meeki</i>
*Moustached kingfisher	<i>Halcyon bougainvillei</i>
*Solomon Islands pitta	<i>Pitta anerythra</i>
*Kolombangara warbler	<i>Phylloscopus amoenus</i>
*Rennell shrikebill	<i>Clytorhynchus hamlini</i>
*Malaita fantail	<i>Rhipidura malaita</i>
*Gizo white-eye	<i>Zosterops luteirostris</i>
*Nendo white-eye	<i>Zosterops santaecrucis</i>
*Sanford's white-eye	<i>Woodfordia lacertosa</i>

Notes * Endemic species

Source Collar & Andrew 1988

A further three species are included on the check-list of near-threatened species (Collar & Andrew 1988). These are the fearful owl (*Nesasio solomonensis*), Whitney's thicket warbler (*Cichlornis whitneyi*), and the shade warbler (*Vitia parens*). A review of the status of rare and endangered Papuasian birds (Schodde 1979) proposes two additions to the list of threatened birds: the Solomon swiftlet (*Collocalia orientalis*), not seen since the first and only specimen was taken in 1927; and the Pavuvu collared kingfisher (*Halcyon chloris pavuvu*), which he considers vulnerable because the species is restricted to Pavuvu and Mbanika Island, which together have an area of less than 240 sq km. Diamond (1987) lists 12 species for which there have been no definite records since 1953 (Table 5 over-page).

Diamond (1987) states that the significance of these non-records varies, ranging from the case of the Solomon Islands crowned pigeon, which has been actively searched for but not found (Parker 1972), to that of the Malaita fantail, where no ornithologist had revisited these mountains since the 1930s. (NB: This area was revisited by Schofield in 1990 and the fantail found to be relatively common.) Diamond (1987) states that according to the assumption "extinct unless proven extant", up to 12 species may be extinct or endangered, although five of these are not even mentioned in the IUCN Red Data Book of endangered species. Diamond (1987) believes that the true number of extinct or endangered species is probably nine, excluding the moustached kingfisher, Meyer's goshawk and the Malaita fantail. He believes these probably still exist, but may not have been observed because they are rare, or difficult to observe, or because no-one has visited their areas of restricted distribution.

Schodde (1979) also assesses the rarity of Solomon Islands birds, and, using the IUCN Red Data Book criteria, states that 102 forms (mostly at subspecies level) should be considered rare. These are either populations restricted to one small oceanic island, or populations which occur on several large islands but have a restricted habitat, for example mountain rainforest above 900 m.

In terms of the forms (species, subspecies and races) considered rare and endangered by Schodde (1979), San Cristobal (Makira) and Rennell are richest with 29 and 15 forms respectively. The remainder occur on other islands.

In summary, two species are almost definitely extinct but a further seven may also be extinct. A further four are considered endangered, threatened or vulnerable, and, according to Schodde (1979), a total of 102 forms should be considered rare.

Table 5 Birds not recorded in Solomon Islands after 1953

Scientific name	Common name	Last collected
<i>Anas gibberifrons</i>	Grey teal	1928 *
<i>Accipiter meyerianus</i>	Meyer's goshawk	1927 –
<i>Nesoclopeus woodfordi</i>	Woodford's rail	1936 **
<i>Columba pallidiceps</i>	Yellow-legged pigeon	1928 **
<i>Gallicolumba beccarii</i>	Grey-breasted ground dove	1953 **
<i>Gallicolumba jobiensis</i>	White-breasted ground dove	1927 *
<i>Gallicolumba salomonis</i>	Thick-billed ground dove	1927 *
<i>Microgoura meeki</i>	Solomon Islands crowned pigeon	1904 ***
<i>Halcyon bougainvillei</i>	Moustached kingfisher	1953 **
<i>Pitta anerythra</i>	Solomon Islands pitta	1936 **
<i>Zoothera dauma</i>	Scaly thrush	1904 *
<i>Rhipidura malaitae</i>	Malaita fantail	1930 **

Notes Level of endemism: *** genus; ** species; * subspecies; – not endemic

Source Diamond 1987

2.3.2 Mammals

State of knowledge

With the exception of frogs, mammals are the least-studied group of vertebrates. Although the Environment and Conservation Division-Australian Museum survey from March 1990 to June 1991 has done much to address this deficiency in

information, the state of knowledge can still only be described as patchy at best. Only 50 published references concerning mammals exist (Leary 1990b). These are largely confined to taxonomy.

Mammal exploration of Solomon Islands began in the 19th century with the work of Meek, Guppy and Woodford. Although some minor collections were undertaken by a number of individual workers, these generally only visited one or a few islands, or were collected ancillary to work on other groups. Significant collections of mammals have been made by the Whitney South Seas Expedition, Troughton of the Australian Museum, the US Medical Field Services, the Templeton Crocker Expedition, the Archbold Expedition No. 13, the British Museum of Natural History, the Danish Rennell (Noona Dan) Expedition, the Royal Society Expedition, Bayliss-Smith, Rowe, and the Bernice P. Bishop Museum. The latter sent several collecting parties to Solomon Islands in 1963 and 1964, which collected from most of the large and more accessible islands. This culminated in the first and only synthesis of distribution of flying foxes (*Megachiroptera*) of Solomon Islands by Philips (1968).

In 1987 the Mammal Department of the Australian Museum collected on a number of islands. This programme was intensified in March 1990 with the initiation of a fauna survey programme in collaboration with the Environment and Conservation Division. Between March 1990 and June 1991 Choiseul, Guadalcanal, New Georgia, Kolombangara, Vangunu, Mono, Santa Cruz, Malaita, Isabel, Pavuvu (Russells) and Nggela Sule (Floridas) were surveyed. This programme has considerably improved the knowledge of taxonomy and island distribution of mammals, but still very little is known of the habitat requirements and ecology of most species. Systematic surveys of the major habitat types are still urgently required, as are detailed ecological studies on species considered rare or endangered.

Five new species have been described as a result of the work of the Australian Museum. These include two new species of monkey-faced flying fox (*Pteralopex*), a new species of blossom bat (*Melonycteris*), a new species of fruit bat (*Pteropus*), and a new species of tube-nosed bat (*Nyctimene*). It seems likely that more species await discovery. From descriptions given by local people it appears that at least a further three or four species of giant rat (*Sitomys*) may still be extant, but these have not even been described by science and appear to be very rare. More detailed taxonomic studies of Solomon Islands species such as the horseshoe-nosed bat (*Hipposideros*) are likely to reveal that Solomon Islands populations actually represent distinct species, and Solomon Islands' level of diversity and endemism will be higher still.

Diversity & endemism

The indigenous mammals of Solomon Islands represent one of the world's richest diversity of bats and rats. There are 52 species of native mammal (excluding the

marsupial cuscus *Phalanger orientalis*, which is believed to have been introduced by humans in prehistoric times). Twenty-six species or 50 per cent are endemic. This makes Solomon Islands mammal fauna one of the most diverse and endemic to be found on oceanic islands anywhere on earth (Flannery 1990).

Table 6 shows the components of the mammal fauna — predominantly flying foxes (*Megachiroptera* 26 species), insectivorous bats (*Microchiroptera* 18 species) and rats (*Muridae* 8 species).

Table 6 Components of the mammal fauna & percentage endemic

Common name	Genus	No. of species	Endemic species*	% endemic
Rats				
Melomys	<i>Melomys</i>	1	0	0
Giant rat	<i>Solomys</i> *	4	4	100
Giant rat	<i>Uromys</i>	3	3	100
Flying foxes				
Fruit bat	<i>Pteropus</i>	12	7	58
Monkey-faced flying fox	<i>Pteralopex</i>	4	4	100
Blossom bat	<i>Melonycteris</i>	2	2	100
Bare-backed flying fox	<i>Dobsonia</i>	1	1	100
Tube-nosed bat	<i>Nyctimene</i>	5	2	40
Blossom bat	<i>Macroglossus</i>	1	0	0
Epulet bat	<i>Rousettus</i>	1	0	0
Insect-eating bats				
Large-footed bat	<i>Myotis</i>	1	0	0
Pipistrelle	<i>Pipistrellus</i>	1	0	0
Bent-winged bat	<i>Miniopterus</i>	4	0	0
Mastiff bat	<i>Chaerophon</i>	1	1	100
Sheath-tail bat	<i>Emballonura</i>	3	0	0
Sheath-tail bat	<i>Saccolaimus</i>	1	0	0
Flower-nosed bat	<i>Anthops</i> *	1	1	100
Trident-nosed bat	<i>Aselliscus</i>	1	0	0
Horseshoe-nosed bat	<i>Hipposideros</i>	5	1	20
Total		52	26	50%

The extremely large *Solomys ponceleti* (Poncellet's giant rat) is the largest endemic Solomon Islands mammal, and was first recorded from Choiseul in 1990 by the Environment and Conservation Division-Australian Museum survey. The Solomon Islands giant rats represent one of the greatest radiations of rats on oceanic islands. Their occurrence in Solomon Islands represents the easternmost natural distribution (as opposed to distribution by human agency) for any non-flying land mammal in the Pacific.

Solomon Islands has 26 species of fruit bat or flying fox (Pteropodidae), one of the greatest diversities of them in the world; of the twelve species of *Pteropus* (large flying fox or fruit bat), seven are endemic. Solomon Islands supports the world's greatest diversity of *Pteropus* and may be the place of origin of this widespread genus (from east Africa to the Cook Islands) (Flannery 1990).

Of the insect-eating bats, the genus *Anthops* (flower-nosed bat) is endemic. This is unusual as Australia, although much larger, has only three endemic genera and PNG only one endemic genus.

Rare & endangered species

Table 7 lists the number of species of mammal recorded per island. Guadalcanal has both the highest number of species (26), half Solomon Islands' known mammal fauna, and the greatest number of species restricted to one island. Although Temotu has a low number of species recorded (8), half are of restricted distribution. Twenty-one species are found on only one island.

Appendix 1 lists the 24 species considered by Flannery and Parnaby (1991) to be rare, vulnerable, endangered or extinct. The giant rats *Solomys salomonis*, *Uromys imperator* and *U. porculus* have not been seen in the last 100 years and are probably extinct. A further two species of giant rat must be considered vulnerable or endangered. These are *S. ponceleti* because it is restricted to Choiseul where logging is in progress and where further extensive logging is proposed, and *U. rex* because much of its habitat on Guadalcanal is being altered, and it does not appear to exist in high altitude forest.

Flannery and Parnaby (1991) also consider seven species of fruit bat (*Pteropus*) vulnerable or endangered. All of these species are restricted to one or two islands. *P. howensis*, *P. tuberculatus* and *P. nitendiensis* are the most vulnerable because of the very small size of the islands. The first species is restricted to Ontong Java and the latter two to Nendo (Santa Cruz).

All species of monkey-faced flying fox (*Pteralopex*) appear to be rare and restricted to only one or two islands. Nothing is known of the ecology of these extremely rare species and the two new species are each known from only a single specimen each.

Considering the large size of these animals, it is likely that they would have been detected before unless rare.

The Santa Cruz tube-nosed bat (restricted to Santa Cruz) has not been recorded since 1907 and is either critically endangered or extinct. Four species of insect-eating bat (*Microchiroptera*) are considered vulnerable or rare by Flannery and Parnaby (1991).

Table 7 Number of mammal species per major island & number of those species restricted to only that island, or to that island & one other

Island	Total no. of Species	Total number of species found	
		only on this island	on this and one other island
Shortlands Group	10	0	1
Choiseul	22	4	2
Isabel	20	1	2
San Jorge	6	0	2
Vella Lavella	7	0	0
Kolombangara	9	0	0
New Georgia	15	1	0
Malaita	21	2	1
Guadalcanal	26	5	1
Makira	17	3	0
Nggela	7	1	0
Russells	8	0	1
Rennell	7	1	0
Temotu Island	8	3	0

In summary, 13 species of flying fox, three species of giant rat and four species of insectivorous bat are vulnerable or endangered (i.e. in danger of extinction if nothing is done) due to their limited distribution (i.e. on one or few islands) and

habitat changes occurring throughout the islands. Three species of giant rat and one species of flying fox are either extinct or close to extinction. The status of at least 24 of the 52 species of native mammals is not secure.

2.3.3 Reptiles

State of knowledge

There are 76 published references on reptiles (Leary 1990b). The earliest comprehensive work was by Boulenger with descriptions of specimens collected by Guppy and Woodford in the 1890s. Significant collections of reptiles were made by most of the expeditions discussed under section 2.3.1. and 2.3.2 as well as by a number of others. However, much of this work was confined to coastal areas or to one or two islands. Although species occurrence on individual islands is relatively well known, little is known of the altitude distribution or ecology of many species (McCoy 1980).

Diversity & endemism

Table 8 shows the number of endemic terrestrial reptile species in Solomon Islands by family. Approximately 41 per cent are endemic. One species is an endemic sea krait (Laticaudidae) in land-locked Lake Tengano on Rennell Island, and is also considered terrestrial.

Table 8 Percentage of endemic reptiles by family

Family	No. of genera	No. of species	Endemic species	% endemic
Gekkonidae (geckos)	6	13	3	23
Scincidae (skinks & lizards)	10*	32	19	59
Varanidae (monitor lizards)	1	1	0	0
Agamidae (dragon lizards)	1	1	0	0
Typhlopidae (blind snakes)	1	6	0	0
Boidae (boas & pythons)	1	2	0	0
Acrochordidae (file snakes)	1	1	0	0
Laticaudidae (sea krait)	1	1	1	100
Colubridae (solid tooth non-venomous & rear fang venomous snakes)	2	2	0	0
Elapidae (venomous snakes)	2**	2	2	100

Notes * 1 endemic genera; ** 2 endemic genera

McCoy (1980) lists 54 species of terrestrial reptiles for Solomon Islands (excluding species restricted to Bougainville, turtles, crocodiles and sea snakes). Further species have been discovered and described since that time; there are currently 61 known terrestrial species. Solomon Islands has a greater diversity of reptiles than other Pacific Island nations, although the percentage of endemism is possibly higher in New Caledonia (Gibbons 1985). The skinks or small lizards are by far the most diverse group and also exhibit a high percentage of endemic species (Brown 1991). There are three endemic reptile genera in Solomon Islands—*Corucia*, *Loveridgelaps*, and *Salomonelaps*—and a total of 25 endemic species. These are given in Appendix 2.

Rare & endangered species

The cryptic behaviour of many Solomon Islands reptiles makes it difficult to assess their rarity, however at least five species appear to be endangered or possibly extinct. These species are known from few collections or have not been collected since 1930 (McCoy 1980; McCoy, pers. comm). These are: two species of blind snakes (*Ramphotyphlops affinis*, known only from one specimen, and *R. willeyi*, known only from one specimen); two species of gecko (*Lepidodactylus shebae*, only known from a single specimen; and *Lepidodactylus* new sp. (Brown et al., in prep.), only known from two specimens); and one species of skink (*Tribolonotus ponceleti*, known from only five specimens) (McCoy, pers. comm.).

McCoy (1980) lists a further eight species as rare or uncommon. These are given in Appendix 3.

2.3.4 Frogs

State of knowledge

Frogs are the least-studied animal group, with only 50 published references (Leary 1990b). With the exception of the work of Brown (1952) there has been little systematic surveying for frogs. Most of the major collecting trips collected frogs on an *ad hoc* basis. Knowledge of their island distribution is far from complete and systematic surveys are needed to clarify distribution. For example, during the Environment and Conservation Division–Australian Museum survey of Choiseul in 1990, six new species records for the island were added. Virtually nothing is known of the ecology of most species.

Diversity & endemism

Brown (1952) lists 17 species of indigenous frogs. This is the greatest diversity of frogs exhibited on any Pacific oceanic island group. Of the Pacific island countries,

Solomon Islands is by far the most significant in terms of diversity and evolution of frogs (Gibbons 1985). The ranid component of Solomon Islands frogs is highly evolved and, when Bougainville is included as a part of Solomon Islands, contains three endemic genera: *Batrachylodes* (2 species), *Palmatorappia* (1 species) and *Ceratobatrachus* (1 species). A fourth genus *Discodeles* (4 species) is shared with the nearby Bismarck and Admiralty Islands (Gibbons 1985). Solomon Islands (including Bougainville) has seven endemic frog species (or 41 per cent endemism). These are listed in Appendix 4.

Rare & endangered species

Information on the distribution, status and ecology of Solomon Islands frogs is so poor that it is almost impossible to assess their status. From the author's personal observations, the following species appear to be rare or at least of restricted distribution, indicating their vulnerability: *Platymantis solomonis*, *P. aculeodactylus*; *Palmatorappia solomonis* and *Discodeles malakuna*.

2.3.5 Invertebrates

There is no estimate of the total number of species of invertebrates in Solomon Islands and many species remain undescribed. Most studies of insects in Solomon Islands have concentrated on pest species, particularly those affecting coconut, cocoa and taro, although the Royal Society Expedition has worked on some other groups of insects and other invertebrates.

Dahl (1986) states that there are 130 species of butterflies in Solomon Islands, of which 35 are endemic, and a further 54 are shared with PNG, but his source is unknown. Solomon Islands has a large number of beautiful and spectacular species, including the very large birdwing butterflies. Species considered rare in the IUCN Red Data Book include the sword-tail butterflies *Graphium meeki* and *Graphium mendana*, and the swallow-tail butterfly *Papilio toboroi* (Dahl 1986).

Greenslade (1969) states that all but the smallest islands support endemic taxa of the well-known insect groups. Other groups of invertebrates such as the non-marine molluscs (land snails) show a high degree of island endemism. Solomon Islands is also important because it supports the most eastward populations of "palaeo-oriental" mollusc species (Peak 1969).

2.3.6 Introduced animals

A variety of animals has been introduced to Solomon Islands, establishing wild populations. Some of these introductions were prehistoric, such as the marsupial cuscus or **kandora** (*Phalanger orientalis*), the spiny rat (*Rattus exulans*) and the pig (*Sus scrofa*). More recent introductions include feral domestic cats (*Felis catus*), the

black rat (*Rattus rattus*), the brown rat (*Rattus norvegicus*), and the house mouse (*Mus musculus*).

Introduced reptiles include two species of geckos (*Gehyra mutilata* and *Hemidactylus frenatus*) which are generally confined to human habitation, and a species of blind snake (*Ramphotyphlops bramina*).

The only introduced frog is the common and widespread marine toad (*Bufo marinus*), which is believed to have been introduced in early 1940 (Lever 1945). There appear to be only two species of introduced birds with wild breeding populations: the Indian myna (*Acridotheres tristis*) and domestic fowls (*Gallus* sp.) (reported to have wild breeding populations in the Santa Cruz group).

Introduced species are a more subtle and often underrated threat to island fauna, either directly through predation or by their toxicity to native fauna, or indirectly by competition for resources. Introduced species which are of concern and may constitute a threat to native fauna in Solomon Islands include the marine toad, the feral cat and the black rat. Recent survey work has raised concern at the spread of these particular species and their potential impact on native populations.

Feral cats do not appear to do well in the lowland rainforests (perhaps because the high humidity and rainfall make them more susceptible to disease). Their threat to fauna in Solomon Islands had therefore previously been dismissed as minor. A recent survey on the highest mountain in Solomon Islands (2331 m) found populations of large and healthy feral cats and black rats (at 900 metres), but failed to find expected species such as ground-dwelling birds and the endemic giant rats. Marine toads were also recorded.

Marine toads are toxic to native fauna and many Solomon Islanders report snakes and lizards dying after ingestion of the toad. In 1952 marine toads were reported to have only a restricted coastal distribution on three islands: Mbanika, Guadalcanal and Malaita. Since then, they have spread to many other islands. A coastal distribution would place little competitive pressure on native frogs, as most are not confined to the coast, but it now appears that the toad has spread inland on Guadalcanal at least up to an altitude of 600 metres. As a large proportion of Solomon Islands is below 600 metres, there is potential for them to spread over the vast majority of islands. Evidence relating to feral animals is all anecdotal, but it seems likely that they are having an impact on at least some native animal populations. For example, the mangrove monitor or iguana (*Varanus indicus*) was reported to be abundant on the north coast of Guadalcanal in 1942-43 by the US military forces but is now uncommon and local people attribute its demise to the presence of the toad.

Most importantly, the presence of these exotic species raises concern at the conservation status of high altitude forests. Little study has been done on the

montane forests, but it has generally been assumed that their conservation status is relatively secure, as they are free from human-induced perturbations. There are few villages and gardens and commercial or large-scale forestry activities are prohibited above 400 metres, thus these forests have been considered natural conservation reservoirs with faunal populations relatively intact. It now appears that complacency at the security of faunal populations in high altitudes may be misplaced. There is an urgent need for further ecological studies not only to establish the status of the native fauna but also assess the impact of feral animals.

chapter 3 ♦

Marine resources

The reliance of Solomon Islanders on marine resources is reflected by one of the highest per capita rates of seafood consumption in the world. A survey conducted by the National Statistics Office in 1983 indicated an average per capita fish consumption of 25.7 kg/year. A subsequent survey in 1988 (unpublished) indicated total seafood consumption of 34.4kg/person/year, comprising 22.4 kg marine fish and 12 kg of shellfish. Using these figures, the national total subsistence catch is probably in the order of 10,000 tonnes/year in 1990 (Skewes 1990).

3.1 Habitats

3.1.1 Coral reefs & lagoons

Wells and Jenkins (1988) reviewed information on the coral reefs and lagoons of Solomon Islands and concluded that very little scientific work has been carried out on its reefs. The 1965 Royal Society Expedition (Stoddart 1969a, 1969b, 1969c; Womersley & Bailey 1969; Morton & Challis 1969) has produced the only substantial accounts. With the exception of work on Marovo Lagoon (Baines 1985), the current status of reefs is unknown as it is 25 years since the Royal Society Expedition and comparable work has not been carried out on other reefs.

The Royal Society Expedition concluded that in general Solomon Islands lacked the luxuriant reefs of many parts of the Pacific because of unfavourable environmental conditions. However this is not a view shared by many people in Solomon Islands, and may reflect the areas visited by the Royal Society Expedition. The fringing reefs are generally associated either with uplifted shores and volcanic coastlines or grow on seaward members of successfully elevated coral limestone beaches.

Few flourishing reefs were encountered by the 1965 expedition apart from one at Haroro (Sandfly Passage, Nggelas), one north of Paruru (Marau Sound, Guadalcanal) and one at Matiu Island (New Georgia). Many reef flats were devoid of corals and

where they occurred, many were found to be dead (Wells & Jenkins 1988). Live corals and calcareous red algae were largely confined, apart from pools, to the seaward zone below the dead reef. The poverty of the reefs examined may be partly explained by the steep and exposed shores with little suitable substrate for coral growth (Wells & Jenkins 1988).

There are a number of lagoon complexes in Solomon Islands and several are of particular scientific interest. New Georgia is a volcanic complex surrounded by reef deposits which are partly elevated to form raised barrier reefs enclosing Marovo, Gerasi and Togavai Lagoons on the north-west coast, and partly drowned to form a submerged barrier south of Vangunu, enclosing the lagoons of Panga Bay.

Marovo Lagoon, Solomon Islands' largest reef lagoon complex, is believed to be one of the world's largest lagoons and is regarded as the best defined double barrier reef in the world (Stoddart 1969a). Other notable lagoon complexes include Marau Sound (Guadalcanal) and Lomlon (Reef Islands, Temotu Province).

As the population is largely settled on the coast, reefs are of major importance to many coastal dwellers, not just for subsistence fisheries but also for collection of shells and other marine products for decoration, ornaments, tools and commercial sales. *Acropora* coral is collected and burned for making lime to be consumed with betel nut.

Live coral has been harvested in some areas for export, most notably in Marau Sound on Guadalcanal. Concern has been expressed at this apparently uncontrolled harvesting. Extraction of live coral is currently not prohibited under the Fisheries Regulations, 1972 as amended, but the Fisheries Division is currently proposing an amendment to designate areas from which coral may be extracted with the written permission of the Minister for Natural Resources. The amendment will also continue to allow live corals to be taken for the purpose of making lime and clearing navigation passages.

3.1.2 Mangroves

Solomon Islands has extensive areas of mangroves. Unfortunately there is no up-to-date information on the distribution and condition of mangrove stands. Hansell and Wall (1976) found mangroves on most islands and covering large coastal areas on Isabel, New Georgia and Malaita. On Makira and Guadalcanal, distribution is mostly confined to the eastern extremities at Star Harbour and Marau Sound respectively. The authors mapped 642 sq km of mangrove forest from aerial photos. They found it to be characteristically species-poor by South-East Asian standards (but rich by Australian standards). The most widespread genera are *Rhizophora* and *Bruguiera*, while *Avicennia* occurs locally but not in large stands.

There is little information on the fish of the mangroves of Solomon Islands. Blaber and Milton (1990) sampled 13 estuaries and found 136 species, although no estuary contained more than 50 species. The role of these estuaries as nursery grounds for coral reef species was assessed and found to be insignificant, but they were considered important feeding grounds for many mobile fish-eating species.

To date the mangroves have not been exploited on an industrial scale, and are protected under the Forests Resources and Timber Utilization Act; however, clearing for new settlements and urban expansion is not uncommon. Cyclone damage to mangroves is also not uncommon, for example on Malaita by cyclone Namu in 1986.

3.1.3 Seagrass beds

Seagrass beds have received little survey or scientific attention. These are thought to be important feeding grounds for dugongs and turtles. Vaughan (1981) identifies the following areas as important turtle feeding grounds: from Baolo around to Dedeu, and at Ghoveo, Poro and Thousand Ship Bay in Isabel Province, and the northern side of Wagina and much of north Choiseul in Western Province.

3.2 Marine fauna & flora

Apart from the 87 scleractinian coral species in 33 genera recorded by Pillai et al. (1974), the marine algal communities described by Womersley and Bailey (1969) and sponges described by Bergquist et al. (1971), there appears to be little inventory of non-fisheries marine resources of Solomon Islands.

Fisheries investigations have primarily been directed towards commercial offshore tuna fishing and baitfishing, however Boutilier (1975) suggests the possibility of upwards of 2,000 varieties of fish being in Solomon Islands waters.

3.2.1 Skipjack & yellowfin tuna

The total commercial catch of skipjack and yellowfin tuna by the domestic fleet of Solomon Taiyo Limited and National Fisheries Development in 1990 was approximately 29,500 tonnes, the lowest for eight years. This low catch was attributed to climatic conditions, the small size of fish found in schools in Solomon Islands waters and problems with the fishing fleet (CBSI 1990). The catches for the years 1986 to 1989 were 44,200, 32,400 and 41,900 tonnes respectively. Solomon Islands now has the largest domestic tuna fishing fleet of the Pacific Island countries. The tuna fishing industry is a major revenue earner (see section 5.2.2). In 1990 licensing of foreign fishing vessels to operate in the country's 200-mile Exclusive Economic Zone yielded \$SI 2 million alone.

3.2.1 Reef fish

The domestic catch is made up of more than 180 species from 30 families of fish (Skewes 1990). Fish sold through markets is often surplus to subsistence needs, but a growing number of artisanal fishermen are entering the fishery.

Apart from fish bought by the fisheries stations and sold locally (in the order of 70 tonnes per year), the total production of this fishery is not known. However, the annual subsistence harvest of 10,000 tonnes, calculated from per capita consumption, is probably predominantly reef fish (Skewes 1990).

A study prompted by concerns that baitfish taken to supply the commercial pole-and-line tuna fishery could have a detrimental effect on the reef fishery concluded that baitfishing had a negligible impact on the reef fish resource (Blaber et al. 1990), despite landowner opinion to the contrary. Results of this three-year collaboration between SIG and CSIRO are being made available in Pidgin and local languages for provincial authorities.

3.2.2 Bêche-de-mer

Commonly fished species are the teat fishes (*Holothuria nobilis* and *H. fuscogilua*) and the blackfish (*Actinopyga millaris*), with smaller numbers of the prickly redfish (*Theilonota ananus*) and the surf redfish (*Actinopyga mauritiana*) (Skewes 1990). Bêche-de-mer is collected by small-scale artisanal fishermen who usually also process the catch, which is then exported through traders in Honiara, Gizo, Munda and Auki. No nation-wide assessment of stocks has been undertaken. The fishermen of Ontong Java are probably the largest producers of bêche-de-mer and there are indications (a higher proportion of the catch is lower-value species, and the average size of the preferred species has dropped) that at least in Ontong Java the bêche-de-mer population is being affected by fishing pressure. The community itself was so concerned that it put in place a self-imposed ban on bêche-de-mer fishing every second year.

3.2.3 Lobster

Several species of panulirid lobster inhabit Solomon Islands waters, but primarily the spined rock lobster (*Panulirus pencillatus*) and the painted crayfish (*P. versicolor*) are harvested. Despite considerable interest in exporting crayfish products to lucrative overseas markets, the catch is currently subsistence and domestic market oriented (Skewes 1990). However these have been exploited on a small scale by joint foreign/Solomon Islands venture. The annual catch is unknown but has been estimated to be in the order of two tonnes (Skewes 1990).

3.2.4 Shark

The catch is primarily made up of the species *Carcharhinus requiem*. Sharks are mostly caught by subsistence and small-scale artisanal fishermen and by the commercial purse-seine fleet as bycatch. Generally only the fins are used commercially, although on occasion the skin, meat and oil are also used. Sunking has been commercial longlining for several years for skins and fins and another company is currently fishing for deep-water species of *Centrophorus* sp. for oil. Around 5,000 kg of fins were exported in 1989. Although there has been no stock assessment, Skewes (1990) concludes that the resource is not under any significant pressure at this time.

3.2.5 Pearl oysters

Three commercially important species of pearl oyster are taken: blacklip (*Pinctada margaritifera*), goldlip (*Pinctada maxima*) and brownlip (*Pteria penguin*). Recent goldlip surveys in the vicinity of Wagina failed to find it in some areas and it is believed to have been subject to systematic over-harvesting. Skewes (1990) suggests that blacklip shell is under the most fishing pressure and is more vulnerable to artisanal free-divers than the deeper varieties, that urgent assessment is needed for the fishery, and that a national annual quota for both goldlip and blacklip should be considered.

3.2.6 Green snail

Little is known about the status of the green snail (*Turbo marmoratus*), but Skewes (1990) states that there are indications that the stocks are currently over-exploited due to the high prices offered for it. Green snail is fished by local small-scale artisanal fishermen and sold to traders for export. Skewes (1990) recommends that marine reserves and a national quota be instituted to limit the current level of exploitation.

3.2.7 Trochus

Trochus shell (*Trochus niloticus*) is the most important non-fish resource in Solomon Islands in terms of export earning. It earned approximately \$SI 4.5 million in 1989 (Skewes 1990). Except for the unknown amount used for subsistence food, trochus shell is either exported or sold to two recently started button factories. No studies on the status of the stocks in Solomon Islands have been carried out, but Skewes (1990) states that exploitation of trochus may be above the sustainable level.

3.2.8 Crocodiles

Messel and King (1989) conducted an extensive survey throughout Solomon Islands for the salt-water crocodile (*Crocodylus porosus*) and found that the species was nearly locally extinct from over-exploitation for the skin trade. They recommended that: 1) a total ban be placed on the sale or export of crocodile skins for at least five years; 2) the wild crocodile population of Solomon Islands remain on Appendix I of CITES; 3) a permanent ban on skins taken from the wild and whose belly width is greater than 45 cm should be imposed to protect the breeding stock; 4) the government immediately commence educating the public about the importance of conserving their natural resources (including crocodiles); 5) the government find some way to protect and conserve the remaining crocodile population; and 6) the government discourage taking crocodiles from the wild to stock farms which are unlikely to be economically viable.

3.2.9 Coconut crabs

The coconut crab (*Birgus latro*) was extensively exploited in 1988-1989. Concern at its over-exploitation resulted in an amendment to the Fisheries Regulation to regulate its export and the minimum size of animals permitted to be taken. This later resulted in a moratorium on its export, but despite this, coconut crabs continued to be exported with the permission of the Minister for Natural Resources.

3.2.10 Deep-water snapper

The deep-water snapper resource in Solomon Islands is dominated by *Pristipomoides flavipinnis*, *P. filamentosis*, *Aphareus rutilens*, *Paraceasio kusakarii*, *Grathodentex mossambica*, *Etelis coruscans*, *E. carbunculus* and *E. radiosus* (Skewes 1990). Although there is some limited fishing of the shallower (to 60 m) deep-water snapper, the deep-bottom fishery is still in the initial phase of development. Current operations supply fish to the domestic market and in the future it is hoped that exports of fresh fish will occur. There is believed to be great development potential for this resource.

3.2.11 Aquaculture

Giant clams

Six species of giant clam are found in Solomon Islands waters, four of them having widespread distribution. Solomon Islands is one of the few countries in the region with relatively good stocks of this resource. The International Center for Living Aquatic Resource Management (ICLARM) has established an aquaculture centre in a

collaborative effort with the Fisheries Division and Guadalcanal Province on Guadalcanal to culture the giant clam (*Tridacna gigas*). By 1992 it is intended that: 1) a substantial array of processed giant clam products will have been developed and test-marketed; 2) selected village groups will be maintaining ocean nurseries and grow-out systems; 3) the hatchery will be producing 750,000 one-year-old clams per year; and 4) progress will have been made on topics relating to genetics, selective breeding, pathology and cultivation systems, and a good understanding of the economics of giant clam cultivation should be available (ICLARM 1990).

Prawns

There is currently one commercial salt-water prawn (*Penaeus monodon*) farm operating on Guadalcanal. Production was over 5 tonnes in 1988, most of this sold on the local market, but generally production figures, at an average of 750kg/ha/yr, are low (Skewes 1990).

Seaweed

Initial results of culture of seaweed (*Eucheuma* sp.) in Vona Vona were not encouraging, but a shift to a more exposed location for the farms saw better results. In early 1990, 2.5 tonnes were exported and Skewes (1990) states there are reasons to be optimistic about this project, particularly if it is extended to other provinces.

3.2.12 Turtles

There are five species of turtles found in Solomon Islands waters: the hawksbill (*Eretmochelys imbricata*), the green (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the loggerhead (*Caretta caretta*) and the Olive Ridley (*Lepidochelys olivacea*). The last two species are very rare. Hawksbill and green turtles nest in small numbers on many beaches throughout Solomon Islands. Isabel and Western Province have by far the most significant nesting beaches for green, hawksbill and leatherback turtles. The Arnarvon Island Group supports the most significant nesting population of hawksbills in Solomon Islands, and is probably one of their most significant nesting beaches east of Australia (Vaughan 1981). Preliminary survey work (Leary & Laumani 1989; Leary 1990d) indicates that the hawksbill population may have significantly declined since 1980, when the last monitoring of turtle populations was undertaken. This is probably attributable to the large volume of hawksbill turtle shell export (3,397 kg or approximately 3,692 turtles in 1989) (Leary 1990a). Beach erosion and hence loss of suitable nesting areas appear to have played a part in the decline in at least some places.

For many coastal people, green turtles are important both as a food resource and in cultural terms. There is a small local trade in turtle meat, but this, coupled with

subsistence usage, does not appear to be having a significant impact on turtles. The eggs of leatherback turtles are consumed despite the fact that it is prohibited by law. However, survey work (Leary & Laumani 1989; Leary 1990d) found increases in the numbers of nesting leatherback in both Isabel and Western Province, despite continuing harvesting of nests.

3.2.13 Marine mammals

Whales are occasionally reported in Solomon Islands waters, with several beachings and subsequent deaths reported. Dugongs are subject to subsistence usage, but the extent of exploitation and the status of the population is unknown. The Environment and Conservation Division has been requesting a survey of the status and usage of dugongs since 1985, but to date no funding has been found, or action taken.

Porpoises or dolphins are also subject to subsistence hunting, particularly in Malaita. The teeth are used for custom money. Preliminary investigations by Hill (1989) found that a wide range of species was taken, and that the catch is probably insignificant. The Environment and Conservation Division is still awaiting the completion and final reporting of that study.

3.2.14 Other marine resources important to the artisanal/subsistence sectors

A number of other marine resources are important in artisanal/subsistence sectors:

- ◆ *Mud crabs* are now becoming an important income supplement, especially in Malaita Province through sales to Honiara;
- ◆ *Land crabs* are an important subsistence food resource, especially *Cardiosoma* sp.;
- ◆ *Mangrove oysters'* domestic sales are growing, and these are now supplied on a regular basis to restaurants in Honiara;
- ◆ *Ornamental shells* are sold generally to tourists and there is a growing local shell jewellery trade;
- ◆ *Coastal pelagic fish* — kingfish, barracuda, mummula (*Caranx* spp.) and buma (*Selar* spp.) — are mostly sold through domestic markets, but are also an important subsistence resource; and
- ◆ *Deep-sea precious corals*.

chapter 4 ♦

Cultural & archaeological resources

The population of Solomon Islands is predominantly Melanesian (94.2 per cent), with 3.7 per cent Polynesian, 1.4 per cent Micronesian and the remaining 0.7 per cent of Chinese or Caucasian descent (SIG 1989b). Linguistic survey has revealed that at least 65 languages are still spoken in Solomon Islands. On large islands such as Guadalcanal and Malaita, between 6 and 10 different languages may be spoken. This has resulted in a richness and diversity of culture, traditions and custom. Custom is still strong in most areas, although much traditional knowledge is beginning to be lost.

Traditional values, beliefs, mythologies and genealogies have been orally passed down through generations. Concern is often expressed that much of this tradition may be lost as older generations die, values change and formal education increases. A number of workers have recorded "custom stories" in various places, but there is no systematic collection or repository of oral traditions.

Archaeological evidence suggests that Solomon Islands was already settled by 4,350 B.C. (V. Totu pers. comm.), giving approximately 6,300 years of human occupation. This has left a wealth of archaeological and tambu (sacred) sites. Tambu sites have a variety of origins ranging from boundary markers between land-owning groups, and burial sites, to sites that symbolise or commemorate ancestors or mythological events and are integral to the country's cultural heritage.

The number of tambu sites in Solomon Islands is inestimable. The National Museum commenced a national tambu site register and to date has recorded several thousand. Likewise individual provinces, most notably Guadalcanal and Western Province, maintain tambu site registers. However these are collected in an *ad hoc* manner and neither the provinces nor the National Solomon Islands Museum have the resources or finances to document tambu and other cultural sites systematically. More often than not, attention is brought to a tambu site after it has

been disturbed by development. It is therefore important that the impact of any development on the cultural environment be given consideration in future environmental impact assessments.

The National Solomon Islands Museum expressed concern at the loss of material culture (cultural artefacts, religious items and objects of custom) through sale to tourists and private dealers and collectors. Currently there is no specific law to protect cultural heritage, but the National Solomon Islands Museum has proposed draft legislation which is yet to go before Parliament for consideration.

There is a War Relics Act which provides for the protection of items left over from the war, but souveniring from ship and plane wrecks by tourists and divers still occurs, as does the dismantling of wrecks to be incorporated in building and other projects.

chapter 5 ♦

Socio-economic situation

5.1 Population & demography

The last population census was in 1986, at which time the population was estimated to be 285,176. This represented an annual rate of increase (from 1976 to 1986) of 3.5 per cent. This population growth rate is one of highest in the world. Median population estimates (assuming moderately declining fertility and mortality and no migration) are: 384,060 in 1996; 446,545 in 2001; 583,891 in 2011; and 721,850 in 2021 (SIG 1989b). Table 9 shows the estimated distribution of the population in 1991 (Statistics Office, Honiara).

Table 9 Estimated population distribution in 1991

Province	Estimated population	% Distribution	Density (per sq km)
Western	64,716	20	7.0
Isabel	16,564	5	4.0
Central	20,997	6	16.3
Guadalcanal (excluding Honiara)	60,746	19	11.4
Honiara	37,451	11	1702.3
Malaita	86,491	26	20.5
Makira	25,235	8	7.9
Temotu	16,495	5	19.0
Total	328,695	100	11.6

Source Statistics Office, Honiara

The overall population density for the country is 11.6 people per sq km. Apart from the very high value for Honiara (11 per cent of the population), above-average densities are found in Central, Malaita and Temotu Provinces. The provincial population densities mask some critical areas of high population density on small islands, where considerable pressure is or will be felt on limited land resources for subsistence agriculture and development needs, and which are likely to be areas with growing environmental concerns (Table 10).

Table 10. Islands with higher than average population densities

<i>Island</i>	<i>Area₂ (km²)</i>	<i>Population 1986</i>	<i>Density₂ per km²</i>
Vella Lavella	868	15,385	17.7
Russells	231	4,727	20.5
Ngella	354	10,161	28.7
Savo	30	1,826	60.2
Ulawa	63	2,049	32.5
Reef	29	5,118	176.5
Santa Cruz	586	7,166	12
Tikopia	4	1,166	291.5
Anuta	3	207	69.0

Source 1986 census

Large stretches of land with low population densities are found on Choiseul, Kolombangara, western Isabel, the southern part of Malaita (wards 25, 26, 31, 33, and 34) and the weather coasts of Guadalcanal and Makira. With the exception of Kolombangara and western Choiseul where logging has occurred, these areas are likely to have the least pressure on the land resources from competing development and subsistence uses.

The 1986 census reported 6,670 settlements on 347 islands, and 51 per cent had less than 20 persons in them (but only accounted for 11.3 per cent of the country's population). The average size of villages was 44.3 persons. The country's urban population is confined largely to Honiara and the provincial capitals. The majority of the population lives in rural areas.

The population of Solomon Islands is essentially a young one, with 47 per cent below 20 years of age (SIG 1989b). Education statistics from the 1986 census showed a generally low level of education, with 40 per cent never having attended school; 50 per cent having at least one year of primary education; 9 per cent having at least one year of secondary education; and only 1 per cent with higher education above secondary level. The latter level was believed to be largely influenced by the number of non-Solomon Islanders enumerated in the census.

5.2 Economic issues

Solomon Islands' economy continued to expand in 1990, with output of goods and services growing at about 6 per cent. This growth is mainly from increased output in the natural resource-based activities of fisheries, forestry and agriculture where export-oriented investment has been financed almost entirely by foreign capital (CBSI 1990).

5.2.1 Economic activity & employment

The 1986 census found that of the adult population aged 14 years and over, 86.5 per cent of males and 84.3 per cent of females were "economically active". "Economically active" covered both work for money and village work, which included unpaid labour such as gardening, food collection, fishing, preparation for village ceremonies, maintenance of village tracks, construction of church buildings or water supplies. The subsistence nature of the economy is reflected in the small proportion (around 15 per cent) of wage and salaried employment of the "economically active" population. The percentage of the total population that are wage and salary earners is 8.3 per cent (*Stats. Bull.* 1990).

The employment breakdown by industry and sector is given in Table 11 (over-page).

Most people were employed in the "Other Services" category (which includes education and health), agriculture, and administration — a total of 52 per cent of wage and salary earners.

The private sector is the major employer, with 64 per cent of employees. The national government is the largest single employer with 32 per cent of employees, while provincial governments only account for 4 per cent of jobs.

From 1988 to 1989 the main areas of growth in employment were trade, forestry and logging, construction and agriculture (*Stats. Bull.* 1990). However, the rise in employment from 1988 to 1989 was only 2.4 per cent, much lower than the population growth of 3.5 per cent. CBSI (1990) predicts that a net increase of 1,000 jobs is needed each year to maintain the present ratio of formal jobs to population.

and also states that even if this were achieved, it would be far short of the education system's yearly output of 5,000 Standard 6 leavers, around 1,200 Form 3 and Form 5 leavers, and nearly 200 Form 6 and tertiary leavers.

Table 11 Summary of number of people employed by national government, provincial government & private companies

	<i>National government</i>	<i>Private sector</i>	<i>Provincial government</i>	<i>Total</i>
Agriculture	0	4,160	60	4,220
Forestry & logging	594	1,286	26	1,906
Fishing	0	1,379	26	1,405
Mining & manufacturing	43	2,243	0	2,286
Electricity & water	69	196	31	296
Construction	251	800	304	1,355
Trade	47	2,650	17	2,714
Transport & communication	353	1,086	11	1,450
Finance	0	755	0	755
Administration	2,918	0	246	3,164
Other services	3,761	1,781	345	5,887
Total	8,036	16,336	1,066	25,438

Source *Statistics Bulletin* (1990)

In 1989 the average figure for monthly earnings was \$515 for employed workers for all provinces, however this was not evenly distributed through the provinces. Honiara workers had a much higher average of \$705 per month, while the lowest average monthly earnings were recorded for Isabel with \$145 per month (*Stats. Bull.* 1990).

5.2.2 Domestic production, foreign trade & balance of payments

The growth of Solomon Islands' economy in the past few years has been slow. The CBSI (1990) report supplies two Gross Domestic Production (GDP) estimates. Using a constant price factor from 1989, real GDP estimates indicate a growth rate of 6

per cent, which, with the population growth at 3.5 per cent, would enable some improvement in income per head.

On the other hand, using current prices, nominal GDP indicates an 8 per cent rise in 1989, due to low relative prices of commodity exports. When the resulting cash incomes are adjusted for price rises of around 10 per cent and population growth of 3.5 per cent, a significant fall in real income per head is indicated (CBSI 1990).

The agriculture sector is the largest contributor to GDP at around 36 per cent, with the forestry and fisheries sectors making a significant contribution of around 11 per cent. The manufacturing sector is quite small and only contributes around 4 per cent (TCSP 1990).

External trade plays a significant role in the overall economic activities of Solomon Islands. Exports are confined to a narrow range of primary and processed products while imports vary over a wide range.

The composition and relative importance of exports are shown in Table 12.

Table 12 Value of principal exports

Product	1989		1990	
	Value per cent of total (\$SI m.)	export earning	Value per cent of total (\$SI m.)	export earning
Copra & coconut oil	21.0	12.3 per cent	13.4	7.5 per cent
Palm oil & kernel	20.1	11.7 per cent	19.3	10.8 per cent
Cocoa	8.0	4.7 per cent	11.1	6.2 per cent
Fish & fish products	65.3	38.1 per cent	53.2	29.9 per cent
Logs & timber	41.3	24.1 per cent	60.8	34.2 per cent
Other*	15.6	9.1 per cent	20.3	11.4 per cent

Notes * This includes minerals and marine products

Source CBSI 1990

Fish and timber have traditionally been the two largest export earners, generally contributing over 60 per cent of export earnings. 1990 was the first year in which log and timber earnings were greater than fish and fish product earnings. Large operations in north Choiseul and north New Georgia were responsible for this increase in importance of log exports. Total production of logs from the natural

forest was about 436,000 cubic metres, suggesting that about 9,000-10,000 ha of forest were logged during that year (CBSI 1990). (NB. Forestry Division figures indicate that 385,126 cubic metres were logged).

The overall balance of payments was in deficit by \$SI 17.9 million in 1990 (CBSI 1990). The balance of trade in 1990 (value of export - value of imports) was -\$SI 62.7 million. The total value of exports rose by 3.5 per cent, well below the 10-15 per cent rate of increase in import payments. The estimated deficit on the service account was 23 per cent higher than 1989. The widening deficit continues the trend of recent years, reflecting an increasing use of non-merchandise resources of service and financial capital obtained from abroad (CBSI 1990).

5.2.3 Aid

In 1990, aid contributed around \$SI 88 million to the transfer account. Grants of goods and services to the government rose by 20 per cent to \$SI 49 million, while technical assistance at \$SI 26 million and cash aid at \$SI 13 million were slightly below 1989 levels. The estimated total value of foreign aid transfers at \$SI 88 million was equal to about 25 per cent of GDP, a similar ratio to 1989 (CBSI 1990).

5.2.4 Government finance

Government finances continued to remain in deficit in 1990 by -\$SI 33 million. The total cost of debt service reached \$SI 20 million in 1990. In effect the government is borrowing domestically \$SI 20 million per year to service its existing domestic and external debt (CBSI 1990). The gross external debt of Solomon Islands rose by 24 per cent in 1990 to an estimated \$SI 414 million (CBSI 1990).

5.3 Development trends & prospects

The CBSI (1989) report projections indicate a scope for growth of 50 per cent in gross export earnings over five years at 1989 prices and an improvement in net foreign exchange flows, and saw no reason to change the output predictions in 1990. The CBSI (1989) provides the following crude estimates as indicators of output growth (Table 13).

Table 1.3 Projected increase in product output

<i>Product</i>	<i>Output unit</i>	<i>1989 actual</i>	<i>1995 potential</i>
Copra	metric tones	34,000	50,000
Cocoa	"	3,000	5,000
Palm oil/kernels	"	25,000	27,500
Fish & fish products	"	37,000	60,000
Logs: natural forest	cubic metres	300,000	400,000
Logs: plantation	"	nil	250,000
Gold	ounces	1,000	50,000*
Tourism	holiday visits	5,000	15,000**

Notes * Gold Ridge output is now estimated to be 30,000 ounces (CBSI 1990)

** Tourism medium estimates is now for 24,600 visits per year (TCSP 1991)

Source CBSI (1989)

5.3.1 Product development trends

The following development trends are largely drawn from CBSI's 1989 and 1990 annual reports.

Copra

There is substantial increase in coconut production in the pipeline. Levers Solomon Ltd's (Solomon Islands' only large plantation enterprise) output of copra is expected to more than double to approximately 16,000 tonnes in 1995. Small-holder production is expected to reach 40,000 tonnes if prices can be maintained.

Cocoa

Existing plantations are expected to take production above 5,000 tonnes in the next two to three years, equivalent to about one five-hundredth of the world cocoa output.

Palm oils & kernel

In 1989 output recovered to pre-1986 cyclone levels and is expected to increase to 27,500 tonnes. Prospects for further increase in Solomon Islands Plantations Ltd's output, thus lower processing costs and overheads, centre on adding several

hundred hectares to the main SIPL estate by leasing nearby customary land and the establishment of small-holder resettlement schemes (CBSI 1989). However, prices are at an all-time low.

Other agriculture

Diversification of cash crops has been evident over the past few years, however to date these have all been small-holder expansions of crops such as spices (vanilla, chilli, cardamom, turmeric) and coffee. There has also been an expansion which is expected to continue of non-timber forest resource production such as ngali nuts and honey. In 1990, honey production reached two tonnes per month (CBSI 1990).

Livestock

The Solomon Islands cattle industry has been declining since 1986 and the 410 head reported in 1990 is the lowest number since the 1970s.

Skipjack & yellowfin tuna fisheries

The Solomon Islands tuna industry has two companies operating — National Fisheries Development (NFD) at Tulagi and Solomon Taiyo Limited (STL) at Noro. Solomon Taiyo Limited has a designed capacity for producing 900,000 cases of canned fish and is expected to reach that capacity in 1991. STL hopes to more than double its canned fish export earnings to around \$SI 50 million, while still exporting around 10,000 tonnes of frozen fish. Domestic sales are also expected to increase. STL and NFD currently have a total allocated volume of catch of 85,000 metric tonnes per annum.

A new fishing company, Makirabelle Ltd, was launched on 4 July. It is expected to commence fishing in September 1991 and is jointly owned by Makira Province and Frabelle, a Philippine company (50 per cent each). It will also undertake deep-sea fishing, but will fish outside territorial and archipelago waters because it will operate with foreign chartered fishing boats. It has an allocated volume of catch of 35,000 metric tonnes per annum.

Non-tuna fisheries

Non-tuna fisheries are an area of potential development. Japanese funding for deep-water fisheries in north Malaita and funding of provincial fisheries centres by EEC and USA are primarily aimed at the fresh fish market in Honiara. There have been a number of initiatives to start commercial export for high-value, well-presented fish, but these have met with various problems; none the less there remains potential for development.

Seaweed cultivation

Pilot projects in seaweed cultivation have been established. Progress to date has been slow, but there is potential for development in this area.

Giant clams

It is hoped that by 1992 an array of clam products will have been developed and test-marketed. There is believed to be great potential for development of clam farming.

Marine shells

Exports have been falling in volume but rising in value in recent years. A shell button manufacturing company opened in 1990 and there seems to be potential for expansion of other shell processing industries to increase the value of exports and lower the volume of unprocessed shells exported.

Turtle shell (bekko)

Solomon Islands exported 3,397 and 2,854 kg of turtle shell in 1989 and 1990 respectively. Work to date on the Regional Marine Turtle Conservation Programme indicates that the nesting hawksbill population has seriously declined since the late 1970s, probably a result of over-harvesting. Japan, the only importer of bekko, has recently announced that it will cease to import it in 1993 and the market will therefore be closed. The Fisheries Division is currently working on an amendment to ban the export of unworked bekko.

Crocodiles

The market for all non-farmed crocodile skins is now closed. The findings of the survey of Messel and King (1989) indicate that a five-year ban on all harvesting of wild crocodiles would be needed before the population recovered to a level which could support crocodile farming using wild-caught breeders or hatchlings.

Timber

There are a number of proposals for expansion of commercial logging of natural forests, including those on Choiseul, Vangunu, Isabel, Rendova and Vella Lavella. The Solomon Islands National Forest Resources Inventory Project commenced in 1990 and field work began in 1991. This inventory is expected to form the database for the rational management of Solomon Islands forests. KFPL, the joint CDC-ICSI forest enterprise, planted 755 ha in 1990. The log production from these plantations is potentially 250,000 cubic metres in 1995 (CBSI 1989). Reforestation and plantation forestry on government lands and customary land has been progressing slowly, but there is potential for growth within this area.

About 22,000 cubic metres of sawn timber were produced by 17 licensed sawmillers (excluding chainsaw operators) and there is definite potential for growth in this area, thus adding value to the current situation of predominantly round log export (CBSI 1990).

Minerals

There has been a decline in prospecting activities in the last few years and known gold prospects in the Shortlands, Vella Lavella and Marovo remain unexplored. The negotiations for Gold Ridge mine are still not completed, but output is expected to be 30,000 ounces when it is operational. Bugotu Mining Co. holds a prospecting licence for nickel in the San Jorge and Tataka areas. The deposits are believed to contain 24 million tons of ore. The proposal includes the processing of ore in Solomon Islands, and the smelter is likely to be situated on Guadalcanal, as an additional hydro-electric scheme would need to be developed to supply its very large electricity needs.

Tourism

The Tourism Council of the South Pacific in conjunction with the Ministry of Tourism and Aviation completed a Tourism Development Plan for Solomon Islands in December 1990. It considers that there is great potential for expansion of tourism. The medium projection for visitors in the year 2000 is 72,100. The projected expenditure of visitors indicates that tourism could have a major balance of payments role, alongside fisheries and forest products and probably ahead of agriculture and minerals. The TCSP (1990) survey projections predict that foreign exchange earnings from tourism will increase to \$SI 164.4 million by the year 2000 (about 15 times the present earnings). Many tourist attractions in Solomon Islands are nature-based and the expansion of tourism largely depends on the maintenance of the country's attractive natural environment.

chapter 6 ♦

Environmental issues in Solomon Islands

Various authors have reviewed environmental issues pertaining in general to the Pacific region and in particular to Solomon Islands (e.g. Dahl 1989; SPREP 1989; Baines 1990; Reti 1990; UNDP 1990; Baines 1981; Paine 1989; Thistlethwaite 1990; Hibberd & Schenk 1991). In developing a National Environmental Management Strategy, the current RETA Project is further reviewing, identifying and prioritising environmental issues and problems and developing strategies for addressing them. This process is being undertaken in conjunction with the relevant natural resource management sectors and provincial authorities, and it is not the intention of this chapter to pre-empt this consultative process, prioritise issues, or apportion blame. It is intended to provide a brief overview of environmental issues relevant to Solomon Islands which will act as a starting point for the National Environmental Management Strategy seminar to be held in November 1991.

Issues exogenous to the Pacific region—climatic and sea level changes, driftnet fishing, whaling and nuclear testing—are not discussed in this chapter. Those issues which are discussed are outlined in general terms and do not pretend to constitute an exhaustive list. Many of these issues are cross-sectoral, interrelated and difficult to separate into discrete entities, and are therefore discussed under broad subheadings.

6.1 Population growth

Solomon Islands has one of the highest population growth rates in the world, and this is the underlying cause of most environmental issues. If population growth continues at present levels, pressures on the limited land area to meet the subsistence and economic needs of the people is likely to lead to more and more

environmental problems, unless development is well managed and more intensive sustainable productivity from the land can be attained.

The nation's development has largely been built on resource exploitation and this will accelerate as every opportunity is grasped to help support the rapidly increasing population (Thistlethwaite 1990). The land resources of Solomon Islands are finite, and the capacity of that land to maintain and improve the quality of life of its people needs to be considered in conjunction with the ever-growing population. One of the primary aims of national development is to maintain and improve the quality of life for the population as a whole. If the quality of life is to be maintained and improved and excessive environmental degradation avoided, the difficult and sensitive issue of population growth needs to be grappled with seriously.

6.2 Lack of environmental information

The preceding review on the state and knowledge of Solomon Islands natural resources highlighted how very little is known of them and of the country's environment. It is difficult to manage resources and predict the impact of development when it is not known how large a resource is, where it occurs or what interrelation it has with other resources. The sustainable use and development of the natural environment depend on an adequate information base.

Some deficiencies in information highlighted in the previous chapters include:

- ◆ the areal extent, condition and quality of the forests and other vegetation types;
- ◆ the timber volume contained in natural forests;
- ◆ the extent, condition and productivity of marine habitats such as coral reefs, seagrass beds and mangroves;
- ◆ the distribution, status, habitat requirements and ecology of most native animals;
- ◆ the detailed geology of Malaita and Makira;
- ◆ the stocks and biology of marine resources such as reef fish, marine shells and other sedentary marine organisms currently being commercially exploited;
- ◆ the extent of soil erosion and degraded lands;
- ◆ the extent of petroleum resources;
- ◆ documented traditional knowledge on and management of resources.

Survey and collection of basic resource information is urgently needed to allow for good planning and management of the sustainable development of resources.

6.3 Lack of environmental awareness

There is a lack of environmental awareness at all levels of the community. The resources of Solomon Islands are still perceived as limitless and large environmental problems are yet to be felt by most communities. There is an urgent need for environmental awareness and education programmes to highlight the importance of the environment and the potential impact of resource exploitation on it. Increased environmental awareness is needed at all levels, from rural communities to government decision-makers.

6.4 Lack of institutional capabilities

There is no environmental policy for national or provincial governments, except in Western Province. An Environmental Management Bill is in draft form, and earlier this year Cabinet approved the drafting of wildlife management legislation to regulate wildlife trade. There are a number of sectoral legislations which have some environmental component, but these are far from adequate, and will be reviewed in a separate document.

The Environment and Conservation Division is small, lacks skilled staff and has only a very small budget. The Division has no legal or statutory responsibilities, nor any policy or corporate strategy to guide its activity, and receives almost no mention in the National Development Plan. The Division's only mandate for action is upon request from landowners and other government sectors. Much of its work is to react to environmental problems as they arise, and it is a credit to the Division that they have achieved so much given the constraints on staffing, skills, finance and policy directives.

There is an urgent need to acquire skilled staff in the fields of environmental engineering, resource management, environmental impact assessment, botany, zoology and ecology. Solomon Islands currently has no trained nationals in any of these spheres, and it will take up to four years for them to acquire such expertise. Although this expertise is needed now and could be filled by expatriate advisers, it is urgent that degree scholarships be awarded to meet future requirements.

Devolution of the functions and powers to legislate for environment to the Provinces and Honiara Town Council is again being discussed. Evidence in Solomon Islands overwhelmingly demonstrates the need for a national framework and institutional capability for the Environment and Conservation Division. If devolution is to proceed, it is essential that a national capability be maintained which could co-ordinate activities and provide advice to the provinces as well as meet regional and international commitments, and carry out more specialised functions which could not be replicated in each of the eight provinces.

6.5 Threats to terrestrial flora, fauna & ecosystems — loss of biodiversity

Threats to terrestrial flora, fauna and ecosystems fall under a number of categories. The most widespread issue geographically is deforestation. There are a number of issues/problems flowing from deforestation, but these will be dealt with under other sections. This section will deal solely with loss of biodiversity.

Deforestation results not just from commercial forestry activities, but also from clearing for shifting subsistence agriculture, from commercial large-scale agriculture, from urbanisation and settlement expansion and is likely in the future to result from mining activities.

Eighty-five per cent of the population live in rural villages, obtaining the bulk of their diet from subsistence production systems. To date no-one has estimated the annual rate of deforestation through shifting cultivation for subsistence agriculture. Much of the forest used in the gardening cycle is secondary forest, probably of little commercial timber value, but population growth inevitably leads to a need for expansion and intensification of agricultural production for food, and must inevitably impinge on the primary forest resource.

Large-scale agricultural developments have concentrated in two areas: the coastal forests on the Quaternary coral fringe which have been planted with coconuts since the 19th century, and the mixed deciduous forests on Guadalcanal where most of the large-scale oil palm and other cash crop developments have taken place. Currently there are no plans for large-scale agricultural expansion into natural forest areas.

Commercial logging activity is occurring over a large number of islands and that deforestation from all sources is presumably occurring at a much faster rate. An important issue to highlight is that forest replacement or reforestation is happening at a much slower rate than logging.

A major issue arising from deforestation is loss of biodiversity. Most of the deforestation is occurring from the coast up to a level of 400 metres. Ecosystems, plants and animals found in this zone are those most under threat. Preceding sections on fauna highlight that very little is known about the habitat requirements and distribution of most terrestrial animals, therefore we know little about what is being lost. Many species are restricted to one or a few islands, so large-scale clearing could be a serious threat to at least some of them.

In Solomon Islands loss of species, ecosystems, and biodiversity in general is an important issue. As many species are endemic, if lost from one island they may disappear entirely. The high level of endemism, the large number of species restricted to one or few islands, the very patchy understanding of fauna and flora

distribution, and the lack of any effective conservation reserve systems mean that large-scale land clearing could result in the irretrievable loss of species and ecosystems from Solomon Islands and from the planet.

Development has largely been based on resource exploitation and the rate of development is rapidly increasing. It is therefore important that conservation areas be identified and a means of establishing a conservation area system be developed before representative habitats are lost. A system of conservation areas suiting Solomon Islands land tenure and land management priorities urgently needs to be developed. Generally, representative reserves in other nations have been established on government-owned land. In Solomon Islands, however, the Government owns only 9 per cent or 246,000 ha of land, of which 117,616 ha is committed to forestry plantations or operations. There appears to be little potential to develop representative conservation areas on such land.

This leaves the prospect of developing conservation areas on customary land. Currently there is no legislation and little incentive for this to happen. There is a strong need to identify conservation measures appropriate for customary lands.

Some legislation has limited provisions for the protection of areas of land and sea. The following areas have been designated protected areas under a variety of legislation: Queen Elizabeth II National Park, Tulagi Bird Sanctuary, Arnarvon Wildlife Sanctuary, Oema Island Bird Sanctuary and Simbo Megapode Management Area. These areas cover less than 0.2 per cent of the country's land area. However, despite their designation as conservation areas, they do not function as such. The various national and provincial legislations all have a separate "sector-" or area-specific origin and most were designated without full consultation and participation of nearby communities. The lack of success in maintaining most of these areas (Simbo Megapode Management Area being the exception) reflects the weakness of this approach.

Traditional conservation and harvesting practices have long been a way of life in Solomon Islands. Tambus are often still effective in giving protection to a specific area or species of wildlife. However many of these traditional conservation practices and tambus are beginning to break down in areas where traditional authority is eroding and with the introduction of a cash economy and new technologies.

Other threats to ecosystems, plants and animals result from indirect impacts of deforestation, for example the effects of soil erosion and siltation on mangroves and other downstream communities.

Another threat to biodiversity is the growing wildlife trade. At least 19 species of reptile and four species of frog have been exported. They are exported live, destined for the exotic pet trade for reptile and frog enthusiasts. A total of 14,137

and 13,538 reptiles and amphibians were exported in 1989 and 1990 respectively (Leary 1991). Butterflies and other insects constitute another major group exported. They are exported dead and are destined for curio collectors and insect enthusiasts, while some of the lower quality specimens may be used for decorative items such as lamp shades and tables. Export of parrots has commenced; in the first eight months of 1991, 866 white cockatoos (*Cacatua ducorps*) and 731 cardinal lorikeets (*Chalcopsitta cardinalis*) were exported. In 1992, the parrot trade grew, and the king parrot (*Electus roratus*) was also exported.

Many of the species exported are thought to be common and widespread and their status does not appear to be threatened by the current level of trade. However, other species with restricted distribution, rare status, a low reproductive rate or a habitat limited or threatened by development are of concern. Areas of intensive fauna collection, in particular small offshore islands which have little potential for recolonisation through natural dispersal, are also at risk of critical depletion of populations through over-collection. It is therefore essential that areas of collection be regularly monitored, to avoid localised extinction of species, subspecies or races restricted to a single island.

A programme to monitor such areas has been drawn up (Leary 1990a), but has yet to be implemented. It is imperative that Solomon Islands Government implement wildlife management recommendations outlined in Leary (1990a), which include drafting of legislation, regulations and instituting careful monitoring of trade. Legislation should include conditions for confinement and shipping of fauna; licensing of exporters; requirements for record keeping by exporters so that geographic areas of collection may be monitored; and a schedule of species permitted for export with quotas which may be adjusted as further information on population status and species ecology comes to light.

Added to these threats to native fauna is the threat imposed by feral animals. The seriousness of this threat is unknown, but there is an urgent need to assess the impact of feral cats, black rats and cane toads on native populations. There is anecdotal evidence that these species are having an impact on at least some fauna populations, particularly in high altitude forests.

6.6 Degradation & over-harvesting of coastal & marine resources

The coral reefs of Solomon Islands are of great importance to its people, as they are the nursery and feeding grounds of many species of fish, the prime source of subsistence protein for the majority of coast-dwellers. Degradation of reefs in Solomon Islands is occurring through:

- ♦ sedimentation from onshore soil erosion from forestry and agricultural activities;
- ♦ pollution from sewage;
- ♦ destructive fishing methods, including using World War II explosives and fish poison;
- ♦ over-fishing; and
- ♦ collection of live coral for aquariums and tourist trade.

Mangroves likewise are important: for their role in providing feeding and nursery grounds for many marine organisms; as a nutrient trap system; for stabilising shallow-water sediments and shorelines during storms; and to absorb excessive run-off during heavy rains.

Degradation of Solomon Islands mangrove resources is occurring through:

- ♦ clearing for new settlements and expansion of old ones;
- ♦ cutting for firewood, especially for copra and bêche-de-mer drying;
- ♦ siltation from onshore soil erosion from agriculture and forestry activities, and
- ♦ landfill coastal "reclamation", especially by using the mangroves as dumps.

Commercial over-harvesting of some marine resources appears to be occurring. The survey recently conducted by the Environment and Conservation Division and the Fisheries Division indicates that there has been a serious decline in nesting turtles in the Anarvon Group, and that over-harvesting of hawksbill turtles is at least occurring in that area. Crocodiles have also been over-exploited (Messel & King 1989) and are currently under threat of extinction.

Skewes (1990) suggests that goldlip, blacklip, green snail and trochus are probably being over-harvested, and that national annual quotas should be considered. Hibberd and Schenk (1991) state that over-harvesting of fish appears to be especially acute in the vicinity of larger urban populations, where there is ready access to large markets, but this is not substantiated.

6.7 Pollution, waste disposal & peri-urban issues

Marine pollution is an increasing issue in almost all provincial centres because of lack of adequate sewage disposal. High coliform contamination in surface waters and ground water near urban areas is probably common.

The industrial base of Solomon Islands is small and therefore industrial pollution is not widespread, but essentially limited to the Ranandi Industrial Estate in Honiara, the fish cannery and associated port and shipping facilities at Noro and Tulagi and

oil palm processing by SIPI, on Guadalcanal. There is little or no monitoring of pollution from these concentrated sources.

Inadequate solid waste disposal and lack of suitable sites for garbage dumps are growing issues in all provincial centres. Almost all urban areas show signs of pollution arising from inadequate disposal and dumping of household wastes. Seepage of hazardous materials and leachates may be resulting in marine pollution, and contamination of ground waters.

Urban environmental issues in Solomon Islands relate to the inability of urban services to keep pace with the inflow of immigrants. Problems in some urban centres occur with water supply, deforestation for garden sites and firewood, soil erosion and resultant sedimentation of reefs and other marine environments from urban run-off.

6.8 Land degradation issues

Land degradation is not a widespread issue in Solomon Islands. Most land degradation complaints—soil erosion, soils compaction, loss of nutrient cycling by forests, loss of soil fertility—occur during and after logging.

Land degradation from over-intensification of agriculture and unsustainable agricultural activities is not widespread. However, it is locally important in such areas as north Malaita where population density is high. There is evidence for this having occurred in the past in other areas by the presence of anthropogenic grasslands in Nggelas and Guadalcanal.

Hibberd and Schenk (1991) state that the Ministry of Agriculture and Lands has identified soil degradation as the main environmental issue facing sustainable agricultural development. They suggest that this is particularly acute in areas where population density is high. They state that fallow periods have fallen in some areas from 15 years to six months, resulting in reduced yield. They also state that expansion of garden areas to more mountainous terrain has meant that soil erosion and landslips are increasing.

6.9 Pesticides & other chemicals

Use of DDT, Malathion and Fenitrothion for anti-malaria spraying campaigns has been widespread in the past and there has been little or no assessment of the impact on the environment. It is likely that there are high residual levels of DDT in the environment. High levels of DDT have been detected in some freshwater animals sampled in rivers on Guadalcanal (Douglas, Martin & Associates 1990).

Agricultural pesticides, herbicides and chemical fertilizers are not actively encouraged by the Ministry of Agriculture and Lands, however they are extensively used on Guadalcanal and in the Russells, mainly in large-scale commercial coconut and oil palm plantations. Timber treatment and processing chemicals and herbicides have given cause for concern in isolated incidents. Most often concern is expressed at the lack of environmental and hazard awareness of operators applying chemicals.

6.10 Mining

There are currently no operational mines in Solomon Islands, but there have been environmental concerns expressed regarding inadequate rehabilitation of prospecting sites and negligent prospecting activities. These complaints have generally been minor.

The major concern is the lack of institutional capability of Solomon Islands Government to adequately screen development proposals and undertake environmental impact assessments on mining proposals. This capacity is expected to be enhanced before the commencement of Gold Ridge mining. In light of the likely development of Gold Ridge mine, the Government's inability to adequately monitor environmental impacts, particularly with respect to water quality, is an issue.

chapter 7 ♦

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APPENDIX I

Rare, endangered & vulnerable mammal species, after Flannery & Parnaby (1991)

Species marked ** have not been recorded in the last 50 years and are probably extinct or critically endangered.

Giant rats

** *Solomys salomonis* (extinct)

S. ponceleti (endangered)

S. sapientis (vulnerable)

Uromys rex (endangered)

** *U. porculus* (extinct)

** *U. imperator* (extinct)

Monkey-faced flying foxes

Pteralopex atrata (endangered)

Pteralopex anceps (endangered)

Pteralopex new sp. 1 (Guadalcanal) (vulnerable)

Pteralopex new sp. 2 (New Georgia) (vulnerable)

Flying foxes

Pteropus cognatus (vulnerable)

Pteropus howensis (vulnerable)

Pteropus mahaganus (vulnerable)

Pteropus nitendiensis (vulnerable)

Pteropus rayneri (vulnerable)

Pteropus tuberculatus (vulnerable)

Pteropus new sp. (vulnerable)

Tube-nosed flying fox

** *Nyctimene santacrucis* (extinct)

Blossom bats

Melonycteris woodfordi (vulnerable)

Melonycteris new sp. (vulnerable)

Insectivorous bats

Anthops ornatus (vulnerable)

Hipposideros dinops (vulnerable)

H. demissus (vulnerable)

Chaerophon solomonis (vulnerable)

APPENDIX 2

Endemic terrestrial reptile species

Here endemic is not confined to species occurring in political Solomon Islands, but includes those endemic to geographical Solomon Islands (i.e. including Bougainville), except when a species does not occur in political Solomon Islands.

Geckos

Cyrtodactylus biordinis

Lepidodactylus new sp. (Brown et al., in prep.)

L. shebae

Skinks and lizards

Corucia zebrata

Emoia flavigularis

E. taumakoensis

E. maculata

E. schmidtii

E. isolata

E. renellensis

E. pseudocyanura

E. rufilabialis

Sphenomorphus bignelli

S. concinnatus

S. cranei

S. tanneri

S. woodfordi

Tribolonotus blanchardi

T. ponceleti

T. pseudoponceleti

T. schmidtii

Geomyersia glabra

Snakes

Loveridgelaps elapoides

Salomonelaps par

Laticauda crockeri

APPENDIX 3

Rare & uncommon reptiles

Geomyersia glabra (endemic)

Lipinia noctua

Sphenomorphus cranei (endemic)

S. woodfordi (endemic)

Ramphotyphlops willeyi

Emoia flavigularis (endemic)

Eugongylus albofasciolatus

Loveridgei elapoides (endemic)

APPENDIX 4

Endemic frog species (including species which also occur in Bougainville)

Ceratobatrachus guentheri

*Palmatorappia solomonis**

*Platymantis guppyi**

*Platymantis webberi**

Batrachylodes trossulus

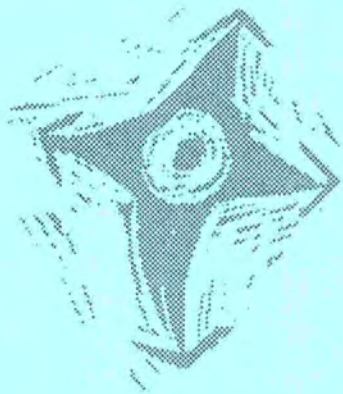
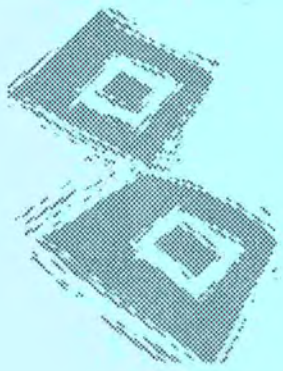
B. vertebralis

*Discodeles malakuna**

* Found only in political Solomon Islands

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