https://theses.gla.ac.uk/

Theses Digitisation:

https://www.gla.ac.uk/myglasgow/research/enlighten/theses/digitisation/

This is a digitised version of the original print thesis.

Copyright and moral rights for this work are retained by the author

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge

This work cannot be reproduced or quoted extensively from without first obtaining permission in writing from the author

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given

Enlighten: Theses
https://theses.gla.ac.uk/
research-enlighten@glasgow.ac.uk

THE MALARIA ERADICATION PROGRAMME AND POPULATION DYNAMICS IN THE BRITISH SOLOMON ISLANDS PROTECTORATE 1970-1976

(with reference to the Malaria Eradication Pilot Project and the Malaria Pre-Eradication Programme.)

being

a Thesis

submitted for the approval of the Faculty of Medicine of the University of Glasgow

in accordance with the regulations

pertaining to the Degree of Doctor of Medicine

by

IAN FLEMING MARIE SAINT-YVES

M.B.Ch.B.(1960), D.T.M.H., D.Obst.R.C.O.G., F.R.S.H.

This thesis was prepared while the author was working in the British Solomon Islands Protectorate as a Malaria Epidemiologist.

August 1975

ProQuest Number: 10662659

All rights reserved

INFORMATION TO ALL USERS
The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript
and there are missing pages, these will be noted. Also, if material had to be removed,
a note will indicate the deletion.

ProQuest 10662659

Published by ProQuest LLC (2017). Copyright of the Dissertation is held by the Author.

All rights reserved.
This work is protected against unauthorized copying under Title 17, United States Code
Microform Edition © ProQuest LLC.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

C O N T E N T S

Thesis
4360
Copy 2

GLASGOW UNIVERSITY LIBRARY

INTRODUCTION

Infectious Diseases and their control or eradication offer the greatest challenge to the health services in developing countries, demanding great expenditure on staff training and the application of specific methods of attack in specially designed programmes.

Malaria is such a communicable disease, and wherever it is endemic it has caused great morbidity and mortality in the population at risk, and has hindered economic development, and, in turn, social development. With the discovery of the residual effect of D.D.T. (di-chloro-diphenyl-tri-chlorethane) in 1939, and the adoption of the goal of Malaria Eradication in 1955 by the 8th. World Health Assembly in Mexico, there was a new challenge to this disease. In the British Solomon Islands Protectorate, this challenge was made in 1961 with the start of a combined BSIP Government/World Health Organisation Pilot Project. This project proved successful, and was expanded through a Pre-Eradication Programme to a full Malaria Eradication Programme on a country-wide basis in 1970. The results have been good, particularly in the Western District, part of which entered into consolidation phase after the cessation of spraying in May 1974.

With the gradual removal of the burden of malaria from these islands, there has been a steady improvement in the health of the population. The most dramatic effect of this improvement in health has been on the reduction in Infant Mortality, with a consequent rise in the annual rate of growth of the population.

Prior to the start of anti-malarial operations, there was a steady annual increase in the population brought about by a continual improvement in the health care and coverage provided

by Government and Church Health Services. However, this gradual increase in the growth of the population was dramatically altered by this new attack on malaria, and consequently resulted in an increase in the annual growth rate of the population.

It is the aim of this thesis to examine the relationships between malaria eradication, with particular emphasis on the Malaria Eradication Programme (MEP) in the period 1970-1974, and the increase in the population. The improvement in the health care and in the level of education of the population have also been contributory factors to the increase in population and their respective roles are discussed. In the Health field, the emphasis has been placed on an evaluation of the basic health services and the major endemic diseases, malaria, tuberculosis, leprosy, filariasis, and until recently, yaws.

It is recognised that the control and gradual elimination of malaria acts as a spur to population growth, but the extent to which it can influence the rate of growth is not generally appreciated. This thesis will attempt to define the probable rate of growth, to relate it to the duration of anti-malarial operations and other factors, and to determine the rate of growth due solely to other health measures and activities. It is submitted that the probable annual growth rate of the Solomon Islands population is considerably in excess of the official growth rate, and that the population may well exceed 200 000 persons at the next census in 1976. It is hoped that this paper will reflect the true picture and apportion the results due to anti-malarial and other operations and factors fairly.

The total population, its annual rate of growth and the percentage of the population under 15 years of age are vital

indices for planning and future development of any country, especially a developing country such as the British Solomon Islands Protectorate.

1.0 THE GEOGRAPHICAL AND HISTORICAL BACKGROUND

1.1 GEOGRAPHICAL BACKGROUND

The British Solomon Islands Protectorate is the largest territory administered by Great Britain in the Pacific. The Islands form a scattered archipelago lying to the east of New Guinea and to the north of the New Hebrides occupying an area from longitude 156°E to 170°E, and from latitude 5°S to 12°S. The islands of the Protectorate cover an area of approximately 11 000 square miles, and a sea area of 500 000 square miles.

The main group comprises a double chain of islands, stretching roughly from north-west to south-east. It includes seven major islands:- Bougainville (politically, part of Papua New Guinea), Choiseul, Santa Ysabel, New Georgia, Malaita, Guadalcanal and San Cristobal - and many smaller islands. There are several smaller island groups, such as Rennell and Bellona to the south, the Santa Cruz group to the south east, the small, isolated islands of Tikopia, Anuta and Fataka, and the major atolls such as Ontong Java and Sikaiana to the east and north.

These islands are predominantly volcanic in origin, and are a link in the large chain of volcanic ranges and islands stretching from south-east Asia through Sumatra, Java and New Guinea, and continuing beyond the Solomons into the New Hebrides.

The large islands of Choiseul, New Georgia, Santa Ysabel, Guadalcanal, Malaita and San Cristobal are rugged, and vary between 90 and 120 miles in length, and between twenty and thirty miles in width. These islands are mountainous (the highest at 7953 feet is on Guadalcanal), the mountains making a central

	Honiara(C) 1954-70		Kirakira(E) 1965-70		Auki(M) 1954-70		Munda(W) 1954-70			Honiara (C)		Kirakira(E)		Auki (M)		Munda (W)	
Month	Max	Min	Max	Min	Max	Min	Max	Min	Year	Max	Min	Max	Min	Max	Min	Max	Min
January	87·2	73·4	86·3	72·9	86·6	74·2	87·7	74·5	1960	87·1	72·9	–	–	85·7	73·4	86·8	74·3
February	86·7	73·4	87·1	72·8	86·2	74·5	87·2	74·7	1961	87·3	72·9	–	–	85·7	73·4	86·6	74·2
March	86·8	73·5	86·1	73·0	86·2	74·6	87·4	74·7	1962	87·1	72·8	–	–	86·1	73·0	87·2	74·1
April	87·1	73·2	85·8	71·7	86·4	73·9	87·0	74·3	1963	86·4	72·9	–	–	85·5	73·0	87·0	74·0
May	87·5	73·2	85·4	71·3	86·2	73·4	86·8	74·4	1964	87·0	72·8	–	–	86·0	73·2	87·4	74·1
June	86·8	72·3	86·1	69·8	85·5	72·4	85·8	73·9	1965	85·8	72·4	85·1	72·5	84·8	73·0	85·7	73·8
July	86·1	72·1	84·1	70·6	84·6	72·1	84·7	73·4	1966	87·3	72·6	85·6	71·2	85·1	73·3	86·2	74·4
August	86·6	71·9	84·6	70·1	84·9	71·8	85·0	73·7	1967	86·5	72·4	85·3	72·2	85·4	73·4	86·5	74·0
September	87·2	72·1	85·1	70·3	85·3	72·6	86·1	73·6	1968	86·9	72·6	85·9	72·0	85·5	73·3	86·5	74·1
October	87·3	72·7	85·3	71·2	85·6	72·9	86·7	74·0	1969	87·3	73·4	84·4	73·3	85·9	73·7	85·9	74·7
November	87·0	72·5	85·6	71·4	86·6	73·1	87·4	74·0	1970	86·9	73·4	85·7	68·7	86·3	73·3	87·4	74·2
December	86·8	73·5	86·0	72·0	86·7	74·0	87·8	74·6									

TABLE 1.

TEMPERATURE: MONTHLY AVERAGES (°F)

SOUTH PACIFIC AIR TRANSPORT COUNCIL

ANNUAL AVERAGES (°F)

spine, which drops down steeply to sea level on one side and on the other, drops through a series of foothills to a coastal plain and the coast. Guadalcanal has the only extensive plain, on the north-east coast, in the Solomon Islands. There are many coral reefs and lagoons around many of the islands.

The islands lie in the Equatorial Oceanic and Tropical Oceanic climate Zones. They have temperatures averaging 80°F with little diurnal variation; the maximum is rarely above 87°F, and the minimum seldom below 71°F. Average Relative Humidity is seldom below 80 % for any month throughout the year. (Table I). (Avery J G. 1975)

The NW Monsoon season, from November to April, and the SE Trades season, from May to October, are the two distinct wind patterns. Rainfall is uniform through most of the islands with averages between 100 - 300 in. per annum. (Table 2:, Map I. Fig I) The Weather coasts of Malaita and Guadalcanal experience high seasonal rainfall in the South-east season, whereas the north coast of Guadalcanal experiences a seasonal low at this time. In the NW season, there are long periods of calm, which are punctuated by squalls, and sometimes by the build-up of cyclones.

1.2 THE PEOPLE

In the 1970 Census, of the 160 998 persons enumerated, 149 667 were Melanesians, 6 399 were Polynesians (together they comprise Solomon Islanders), 2 362 were Micronesians (resettled in the Protectorate in the early 1960s), 1 280 were Europeans, 577 were Chinese, and 713 others. 1

Month	Honiara(C) 1954-70	Kirakira(E) 1965-70	Auki (M) 1957-70	Munda (W) 1957-70	Year	Honiara(C)	Kirakira(E)	Auki (M)	Munda (W)
January	10·73	15·91	13·17	16·59	1960	95·54	–	111·83	123·82
February	11·90	13·18	15·67	13·60	1961	81·65	–	138·90	153·99
March	13·82	14·00	16·78	14·27	1962	91·75	–	135·70	144·10
April	8·86	12·87	11·35	10·98	1963	81·40	–	121·29	130·13
May	5·59	13·00	7·37	9·59	1964	63·32	–	127·92	122·30
June	3·82	12·25	7·44	10·36	1965	95·86	196·34	143·56	174·49
July	3·91	14·66	10·31	15·16	1966	61·66	121·50	108·35	131·52
August	3·57	16·45	8·76	11·28	1967	116·65	182·48	150·78	164·97
September	3·98	9·60	10·48	9·40	1968	81·41	157·75	151·04	147·44
October	6·26	13·54	9·47	10·52	1969	83·80	191·65	140·61	165·42
November	5·62	9·01	8·20	10·74	1970	100·83	149·28	176·41	134·93
December	9·03	17·22	12·85	10·53					

TABLE 2

SOUTH PACIFIC AIR TRANSPORT COUNCIL

RAINFALL: MONTHLY AVERAGES (INS.)

ANNUAL TOTALS (INS.)

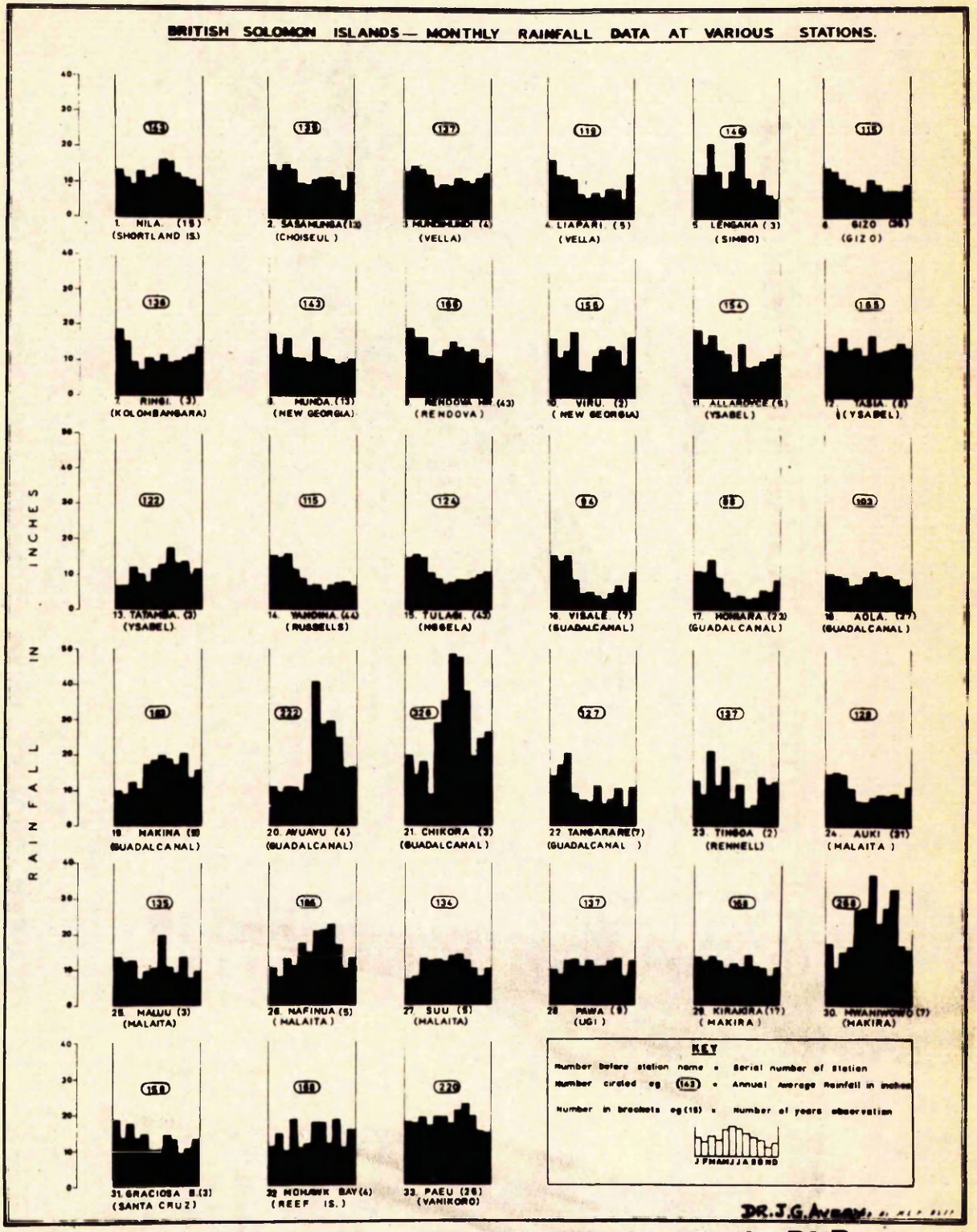
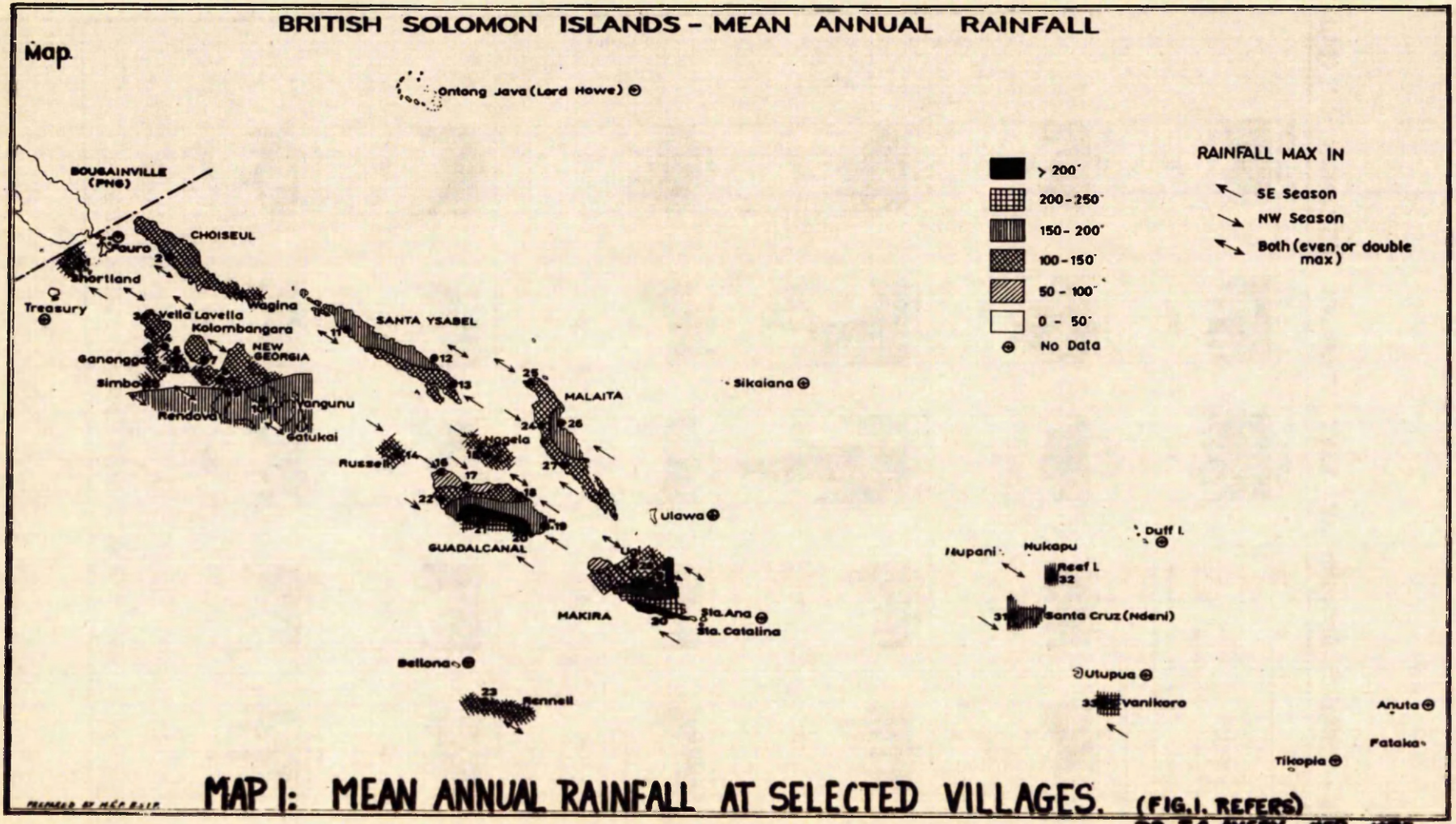


FIG. 1. :- MONTHLY RAINFALL DATA AT VARIOUS STATIONS — BSIP


BRITISH SOLOMON ISLANDS - MEAN ANNUAL RAINFALL
Map.
Ontong Java (Lord Howe)
BOUGAINVILLE (PNG)
CHOISEUL
Shortland
Treasury
Wagina
Lavella
Kolombangara
NEW GEORGIA
SANTA YSABEL
MALAITA
Sikaiana
Simbo
Rendova
Gatukai
Russell
Ulawa
GUADALCANAL
MAKIRA
Sta. Ana
Sta. Catalina
Bellona
Rennell
Duff I.
Nukapu
Reef I.
Santa Cruz (Ndeni)
Utupua
Vanikoro
Anuta
Fataka
Tikopia
RAINFALL MAX IN
SE Season
NW Season
Both (even or double max)
> 200"
200 - 250"
150 - 200"
100 - 150"
50 - 100"
0 - 50"
No Data
MAP I: MEAN ANNUAL RAINFALL AT SELECTED VILLAGES. (FIG.1. REFERS)
DR. J.G. AVERY MEP 1975

The Melanesians tend to inhabit the main islands, while the Polynesians (and Micronesians) tend to inhabit the peripheral islands such as Ontong Java, Rennell and Bellona, Sikaiana, Tikopia, the Duffs and Anuta. The largest group of Micronesians, recent immigrants from the Phoenix Islands of the Gilbert and Ellis Islands Colony, is mainly settled on Wagina Island, off Choiseul.

Following a period of prolonged, peaceful administration, there has been a movement of villages down to the coast, and except for Guadalcanal and Malaita, most of the land in the interior is almost empty of inhabitants.

Basically, the mode of living for the great majority is still the traditional way of the village, with every family growing its own food and building its own house. Nevertheless, there is an increasing drift to the towns, and to Honiara, the capital, in particular. (Solomon Islands Annual Report, 1973.)

It is said that there are 87 different vernaculars spoken in the Solomons Islands; as a result, English and Pidgin English are the means of widespread communication. The Polynesians speak languages closely related to the Maori.

The Melanesians can basically be divided into (a) Westerners - who inhabit New Georgia, Vella Lavella, the Shortlands Group and Choiseul, and together with Bougainville, form the "black spot" in Melanesia. (b) The Saltwater peoples - who inhabit Santa Ysabel, Russells, Malaita, Nggela, Savo, Guadalcanal, San Cristobal and Santa Cruz and have traditionally lived on the sea coast or

on artificial islands, as on Malaita. (c) Bush or Mountain peoples - the inland dwellers of Santa Ysabel, Malaita, Guadalcanal and San Cristobal. (Macgregor J.D. 1966).

1.3 MALARIA AND THE PEOPLE

It is possible that the high densities on the small, mountainous islands and on small offshore islands may have been related to their freedom from mosquitoes. (Brookfield H.C.; Hart D. 1971).. Parsonson (1966) has suggested that the artificial village islands on the Malaita reefs and elsewhere were built specifically to escape malaria, though defence may well have been equally significant. However, the island - builders may also have been late comers who were unable to obtain land on the mainland (Tedder J.O.L. 1971).

The distribution of the population in Melanesia may have been influenced by the geography of malaria, and other diseases such as tuberculosis, filariasis, yaws and leprosy. (Brookfield H.C.; Hart D; 1971). There was no doubt that variations in the disease pattern over the region were well enough defined to have a major effect on population distribution. (Norman - Taylor W. 1964).

1.4 HISTORY AND ADMINISTRATION

Melanesians, by far the largest racial group of Solomon Islanders, are thought to have originated from some of the islands in sout-east Asia, although this is uncertain. The Polynesian people of the outer fringe islands of Ontong Java, Sikaiana, some of the Reef and Duff Islands, Tikopia, Rennell and Bellona, appear to have come from the western islands of Polynesia relatively recently, The people on Santa Cruz, Savo, and Vella Lavella are distinguished by their languages, being non-Melanesian in character, but who themselves show the physical characteristics of Melanesians; they are either believed to be descendants of an earlier wave of migration from south-east Asia, or to be among the more recent arrivals.

The recorded history of these islands began with their discovery by the Spanish explorer Alvaro de Mendana, who reached Santa Ysabel in February 1568. In 1595, he returned to the islands to colonise them, but, although reaching Graciosa Bay, Santa Cruz, on 28 September 1595, the Spaniards were later forced to abandon the settlement due to disease and disputes. Mendana died on 18 October of the same year.

Thereafter, many of the famous names of Pacific exploration gradually rediscovered these islands - Tasman rediscovered Ontong Java (1643), Carteret rediscovered Santa Cruz, Ndai and North Malaita (1768), Bougainville discovered and named Bougainville and Choiseul (1768), and in 1769, de Surville rediscovered Santa Ysabel, Ulawa, San Cristobal and Santa Ana.

Contact with the local inhabitants was sparse, and unpredictable in the initial stages. The Solomon Islands acquired a reputation of being the most feared place in the Pacific. However, in 1845, attempts to establish a Roman Catholic mission on Santa Ysabel and San Cristobal ended in failure after two years with the death of four missionaries. Nevertheless, at this time, trading contacts had been successfully established.

Between the years 1875 - 1893, there was both a boom in copra and a demand for labour in the sugar plantations of Fiji and Queensland. The recruitment of labour was uncontrolled, and most approached a slave - trade (blackbirding), with kidnapping and inhuman treatment. However, between 1903 - 1906 most of the labourers were enforced by law to return, although a few remained in Queensland and Fiji. The labourers returning home brought with them a knowledge of new ways learned in the plantations.

In 1893, a Protectorateship was progressively declared over the islands, beginning in New Georgia. By the Samoan Tripartite Convention of 1899, Santa Ysabel, Choiseul, Shortlands, and Ontong Java were transferred to Britain by Germany in return for the relinquishment of British claims in Samoa.

The 1914 - 1918 War had little effect on the Solomon Islands. However, the second World War left a lasting impression on the peoples of these islands. Guadalcanal was a turning point in the Americal effort of the Pacific war, which was at its height in the years 1942 - 1943. During this struggle, the islanders proved to be loyal and brave in the face of adversity. The war

was also the first major influence of the West on these people, and dramatically altered their traditional way of life.

After the war, the recovery was slow, with the slow growth of government and trade. A home - rule, "Marching - Rule" movement started in Malaita in 1946, lasted about six years and was characterised by a resistance to government and church in particular. In many ways, it was a cargo - cult movement. Local councils were established in many areas in 1952, and by 1964 covered a great majority of the islands.

A legislative Council was established in 1960, and decisions were made in association with the Executive Council. In 1967, the first direct elections were held in thirteen out of the fourteen representative constituencies.

Changes in the constitution in 1969, permitted an Election to be held in 1970 to elect a single Governing Council with executive committees. In 1973, a general election was held in all 24 constituencies on the basis of universal adult suffrage. In 1974, following further Constitutional development, the Governing Council was renamed the Legislative Assembly, and the Executive committees were replaced by a Council of Ministers. The High Commissioner was redesignated Governor, and presided over the Council of Ministers (Annual Report 1973).

It has recently been announced that the country will be self-governing by the end of 1975.

2.0 MATERIAL AND METHODS

There are three main sources of data used in this thesis. The health data are obtained from Annual Report of the Medical Department, British Solomon Islands Protectorate for the years 1960 to 1972, the semi - official reports prepared by medical officers at District level, and from Annual and Monthly Reviews prepared by the Malaria Eradication Programme. Data have also been obtained from Assignment and Field Trip Reports prepared by visiting World Health Organisation advisors, and from official government publications such as the Abstract of Statistics and the Solomon Islands Annual Report 1973. The sources of all other data are clearly indicated with the citation or figure.

The maps and rainfall figures used throughout the thesis were prepared by the mapping section of the Malaria Service; additions to them were prepared by the author, as were the special graphs. Avery (1975) prepared the original rainfall data.

The population data for the period 1931 - 1970 were obtained from the official census returns for the years 1931, 1959 and 1970. From these official figures, various other data were derived, and their methods of derivation are explained in the appropriate text.

The Malaria Eradication Programme (MEP) population figures for 1970 were used as a base-line, and directly compared with the official 1970 census figures. The difference between the Census and MEP populations was expressed as a percentage, and determined on an Islands Group and District basis.

The MEP population figures were obtained from the ongoing Census returns obtained by malaria staff on a zonal basis at the time of each cyclical spray round, the maximum zonal figure

recorded being used. This method of enumeration was used to obtain both the 1970 and 1974 MEP populations, except for the New Georgia group in the Western District, where spraying ceased at the end of 1973. For the New Georgia group, the population used was obtained from a 3.1 per cent increase (official annual growth rate) over the 1973 MEP figures, so that they tend to be on the low side.

The 1931 census was not a true census, and amounted to little more than a head-count in most instances, supplemented with estimates made by district officers and missionaries. On the other hand, the 1959 census was a de jure census (persons were classified according to the place that was there usual or legal place of residence as of census night), while the 1970 census was a de facto one (persons were enumerated in the place where they happened to be at the time of the census). Nevertheless, because there was very little inter-island or inter-district movement prior to the late 1960s, the total de jure population for 1959 can be considered as virtually equal to the de facto population on that date, and therefore the the 1959 census data can be validly compared to the 1970 data.

On the other hand, the MEP populations are more directly comparable to the population figures obtained in the 1931 census, as they were both basically head counts. The author is of the opinion that this is of little moment as the data used are only required to suggest trends on island groups, districts and country bases, and to apportion an approximate rate of growth to the MEP.

The MEP populations may be affected by enumeration error due to failure to accurately record the actual numbers present in each household, although large errors are considered to be unlikely.

It is proposed to hold the next Protectorate-wide census in 1976. In an attempt to assess the population that could be expected in 1976, the MEP population figures for 1974 were adjusted by the percentage difference from the census figures, and projected for two years to an estimated value for 1976. From the adjusted 1970, 1974 and estimated 1976 MEP population figures, annual rates of growth were obtained for island groups, districts and the whole Protectorate. The Annual Growth Rates were determined by the use of the formula

$$A = P\left(1 + \frac{r}{100}\right)^n$$

were A equals the expected population, P equals the present population, r equals the rate of increase and n equals the number of years.

In addition, the annual growth rates were correlated with the number of years of anti-malarial operations on island groups and districts bases, in an attempt to show the overwhelming results obtained by the removal of the malaria burden.

Unfortunately, until very recently, the collection of official vital statistics in many segments of the government services has been rudimentary, and not strictly comparable from year to year. In the Health Department, the format of the Annual Report remained virtually unchanged from 1960 to 1969, when it was changed, and the data became difficult to obtain and compare.

The new format of the Report continued until 1972, after which date the publication of the Annual Report ceased, although attempts are now being made to revive the Annual Report. In 1974, Annual Reports were prepared for Tuberculosis and Leprosy. Similarly, in the Education Department, there are apparently few reliable official statistics available for the years prior to 1972. This deficiency has made the collection and presentation of suitable and relevant data more difficult. Even in the MEP, it is not possible to obtain complete data to cover the operations from the start of the programme in 1970, let alone data for the Pilot Project and the Pre-Eradication Programme.

Reference has also been made to the latest Annual Reports of various government departments where necessary; where this has been done, the source has been quoted. With regard to the anti-malarial operations, reference has been made to the Pilot Project and to the Pre-Eradication Programme, as well as to the present MEP.

This thesis has been divided into the following parts:-

(I) Factors in Development:

(a) HEALTH: in which the basic health services, and the major endemic diseases, both present and past, such as malaria, tuberculosis, leprosy, yaws and filariasis, are discussed. The effects of the improvement in the basic health services, and of the gradual control and elimination of major endemic diseases are discussed in relation to the improvement of the general level of health.

(b) EDUCATION, AGRICULTURE AND TRADE:

These three aspects of the economy are greatly affected by population trends, which must be seriously considered in planning for the future of the country as a whole, especially if the country has limited resources and cultivable land.

3. FACTORS IN DEVELOPMENT

3.1 BASIC HEALTH SERVICES

There has been a progressive improvement in the coverage and care provided by the Basic Health Services. The training and retraining of staff has assumed a high priority. The Government services have been complemented by those of the Missions, and this improved standard of health care has helped raise the level of health in the community.

The Central Hospital in Honiara is staffed by specialist medical officers who also visit the Districts regularly. Government District hospitals and Mission hospitals are supplemented by a system of rural health units and clinics, each of which is staffed by registered nurses responsible for carrying out vaccination (Triple antigen, BCG and Polio) and educational programmes. Environmental health and safe water supplies are also receiving increasing attention throughout the Protectorate. The distribution of the hospitals, rural health units and clinics on a district basis is shown on the additional map No. 1.

The Government and Missions have progressively increased their bed states from a total of 453 in 1962 to 614 in 1972, and from 498 beds in 1962 to 533 beds in 1972 respectively. (Tables 3, 4)

If the U.N. definition of an hospital bed were applied, there were 381 hospital beds in the Protectorate, or one bed per 397 persons in 1968, which had risen to 542 beds or one bed per 309 persons in 1972.

Hospital	Total Number of Hospital Beds		
	1962	1968	1972
Central	148	159	170
Tetere*	100	88	88
Tataba/Buala	20	30	32
Central District	268	277	290
Gizo (W.D)	43	46	46
Auki	60	112	112
Malu'u	36	62	62
Malaita District	96	174	174
Kira Kira	46	64	72
Santa Cruz	-	-	32
Eastern District	46	64	104
BSIP	453	561	614

TABLE 3 * LEPROSARIUM ANNUAL MEDICAL REPORTS

GOVERNMENT HOSPITALS-BED STATE

CHURCH	PLACE	10 OR MORE BEDS WITH OVERSEAS MED/NURS. STAFF			No. OTHER RURAL INSTITUTIONS		
		1962	1968	1972*	1962	1968	1972
MELANESIAN	FAUAMBU	140	140	130	8	4	4
	KEREPEI	10	30	34			
	TARONIARA	11	11	46			
	TOTAL	161	181	210	8	4	4
UNITED	MUNDA	64	52	52	36	7	6
	OIKAMA	24	–	–			
	BILUA	28	22	–			
	SASAMUGA	–	20	20			
	TOTAL	116	94	72	36	7	6
ROMAN CATHOLIC	BUMA	24	16	16	10	9	9
	NILA	20	20	20			
	AVU AVU	20	20	20			
	MOLI	–	20	20			
	SIROVANGA	–	20	20			
	ROHINARI	–	–	20			
	TOTAL	64	96	116	10	9	9
SDA	KUKUDU	24	14	14	–	23	23
	BATUNA	24	14	14			
	KWALIBESI	54	14	14			
	ATOIFI	–	83	83			
	TOTAL	102	125	125	–	23	23
SSEC	NAFINUA	10	10	10	1	3	

TABLE 4 *LARGELY LOCALISED MED. ANNUAL REPORTS

CHURCH MEDICAL FACILITIES

3.2 ENDEMIC DISEASES

The major diseases which are, and were, endemic in the Solomon Islands were malaria, tuberculosis, leprosy, filariasis and yaws. Innes (1938), during a leprosy survey, obtained prevalence rates for the major endemic diseases of malaria, yaws and leprosy (Table 5); these observations suggested that these diseases, and the others mentioned, constituted a considerable burden to the indigenous population.

(a) Malaria:

> This was the major health problem in these islands, with extremely high spleen rates being recorded on Malaita, San Cristobal, Santa Ysabel, Russell Islands and Guadalcanal (Innes J.R. 1938. Table 3). Parsonson (1966) has suggested that malaria was, and is, the major influence in the history of the South-west Pacific west of 170°E, Buxton's Line.

Malaria infection, in particular P.falciparum infection, is a major cause of morbidity being responsible for a low state of health in the general population in areas where the disease is not controlled or eradicated.. In the recent past, it was also a major cause of mortality.

Repeated attacks of malaria lead to a state of anaemia, which is particularly important in pregnant women and young children. Clinical illness from malaria does not occur without haemolysis. Anaemia, with little or no febrile reaction, may be the presenting sign in partially immune populations. The causes of malaria anaemia include phagocytosis of damaged red cells by cells of the reticulo endothelial system, the spleen in particular, intravascular haemolysis of parasitised erythrocytes and immunological response to red-cell sensitisation. (Barrett-Connor E. 1972)

Age groups

Islands	No. of Persons Examined	No. Persons with Enlarged Spleens (%)	No. Persons with Yaws (%)	% Incidence of Leprosy
Malaita	10 245	7906 (77·2)	5480 (53·5)	1·35
San Cristobal	1 118	903 (80·8)	949 (84·9)	0·45
Sta. Ysabel	2 717	2226 (81·9)	2095 (77·1)	0·55
Nggela	1 410	–	–	0·99
Russells	853	668 (78·3)	520 (61·0)	0·47
Savo	249	–	–	0·44
Guadalcanal	5 023	3 924 (78·1)	3 685 (73·4)	0·89
Total	21 615			1·02

TABLE 5 DR. J.R. INNES - LEPROSY SURVEY

SPLEEN, YAWS, LEPROSY RATES 1938

The control of malaria does lead to statistically significant improvements in mean haemoglobin values (Schofield F.D. et alii 1964) and to a marked reduction in parasite and spleen rates in all age groups. Crane and Kelly (1972) showed that the mean haemoglobin concentrations were 0.9 G per 100 ml. higher in men, 1.4 G per 100 ml. in women and 1.8 G per 100 ml. in children than before the spraying programmes were started in the Kaiapit area of New Guinea. Their relative improvements reflect the severity of malaria in each group.

Anaemia is important in pregnancy, being associated with retardation of intra-uterine growth -- it is therefore essential to correct maternal anaemia well before the end of pregnancy or else foetal growth will remain impaired and the perinatal mortality rate will rise. (Harrison K.A. et al. 1973) To this end, pregnant women should receive regular chemoprophylaxis against malaria.

Macgregor and Avery (1974), in a study of the effect on birth weights of the MEP in the Solomon Islands, showed that mean birth weights rose substantially within months of starting anti-malarial operations. The increases between 1969 and 1971 averaged 252 G in babies of primigravidae and 165 G in all babies. The proportion of babies with birth weights of less than 2 500 G fell by eight per cent overall and 20 per cent among babies of primigravidae.

It has also been shown that the mortality rate in children in malaria-controlled areas of the Solomon Islands shows a progressive reduction, whereas in the uncontrolled district of

Malaita, the mortality remained almost stationary between 144 and 149 per thousand, but showed a downward trend after the start of spraying operations in 1970. (Table 6)

There is also a close relationship between malaria infection and pulmonary disease. A five per cent incidence of pneumonitis due to viral, bacterial and malarial causes has been reported with malarial infections. (Applebaum I.L., Shrager J. 1944). Pulmonary oedema and pneumonia have been reported in over half the cases in a post-mortem study of 50 patients. (Spitz S. 1946) This association tends to be supported by the large number of respiratory tract infections due to all causes treated in hospitals in 1969 (16.43 per cent of patients) and the proportionately high mortality rate (15.4 per cent), due to pneumonia in most cases. There was a distinct improvement in 1972, when pneumonia and bronchitis/asthma only accounted for 6.26 per cent and 6.77 per cent of the hospital admissions respectively. (Table 7) Malaria in 1969 was the major cause of morbidity in both outpatients and inpatients, but was not amongst the principal causes of admission in 1972. (Tables 8, 9.)

The mortality rates in the main hospitals of Malaita and Central Districts in the years 1960 - 1962 showed a generally downward trend, although the number of cases admitted remained high; there was no obvious trend in the numbers admitted in the Eastern and Western Districts. (Table 9) However, when the proportion of deaths due to malaria in relation to the number of inpatients due to malaria is examined on a yearly basis, from

Year	Malaita District			Malaria Controlled Areas		
	Born Alive	Now Dead	Mortality ‰	Born Alive	Now Dead	Mortality ‰
1968	243	35	144	347	28	81
1969	261	39	149	494	41	83
1970	280	41	146	797	69	87
1971	306	33	108	970	78	80
1972	371	41	111	1169	67	57

TABLE 6 MINISTRY OF HEALTH-WELFARE 14-3. 13 SEP 74

MORTALITY OF PREVIOUS CHILDREN (BOTH SEXES)-BSIP

CONDITION	MALE	FEMALE	TOTAL	PERCENTAGE OF TOTAL
ACCIDENTS	691	271	962	10·75
FRACTURES	166	–	166	1·85
OBSTETRICS	–	2806*	2806	23·87*
LACERATIONS	275	102	377	4·21
PNEUMONIA	326	234	560	6·26
BRONCHITIS/ASTHMA	322	284	606	6·77
PULMON. T.B.	224	201	425	4·75
OTHER TB	292	256	548	6·12
SKIN INFECTION	284	254	538	6·01
DIARRHOEAS	258	282	540	6·04
OTHERS	1902	2324	4226	47·24
TOTAL	4740	4208 (7014*)	8948(11754*)	100·00

TABLE 7 * INCLUDES OBSTETRICS 1972 ANNUAL MED. REPORT

PRINCIPAL CAUSES OF DISCHARGES AND DEATHS (ADMISSIONS) - ALL HOSPITALS - 1972

DISEASE	No. OF DEATHS	% OF ALL DEATHS
PULMON. TB.	20	10
TB	29	14
MENINGITIS	26	12
ALL CVS	25	12
RESPIRATORY	18	9
BRONCHITIS/ASTHMA	14	7
ALL NEOPLASMS	14	7
DIARRHOEAS	10	5
TETANUS	10	5
INFECT. HEPATITIS	7	3
NON-ACUTE NEPHRITIS	6	3
ACCIDENTS	5	2
CIRRHOSIS OF LIVER	4	2
ANAEMIAS	4	2
MALNUTRITION	3	1
PEPTIC ULCER	2	1
NO OTHER CAUSE WITH MORE THAN ONE DEATH		

TABLE 8 1972 ANNUAL MED. REPORT

PRINCIPAL CAUSES OF DEATH IN ALL HOSPITALS-1972

	Central District		Malaita District		Western District		Eastern District	
Year	Total No. Admitted	Deaths (%)	Total No. Admitted	Deaths (%)	Total No. Admitted	Deaths (%)	Total No. Admitted	Deaths (%)
1960	1046	14 (1·34)	959	21 (2·19)	157	1 (0·64)	25	–
1961	1430	11 (0·77)	967	13 (1·34)	242	5 (2·07)	56	2 (3·57)
1962	1241	5 (0·40)	803	10 (1·24)	189	5 (2·65)	31	–

TABLE 9 ANNUAL MEDICAL REPORTS

PRE-SPRAY: MAIN HOSPITALS- MALARIA IN-PATIENTS AND DEATHS.

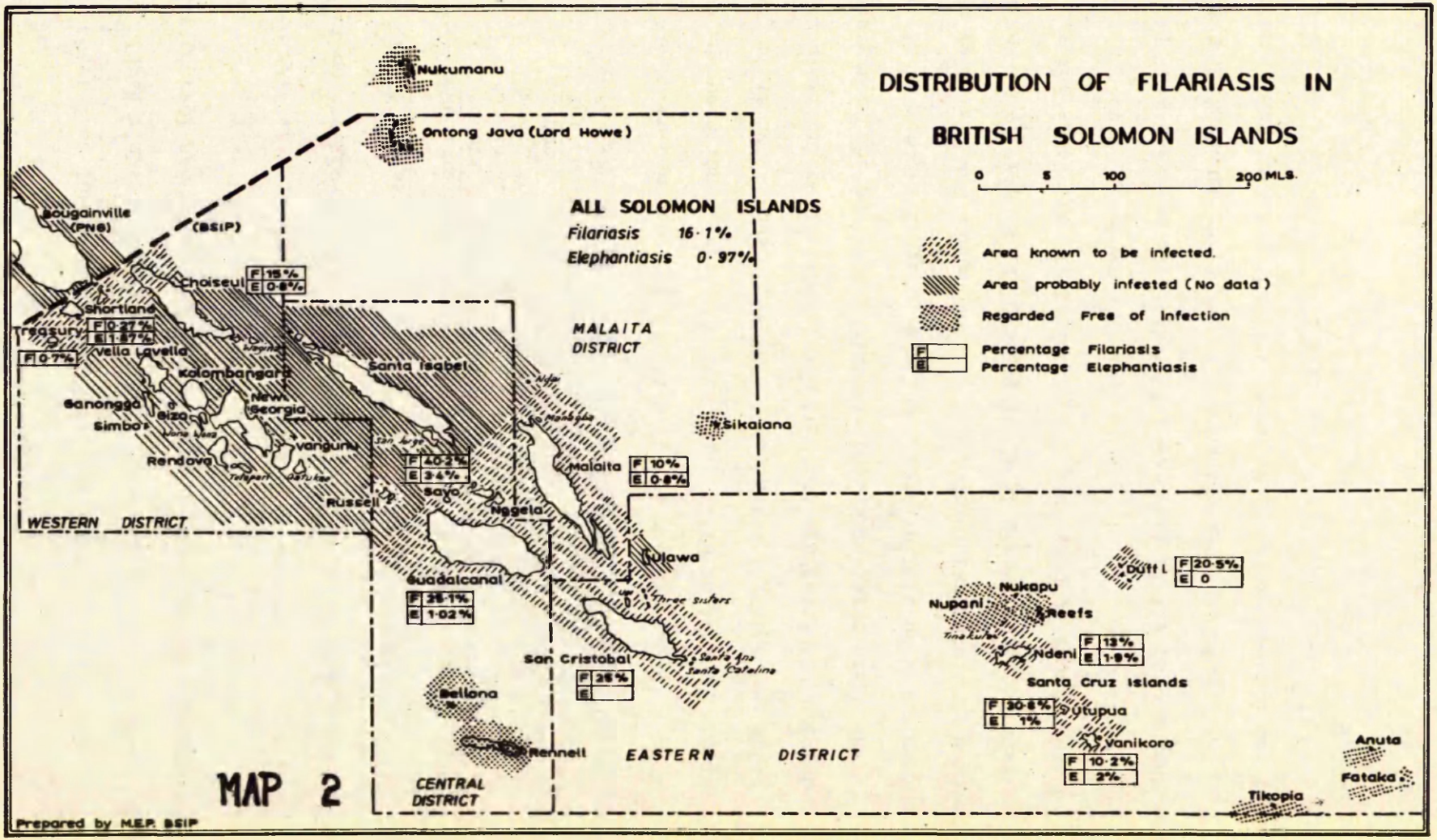
ISLAND	No. EXAMINED	No. POSITIVE	% POSITIVE	ELEPHANTIASIS %
GUADALCANAL	3 035	762	25·1	1·02
MALAITA	1 260	126	10·0	0·8
SAN CRISTOBAL	2 654	662	25·0	1·02
NGGELA	266	107	40·2	3·4
INFECTED EASTERN ISLANDS	1624	227	14·8	1·9
BSIP	ADJUSTED FOR POPULATION		16·1	0·97

TABLE 20 EXCLUDES DAYTIME/MALE COLLECTIONS RH. WEBBER 1974

FILARIASIS: SUMMARY OF INFECTED AREAS

Pre-spray data on Guadalcanal showed a positivity rate of 25.1 per cent (Table 20), and after three years of residual spraying, the rate had fallen by 6.3 per cent (Mataika J.U. 1965). In a pre-spray survey carried out by MacDonnell (1970) in the Graciosa Bay area of Santa Cruz, there was a positivity rate of 9.5 per cent, which had decreased to 2.7 per cent after three years of spraying (Watson T. M. 1973), although the surveys were not strictly comparable.

McMillan (1968) carried out a base-line survey of villages in New Ireland and the Sepik Plains areas of New Guinea prior to the start of residual spraying with DDT, which he followed up after six and one-half years of spraying at six monthly intervals. He failed to show a reduction in the infection rate, although there was a reduction of microfilarial densities. He concluded that DDT spraying as carried out in New Guinea appeared to have had little impact on filariasis --- presumably this was due to a failure to interrupt transmission. On the other hand, in Netherlands New Guinea, it was shown that three and one-half years of residual spraying had reduced the infection rate from 10.0 per cent in children under 15 years of age to zero in the under 9 years group and to 3.6 per cent in the 10 - 19 years age group. However, a further follow-up five years later showed that the total rate was now 14.2 per cent, presumably due to a failure to interrupt transmission and to the fact that the vector may have changed. (Iyengar M.O.T. et alii. 1959., Van Dijk W. J. O. M. 1964). It would appear that the MEP has exerted a considerable effect on Filariasis throughout the Solomon Islands. It may be necessary to combine mass treatment



FILARIASIS: DISTRIBUTION AND PREVALENCE RATES-B.S.I.P.

Apart from local foci, principally in Malaita, which were given further mass treatments, the disease was rapidly brought under control and since 1965 has ceased to be an health problem. In reality, yaws was brought under control prior to the start of any anti-malarial operations; it did, however, exert a positive effect on the growth of the population as a whole (Census 1970).

(e) Filariasis:

> Wuchereria bancrofti, in its nocturnally periodic form occurs in the New Guinea - Solomon Islands area of the South West Pacific, and is transmitted by night-biting mosquitoes of the Anopheles species, A.farauti, A.punctulatus and A. koliensis, which are also responsible for the transmission of malaria. (Edeson J.F.B. et al. 1964)

As a consequence of the anti-malarial operations which have been in operation in various parts of the Solomon Islands since 1961, it is not unreasonable to assume that filariasis may also be progressing toward control and eventual eradication. Prior to the start of the anti-malarial opertions, filariasis was widely distributed in the islands, but had a more restricted distribution than malaria. and tended to miss the more distant atolls. However, like malaria, filariasis is a highly focal disease, and because it has the same vectors, it could be expected to be found wherever malaria occurs. (Webber R.H. 1974 Map.2)

It has been estimated that 16.1 per cent of the population are affected, although the level of elephantiasis is not high. Webber (1973) reported the prevalence of filariasis as 3.8 per cent on Fauro island, whereas the average for all the islands is 0.97 per cent.

Although Government reports show that there has been a substantial fall in the number of cases each year since 1964 (from 144 t0 34 in 1974) lesprosy still remains a considerable health problem, and its gradual improvement has not materially affected the population growth.

(d) Yaws:

> Yaws was also reported upon by Innes in 1938, when he noted an incidence rate of 84.9 per cent on San Cristobal and a minimum rate of 53.5 per cent on Malaita (Table 5). Similarly, in the 1938 Annual Medical Report, a survey of 9 530 persons showed 0.1 per cent of primary lesions, 11.0 per cent of secondary and 26.0 per cent of tertiary lesions, indicating holoendemic yaws.

In 1956, mass campaigns were carried out in a number of pilot areas by Government/WHO; these were followed by two resurveys at yearly intervals. In the Malaita pilot area, there was a spectacular decrease from 13.8 per cent (of which 5.7 per cent were infectious) of active yaws to 0.19 per cent of active cases (of which 0.13 per cent were infectious) following treatment. A similar spectacular decrease was shown in the second resurvey in 1958.

Following the campaigns in pilot areas, a mass Penicillin campaign was carried out giving total mass treatment to the entire population. Of the 115 000 population, 109 479 persons were covered (94.2 per cent). The findings from this campaign were: 1.3 per cent infectious lesions, 2.0 per cent hyperkeratoses and 7.47 per cent late lesions, witha substantial rate of inactive lesions indicating severity of yaws in earlier periods. Malaita had, on average, a rate of infectious lesions of 4.7 per cent, although the range varied from 2.3 to 14.3 per cent in various areas of the island. (Annual Medical Report 1958)

District	Up to 1968	1969-72	Total		Prevalence ‰
Central	251	55	306		5·5
Malaita	181	57	238		4·5
Eastern	38	6	44		1·9
Western	19	5	24		0·6
BSIP	489	123	612		3·7

TABLE 18 1973 PLAN OF WORK WPRO 1301

TOTAL NO. LEPROSY CASES IN ACTIVE REGISTER

YEAR	No. New Cases	YEAR	No. New Cases
1964	144	1965	110
1966	94	1967	97
1968	58	1969	33
1970	33	1971	37
1972	41	1973	42
1974	34		

TABLE 19 BSIP MED. DEPT. ANNUAL REPORTS

LEPROSY: NEW CASES NOTIFIED

some importance. (Table 18) The number of new cases notified each year is very variable. (Table 19)

The Government policy is for all new cases, especially the bacteriologically positive ones, to be admitted to hospital on a voluntary basis for a period of one or two months at the start of treatment --- this is of importance in the education of the patient. Dapsone (diamino-diphenylsulphone) is the drug of choice, and is administered in a dose of 6-10 mg. per Kg. body weight per week, dividely on two different days of the week. Patients with lepra reactions, and those with intolerance of resistance to dapsone are treated with Clofazimine. Infectious patients are submitted to a clinical examination by a medical officer at least once a year, and a bacteriological examination is made once a year in a positive case. (Plan of Work 1973)

Dapsone is itself a slow-acting schizontocide and may have been expected to exert a considerable effect as a prophylactic anti-malarial in patients being treated with it. However, Rieckmann (1968) showed that it was unimpressive in this respect in infections of P.vivax of South West Pacific origin in New Guinea.

Since the start of the Leprosy Register, lepromatous and borderline leprosy notifications have been running at about the same level, the decline being in the tuberculoid group. This may be consistent with the view that the BCG vaccination is effective in preventing tuberculoid but not lepromatous leprosy, although the BCG Coverage has been disappointing recently. (Ministry of Health and Welfare 1975)

Clinical Classification	Total No. Cases	Positive Bacteriology		Negative Bacteriology		Not Recorded	
		No. Cases	%	No. Cases	%	No. Cases	%
Lepromatous	131	48	36·6	52	39·7	31	23·7
Indeterminate	4	2	50·0	2	50·0	–	–
Tuberculoid	505	17	3·4	303	60·0	185	36·6
Unclassified	75	7	9·3	31	41·3	37	49·3
Total	715	74	10·3	388	54·3	253	35·4

TABLE 17

DR. BRAVO 1974 WPRO 1301-E (BSIP)

BACTERIOLOGICAL STATUS OF ALL LEPROSY CASES AS OF 1 AUGUST 1973

RACE	POPULATION '71	No. CASES	PREVALENCE RATE ‰	DISTRICT	POPULATION SURVEYED	NEW CASES	PREVALENCE RATE ‰
MELANESIAN	145 590	709	4·6	CENTRAL	7 122	13	1·8
POLYNESIAN	6 680	3	0·4	MALAITA	5 592	18	3·2
OTHERS	5 020	3	0·6	EASTERN	1 611	6	3·7
				WESTERN	3 007	1	0·3
				TOTAL	17 332	38	2·2

TABLE 16 DR. BRAVO 1974 WPRO 1301-E (BSIP)

LEPROSY: BY RACE AND BY DISTRICT - BSIP

District	1972	1973	1974	‰ of Total
Central	93 (1·6)	118 (1·8)	107 (1·5)	34
Eastern	55 (2·5)	58 (2·6)	39 (1·6)	12
Malaita	150 (2·9)	112 (2·0)	144 (2·5)	45
Western	43 (1·3)	36 (1·0)	29 (0·8)	9

TABLE : 15 1974 TB ANNUAL REPORT

NEW TB CASES BY PRESUMED DISTRICT OF ORIGIN OF INFECTION. (RATE PER ‰ OF ESTIMATED POPULATION.)

thousand of the cases in 1974, while Western District only accounted for nine per thousand; the number of cases, however, still tends to fluctuate. (Table 15)

Tuberculosis remains a problem, and the control attemps have not exerted a significant effect on the growth of the population as a whole.

(c) Leprosy:

> In 1938, it was reported that the overall incidence of leprosy in 21 615 persons examined was 1.02 per cent, the highest rate being recorded in Malaita (1.35 per cent) and the lowest on Savo Island (o.44 per cent); the Western District was not covered in this survey. (Innes J.R. 1938. Table 5)

During 1973, a comprehensive survey was carried out in the Solomon Islands by Lopez-Bravo. It was shown that Melanesians had a prevalence rate of 4.6 per thousand, while Polynesians and others had rates of 0.4 and 0.6 per thousand respectively. The Eastern District, with 3.7 per thousand, had the highest prevalence rate, while the Western District had the lowest with 0.3 per thousand. The overall prevalence rate was estimated at 2.2.per thousand. (Table 16) However, the lowest Lepromatous rate was also in the Eastern District (13.2 per cent) while the highest was in the Western District (21.9 per cent). Of the 715 cases examined, 77 (10.8 per cent) occurred in children 15 years of age or younger, and of the 715 cases, only 10.3 per cent (74 cases) had positive bacteriology, while 253 cases did not have bacteriology recorded. (Table 17)

The total ratio per thousand in the active register (3.7 per thousand) and the ratio per thousand from the leprosy surveys (5.3 per thousand) suggests that leprosy is a health problem of

	1961-69	1970	1971	1972	1973	1974
New Cases	2665	340	367	341	324	319
Reactivated Registered	18	26	26	43	51	37
Reactivated Non-Registered	–	3	9	12	9	9
Total	2683 Mean 268	369	402	396	384	365

TABLE 14 1974 TB ANNUAL REPORT 7-3 JAN 75

TUBERCULOSIS - BSIP

	Central District			Malaita District			Western District			Eastern District			BSIP		
Year	In-Patient	Delivery	Del% / IP%	In Patient	Delivery	Del% / IP%	In Patient	Delivery	Del% / IP%	In Patient	Delivery	Del% / IP%	In Patient	Delivery	Del% / IP%
1959	2410	251	10·4	3123	194	6·2	771	52	6·7	225	7	3·1	6529	504	7·7
1960	2964	476	16·0	3080	311	10·1	678	92	13·6	353	13	3·7	7075	892	12·6
1961	4676	391	8·4	3461	325	9·4	1358	235	17·3	390	29	7·4	9885	980	9·9
1962	3265	386	11·8	2763	268	9·7	1016	264	26·0	434	59	13·6	7478	977	13·1
1963	3359	475	14·1	3454	332	9·6	1090	294	27·0	388	51	13·1	8291	1152	13·9
1964	2975	585	19·7	4100	413	10·1	1084	287	26·5	437	74	16·9	8596	1359	15·8
1965	3810	553	14·5	3923	375	9·6	680	136	20·0	476	41	8·6	8889	1105	12·4
1966	2902	570	19·6	3815	474	12·4	1264	394	31·2	469	67	14·3	8450	1505	17·8
1967	2940	688	23·4	4513	539	11·9	1426	426	29·9	472	82	17·4	9351	1735	18·6
1968	2718	623	22·9	3755	812	21·6	1516	450	29·7	513	76	14·8	8502	1961	23·1
1969	3549	797	22·4	6253	635	10·1	1261	403	31·9	854	123	14·4	11917	1958	16·4
1970	3324	795	23·9	4154	386	9·3	1135	450	39·6	767	110	14·3	9380	1741	18·6

TABLE 13 ANNUAL MEDICAL REPORTS

HOSPITAL IN-PATIENTS AND DELIVERIES (ALSO RATIO AS %AGE).

(Table 13) In the Central District, the delivery rate has risen from 10.4 per cent in 1959 to 23.9 per cent in 1970, with a total of 795 deliveries. In the Western District however, the increase has been most dramatic, from 6.7 per cent in 1959 to 39.6 per cent in 1970. Nevertheless, in the two districts not under spray coverage, Malaita and Eastern, there were also increases, but to a lesser degree. The Protectorate rate rose from 7.7 per cent to 18.6 per cent in this period. In 1974, there was a total of 2 747 hospital deliveries.

Malaria infection is also associated with the Tropical Splenomegaly Syndrome, Burkitt's Lymphoma and the Nephrotic Syndrome associated with P. malariae infection, and although these diseases are recognised in the Solomon Islands, they do not present as a major problem. This state of affairs may be due to the gradual eradication of malaria from holo or hyperendemic areas. (Lancet 1970)

(b) Tuberculosis

> This disease is a major health problem. Innes (1938) commented on its presence; however, it was not until 1965 that a mass BCG campaign of the age group up to 20 years was begun, without preliminary testing. Recently, the BCG coverage has been unsatisfactory, the unsatisfactory post-vaccination allergy being attributed to inadequate protection of the vaccine from heat and light during transportation. (Tao J. C. 1973)

In the period 1961 - 1969, there was a total of 2 683 cases, of which 2 665 were new. In the period 1970 - 1974, the number of new cases notified annually has been between 319 and 367, while the total number of registered cases has been between 365 and 402. (Table 14). On a District basis, Malaita accounted for 45 per

1960 - 1969, it is found that there was a downward trend from 1.74 per cent in 1960 to 0.54 per cent in 1969, which was also accompanied by a fall in the total number of cases of malaria admitted to all hospitals.(Tables 10, 11)

However, it is only by an examination of Table 12 that the true impact of the MEP can be assessed. It was estimated (WHO Independent Assessment Team 1973) that there was an overall saving of 92 240 cases of malaria in the island groups examined in 1973 as a result of the MEP, of which Guadalcanal alone accounted for 41 400 cases.

Failure to thrive is not an uncommon occurrence in the Solomon Islands. It is known that the peak periods of malaria and malnutrition coincide, but in a small series in the Morobe District of New Guinea, a highly malarious area, Saint-Yves (1967) was not able to demonstrate a relationship between malaria and malnutrition in children. Falciparum malaria does impair gastro-intestinal function during the acute phase of the illness; the mucosal changes in the small bowel revert toward normal during convalescence. (Karney W.W. et al 1972) In the urban and rural areas of the Solomons, it was noted that the dietary intakes of most households were fairly satisfactory when compared with the WHO recommended levels. (Jansen A.A.J. et al. 1970)

It has been found that as the burden of malaria has lessened, there has been an increase in the number of women being admitted to hospitals for delivery, together with an increase in the proportion of deliveries to total inpatients expressed as a percentage.

Island Groups	1970 Census Population	Pre-Spraying Parasite Rate	Est. Inoculation Rate per Annum	No. cases if no Spraying	No. malaria cases detected	Est. No. Cases saved
Guadalcanal	36539	60 (1962, 1-4)	1·20	43800	2436	41400
Sta. Ysabel	8653	47 (1969)	0·94	8120	64	8060
Russells	2715	23 (1970)	0·46	1240	Incomplete	1000
Nggelas	5351	54 (1970)	1·08	5780	104	5680
Rennell	900	6 (1970)	0·12	100	—	100
New Georgia	22264	29 (1962)	0·58	12900	92	12800
Choiseul	8017	37 (1968)	0·74	5930	120	5800
Malaita	50659	27 (1970)	0·54	27300	12700 (12·6)	14600
San Cristobal	10921	45	0·90	9800	7000 (34·4)	2800
				114990	22526	92240

TABLE 12 1973 WHO-IAT REPORT WPRO 2002-E

ESTIMATE OF CASES SAVED BY THE MALARIA CAMPAIGN PER YEAR IN 1973. (P.R)

	No. of Malaria Patients Admitted		No. of Deaths		Deaths % Inpatients
Year	Male	Female	Male	Female	
1960	1299	909	21	17	1·72
1961	1467	1288	11	20	1·12
1962	1591	1283	11	13	0·83
1963	1027	908	5	6	0·57
1964	808	705	6	5	0·73
1965	645	590	2	1	0·24
1966	791	690	8	3	0·74
1967	668	613	4	8	0·94
1968	523	541	4	3	0·66
1969	578	538	4	2	0·54

TABLE II ANNUAL MEDICAL REPORTS

ALL HOSPITALS - MALARIA IN-PATIENTS AND DEATHS

	Outpatients			Inpatients			Deaths		
Disease	Male	Female	Total	Male	Female	Total	Male	Female	Total
TB	253	234	487	265	222	487	22	14	36
Malaria	9619	8734	18353	729	678	1407	5	2	7
Other Infect.	4006	3442	7448	633	516	1149	24	32	56
Total	13878	12410	26288	1627	1416	3043	51	48	99
CVS/CNS	255	200	455	77	92	169	5	23	28
RTI	19730	15471	35201	1025	955	1980	21	22	43
GI	5597	4654	10251	437	371	808	11	3	14
Obstet.	—	2194	2194	—	1966	1966	—	19	19
Skin	15112	10993	26105	697	661	1358	—	1	1
Locomotor	4971	3659	8530	176	66	242	—	—	—
Accidents	7029	3700	10729	597	235	832	3	2	5
Misc.	6600	5392	11992	760	891	1651	36	34	70
Totals	73172	58673	131845	5396	6653	12049	127	152	279

TABLE 10 1969 ANNUAL MEDICAL REPORT

CAUSES OF MORBIDITY-MORTALITY - ALL HOSPITALS - 1969

of populations in endemic areas with diethylcarbamazine with residual spraying to achieve eradication. (Edeson J. F B. 1972) However, Filariasis, or its control, did not exert a positive effect on the population growth.

3.3 MALARIA ERADICATION PROGRAMME EXPENDITURE

It was estimated that the total cost to achieve malaria eradication over a period of 21 years (1961 - 1981) would be Aust.$5 947 654 at constant prices, and that the expenditure would peak in 1973.

The per capita cost for the anti-malarial programmes between 1961 and 1972 was about Aust. $18.07. For 1972 alone, it was Aust. $2.80 per capita. (Baker W. G. 1973)

In the period 1961 - 1972, the expenditure by source has been:

Source	Aust. $
U.K. Government	1 165 644.17
BSIP Government	800 228.31
U.N.D.P.	551 819.49
W.H.O.	166 477.37
Private Sector	115 200.00
U.N.I.C.E.F.	2 053.64

In 1972, the total expenditure on health was Aust.$1 339 375, of which the malaria expenditure accounted for Aust.$428 509 or 32.0 per cent of the health expenditure. (C.E.O. 1972) In 1973, the malaria expenditure was Aust. $521 746 (37.7 per cent of the health budget, which was itself 12.4 per cent of the national budget. The estimated expenditure for 1974 was Aust. $395 300.

It can be seen from these figures that the MEP in the Solomon Islands is an expensive one on a per capita basis, probably the most expensive programme in the world.

3.4. EDUCATION, AGRICULTURE AND TRADE

EDUCATION:

Up until 1974, Primary education was largely in the hands of the Churches, although there was a progressive increase in the number of Government schools. It was in the fields of secondary education, technical and teacher training and further education overseas that the Government exerted its main efforts; in addition, the government provided considerable financial and professional assistance to the Churches and local councils in primary education. (Solomon Islands Annual Report 1973)

Data for the primary enrolments are available for the years 1972-1974 (Table 21). It is to be noted that the number of pupils enrolled has stayed almost static; this is due to the fact that the number enrolled is dependent on the number of places available and on the number of pupils who are required to repeat their years.

In 1972, it was estimated that boarding pupils accounted for 35.6 per cent of all registered primary pupils and 69.0 per cent of senior primary pupils; with regard to the sex ratio in schools, girls accounted for 37.8 per cent of all pupils registered in primary schools, but only 24.4 per cent of pupils in secondary schools.

Late in 1974, a report entitled 'Education for what?' was published which questioned the present trend of education in the Solomon Islands, and suggested that the content of the primary school course should be geared towards the majority of children who are going to remain in the village; to this end, education

Central District			Malaita District			Eastern District			Western District			Totals		
1972	1973	1974	1972	1973	1974	1972	1973	1974	1972	1973	1974	1972	1973	1974
7893	7939	7764	5968	6054	4478	4169	4090	4120	7540	7359	7726	25570	25442	24088

TABLE 21 MINISTRY OF EDUCATION & CULTURAL AFFAIRS 1975

REGISTERED PRIMARY SCHOOLS ENROLMENT 1972-1974

will be decentralised and more control will be given to District Education Boards. Free universal education to Form II was also recommended, and, in fact, this was implemented early in 1975. It was estimated that 69.8 per cent of the estimated 7-12 years age group were enrolled in primary schools in 1972; the proportion will then be expected to fluctuate until it reaches the same level again in 1983, with 100.0 per cent participation being expected in 1985.

Even this modest expectation may, however, be upset by a rapid growth of population in the interventing years.

3.5 AGRICULTURE AND TRADE:

In the Sixth Development Plan, agriculture was recognised as being of fundamental importance to the economy; to this end, copra production was encouraged, the oil palm industry was to be developed to enable it to become the second main crop by 1980, meat production was to be expanded to enable self-sufficiency by 1980-1983, and an export industry thereafter, increase the productivity of subsistence crop production, develop cocoa, spices and other cash crops on an economic basis, to build an agricultural infrastructure and to encourage a modern approach.

Generally speaking, the progress has been encouraging and it was expected that most of the programme proposed in the plan would be completed or exceeded by the end of 1974.

The coconut industry, with copra production, remains the backbone of the economy. The earning capacity of copra on the international market is wholly dependent on international market prices; 1974 was a good earning year as the world copra prices were high.

(Table 22) It can be seen from the Table that the annual copra production has varied from year to year, and that in all districts except Central, there was a record level of production in 1974. A cyclone in 1972 caused considerable damage and affected copra production in 1973 in the Central District. Cocoa production has also shown a considerable fluctuation in all Districts except Eastern where it is not produced.

The Rice and Oil Palm industries have been established on the Guadalcanal Plains and the progress appears to be satisfactory. Oil Palm research is also being carried out on Kolombangara island in the Western District. Similarly, the cattle industry is now fully established and at the end of 1973 there were 397 herds, most of them in Malaita District, with a total of 17 206 cattle. This was an increase of 1 485 cattle (9.4 per cent) over the 1972 number.

In addition, a commercial fishing enterprise started operations in March 1973. It has placed its canning factory in Tulagi in the Nggelas, and in 1973, the total catch was just under 6 500 metric tons. The company supplies fish for home consumption and export.

There is also a considerable timber industry in the Solomons, with timber tracts on Santa Ysabel, Santa Cruz, New Georgia, Kolombangara, Vangunu and Guadalcanal. The value of the log exports in 1973 exceeded Aust.$4 millions, and the cubic capacity of logs rose from 1 143 thousnad cubic feet in 1966 to 8 975 thousand cubic feet in 1973.

	Central District		Western District		Malaita District		Eastern District	
Year	Copra	Cocoa	Copra	Cocoa	Copra	Cocoa	Copra	Cocoa
1962	-	6·75	—	6·50	—	9·46	—	—
1963	13 282	4·56	7 904	10·13	1 772	20·41	2 241	—
1964	13 228	12·12	7 687	19·81	1 976	31·30	2 361	—
1965	13 035	11·38	7 652	22·73	1 672	37·78	2 184	—
1966	12 267	12·14	6 850	26·01	1 738	57·31	2 451	—
1967	11 209	9·12	8 159	22·74	1 668	27·98	2 481	—
1968	10 831	28·88	5 789	33·82	1 540	42·19	2 381	—
1969	13 038	31·54	7 587	30·69	1 569	33·16	2 525	—
1970	12 431	42·98	7 557	40·25	1 769	45·17	2 467	—
1971	13 669	35·33	7 447	41·81	1 876	40·17	2 739	—
1972 *	10 363	15·15	6 633	21·19	1 556	26·60	2 271	—
1973	7 182	22·47	5 355	21·98	1 398	20·92	1 839	—
1974	12 858	43·84	9 627	25·57	2 672	34·46	2 842	—

TABLE 22 *CYCLONE DEPT. OF AGRICULTURE

ANNUAL COPRA AND COCOA PRODUCTION (TONS)-1962-74

In the mineral field, there are promising commercial prospects for bauxite mining on Wagina island in the Western District, and on Rennell island in the Central District. Detailed geological surveys are continuing throughout the islands.

There has been a considerable diversification of the economy over the last few years. However, the balance of trade situation remains precarious. In the years 1969-1973, there were annual balance of trade deficits of between Aust.$1.6 million and $0.9 million. In 1974, due to the high market prices for copra, there was a trade surplus of $1.3 million, the imports totalling $16.99 millions and the exports $18.3 millions.

It is not possible to say what the direct effect of progressive malaria control and eradication has been on the development of the economy, but a reduced burden of malaria has undoubtedly affected the individual worker, and, through him, the whole economy. As has been previously stated, a certain level of social, political and economic benefit and activity is required before public health measures exert their full effect; that the MEP is now exerting its full effect is unquestionable. The population now is healthier than it has ever been before, thereby making available a more vigorous and potentially more productive work force.

4.0 THE MALARIA ERADICATION PROGRAMME 1970-1974

(With reference to the Pilot Project and the Pre-Eradication Programme)

4.1 Recent History of Malaria and Anti-Malarial Activities

Malaria is the most important health problem in the Solomon Islands. Following a successful, joint BSIP Government/World Health Organisation Pilot Project (MEPP) starting in 1961, and an evolving Pre-Eradication Programme (MPEP) starting in 1965, a full Malaria Eradication Programme started in 1970.

Macgregor (1966) has fully reviewed the history of malaria in the Island Territories of the South-west Pacific, with special reference to the Solomon Islands. Similarly, Maffi and McDonnell (1971) described the malaria situation in the Eastern Outer Islands of the Protectorate. Avery (1975) is examining the current malaria situation at present.

For the sake of interest, it is worth noting that Innes in 1938 recorded overall Spleen Rates of 81.9%, 80.8%, 78.3%, 78.1% and 77.2% on Santa Ysabel, San Cristobal, Russell Islands, Guadalcanal and Malaita respectively (Table 5). Similarly, the campaign for the Solomon Islands in World War II, which began in August 1942 with the invasion of the north coast of Guadalcanal by US and Allied Forces, was considerably hindered by malaria. At its peak in November of 1942, there was a case rate of 1 800 per 1 000 per annum in this month alone; these epidemic conditions prevailed for at least nine months. It has been estimated that of the 100 000 cases of malaria contracted in the South Pacific, more than

three-fifths of the total number were contracted on Guadalcanal, largely during the period from November 1942 to August 1943 (Downs, W.G. et alii 1947). During this period of conflict, 1942-1945, the US Forces carried out extensive malaria control measures in their base areas. Between 1945 and the start of the Pilot Project (MEPP) in 1961, control measures lapsed.

4.2 Endemicity

In the Solomon Islands, New Guinea and the New Hebrides, the vectors of malaria are A.punctulatus, A.farauti and A.koliensis, all of which belong to the Punctulatus complex. Of these, A.farauti is undoubtedly the most important.

As mentioned, the population distribution may have resulted from efforts by the people to escape the ubiquitous mosquito; this has thus influenced the endemicity of malaria in a few instances.

To measure the level of endemicity, two measures have been devised. The first is based on the "Spleen Rate", which is the percentage of persons in a community in the 2-9 years age group having enlarged spleens. This is a modified version of the classification proposed in Kampala, Uganda, in 1950 (WHO 1951). If used in conjunction with the Average Englarged Spleen, which is a weighted average calculated by multiplying the number of individuals in each spleen class (Hackett L.W. 1944) by the class number, adding their products, and dividing the total by the number of those whose spleens are palpable (WHO 1963), a better picture of the malaria situation emerges. The second measure is based on the

"Parasite Rate" in the 2-9 years age group (Metselaar D, Van Thiel P.H. 1959), with a parasite rate of over 75 per cent in the under one-year age group for holoendemic malaria. The Parasite Rate in the under one-year group is termed the Infant Parasite Rate, and is an important index of recent malaria transmission (Pampana E.J. 1969).

Prior to the onset of the MEP in each District, malariometric surveys were carried out in each District during the MEPP and the MPEP. In the Central District, it was shown that on -

(a) Guadalcanal - north coast - the Parasite Rate in the 1-9 years age range was 44.8%. This suggested a high mesoendemicity. The parasite formula at the same time showed P.falciparum: P.vivax: P.malariae: Mixed Infections = 45.2: 23.1: 17.0: 14.7 (Table 23). This survey was completed in November 1962.

(b) Santa Ysabel - coastal - Parasite Rates in the 2-9 years age group at selected village ranged from 20.0% to 56.0% - that is from moderate mesoendemicity to low hyperendemicity (Table 24). Earlier surveys in 1966 and 1967 gave results of low meso - to hyper-endemicity - showing that although transmission was perennial, there was quite a distinct season of peak transmission (Table 25).

(c) Russell Islands - showed low mesoendemicity in both the Melanesian and Polynesian populations in March 1966 (Table 25).

(D) Rennell showed distinct seasonal hypoendemicity, while Bellona Island was apparently free from malaria (Table 25).

(e) In the Malaita District, it was shown that the coastal villages tended to have mid-mesoendemicity, the riverine villages to have high mesoendemicity, hyper- or even holo-endemicity, the high bush villages to have hyper- or low-meso-endemicity. In the island of Sikaiana, Spleen Rates showed low mesoendemicity with high mesoendemicity according to Parasite Rates, whereas on Ontong Java, at two different villages, there was fairly close agreement between the endemicities derived from the Spleen and Parasite Rates, one village being hyper-endemic, the other hypo- or low meso-endemic (Table 26).

Age Group	No. Examined	No. Positive	Parasite Rate %	P. falciparum	P. vivax	P. malariae	No. mixed Inf.
Under 1	129	89	69·0	23	30	12	24
1-4 y.	1572	992	63·1	412	278	172	130
5-9 y.	2025	620	30·6	361	114	75	70
10-14 y.	1344	392	29·2	140	106	73	73
15+ y	4262	711	16·7	331	119	145	116
Total	9332	2804	30·0	1267	647	477	413

TABLE 23 OCT-NOV 1962 RATIO P.FALCIP: P.VIVAX: P.MAL: MIXED = 45·2 : 23·1 : 17·0 : 14·7

COASTAL GUADALCANAL: PRE-SPRAY PARASITE RATES - 1962

VILLAGE	NO. EXAMINED	NO. POSITIVE	PARASITE RATE %	P. FALCIPARUM	P. VIVAX	P. MALARIAE	MIXED INF.
BUALA	113	47	41·6	11	20	5	11
BARA	99	45	45·4	5	18	15	7
TAUSESE	21	8	38·1	–	8	–	–
TATAMBA	84	21	25·0	4	12	1	4
KOLOTUBI	100	56	56·0	12	18	11	15
KIA	50	10	20·0	–	–	10	–

TABLE 24 AGE GROUP 2–9 YEARS

STA YSABEL (COASTAL): PRE-SPRAY PARASITE RATES. JAN. 1969

Location	No. Examined (2-9 years)	No. Positive	Parasite Rate %	Pf	Pv/Pm	Mixed
Sta. Ysabel (Aug)	151*	18	11·9	–	13/3	2
Russell Is. (Melanesians) (Mar)	525*	62	11·8	11	28/12	1
Russell Is. (Polynesians)	53	6	11·3	3	3/–	–
Bellona I. (Apr)	137*	–	–	–	–	–
Rennell I. (Apr)	137*	–	–	–	–	–
Sta. Ysabel (Jul)	334*+	177	53·0	86	83/13	5
Rennell I (Jul)	67+	2	3·0	1	–/1	–

TABLE 25 * 1-9 YEARS +1967

CENTRAL DISTRICT: PRE-SPRAY PARASITE RATES, 1966-67

Location	No. Examined (2-9 years)	No. Palpable Spleens	Spleen Rate %	No. Slides Examined	No. Positive Slides	Parasite Rate %
Sikaiana	31	5	16·1	31	15	48·4
Ontong Java NE	47	3	6·4	47	6	12·8
Ontong Java SE	85	55	64·7	85	61	71·8

TABLE 26 2-9 YEARS AGE GROUP

MALAITA OUTER ISLANDS: 1967 PRE-SPRAY SPLEEN AND PARASITE RATES

In the Western District, Mass Blood Surveys of all age groups in November-December 1962, revealed in -

(a) New Georgia - a parasite rate of 34.9%

(b) Gizo - a parasite rate of 13.1%

(c) Simbo - a parasite rate of 40.2%

(d) Vella Lavella - a parasite rate of 17.6%

(e) Ranongga - a parasite rate of 27.6%

These surveys covered a population of 6 527 persons, of whom 1 889 were found to be positive for malaria parasites (a slide Positivity Rate of 28.9%). These results suggest that the New Georgia group of islands were predominantly low to mid mesoendemic.

(f) Surveys carried out in Choiseul, Rendova, Wagina and Kolombangara between 1965 and 1967, revealed Choiseul to vary between low meso- and hyperendemicity, Kolombangara to be hypoendemic, Rendova to be low mesoendemic, and Wagina to be apparently malaria free (Tables 27, 28).

In the Eastern District, Spleen and Parasite Surveys gave differing results. Santa Cruz varied between hypoendemicity and holoendemicity, and the other islands showed similar variations (Tables 29, 30).

Thus, it can be seen that there is the potential for perennial malaria transmission in many areas.

4.3 Organisation of the Malaria Eradication Programme

The MEP is an autonomous unit within the Community Health Division of the Ministry of Health and Welfare, the Chief Medical Officer, Community Health, being directly responsible for the running of the Programme.

LOCATION	No. EXAMINED (2-9 YEARS)	No. POSITIVE	PARASITE RATE%	P_F	P_V	P_M	MIXED
CHOISEUL (FEB 1966)	1680 *	281	16·7	75	35	163	8
RENDOVA (JUN 1965)	231 *	45	19·5	17	24	4	–
KOLOMBANGARA (JUL 1965)	186 *	13	7·0	6	–	7	–
WAGINA I (1967)	39	–	–	–	–	–	–
CHOISEUL (1967)	109	72	66·0	N.A	N.A	NA	NA

TABLE 27 * 1-9 YEARS NA - NOT AVAILABLE

WESTERN DISTRICT: PRE-SPRAY PARASITE RATES. BSIP.

Location	No. Examined	No. Palpable Spleens	Class of Spleen						Spleen Rate %
			0	1	2	3	4	5	
Rendova (Aug 65)	232	122	110	62	43	17	–	–	52·6
Kolombangara (Aug 65)	218	106	112	72	31	3	–	–	48·7
Choiseul (Feb 66)	761	300	461	95	127	72	6	–	65·8

TABLE 28

2-9 YEARS AGE GROUP

WESTERN DISTRICT: PRE-SPRAY SPLEEN RATES

Location	No. Examined	No. Slides Positive	Parasite Rate % 2-9 years	Slide Positivity Rate %	No. Palpable Spleens	Spleen Rate % 2-9 years
Graciosa Bay	26				4	15·4
Sta. Cruz S.E.	53				27	50·9
Sta. Cruz S.W.	34				2	5·9
* Sta. Cruz N.	11	10	91·0	76·2 (84)	5(20)	25·0
Utupua I.	46	14	30·4	28·6 (84)	40	86·9
Vanikoro I.	36	9	25·0	13·1 (99)	21	58·3
Duff Is.	43	14	32·5	23·4 (107)	20	46·5
Reef Is.	90	2(39)	5·1	2·8 (72)	3	3·3

TABLE 29 * 5-9 YEARS (NO. SLIDES EXAMINED)

E.O.I: SPLEEN, PARASITE, SLIDE POSITIVITY RATES. NOV.'67.

Location	Spleen Rate %	Parasite Rate %	Overall Parasite Rate %
Graciosa Bay	45	32·5	–
Utupua Is.	34	60·0	–
Vanikoro Is.	0	–	8·2
Tikopia Is.	2·7	9·4	8·0
Anuta Is.	0	4·4	8·8
Duff Is.	31·8	14·4	13·5

TABLE 30 S.R., P.R. – 2-9 YEARS AGE GROUP

EASTERN OUTER ISLANDS: PRE-SPRAY SPLEEN AND PARASITE RATES. JANUARY 1970

It is mainly financed by a direct grant in aid as part of the Capital Budget, and is included in the Seventh Development Plan 1975-1979. In addition, considerable assistance is provided by International Agencies such as UNDP, and WHO. The BSIP Government and WHO prepared a Plan of Operations which covered the period 1970-1972; an annual addendum is prepared to this (Avery J.G. 1975).

The Chief Medical Officer is assisted by a Chief Field Operations Officer at headquarters. In addition, WHO provides a malaria advisor, a sanitarian and an epidemiologist. There is a Malaria Technical Operations Committee which consists of the Chief Medical Officer, Principal Medical Officer (Research and Evaluation), the Under Secretary of Health, the Chief Health Inspector and the WHO advisors. This committee meets monthly to advise on the Programme.

At the District level, there is a Field Operations Officer who, in addition to being in overall charge of District operations, is primarily responsible for Surveillance activities. He is assisted by an Assistant Field Operations Officer who is usually responsible for the cyclical spraying operations. Below them is the Field Supervisor who is in charge of activities (except cyclical spraying) carried out by his field staff in the few zones, usually two or three, which make up a Region. The Field Operations Officer is a member of the District Health Team, which is under the leadership of the District Medical Officer.

The Zoning of the Districts, and the approximate distribution of staff and transport facilities are shown in separate District maps (Additional Maps 2-5).

Since the start of the MEP in 1970, the expenditure has been:

1970	A$177 094	
1971	A$265 711	
1972	A$428 509	
1973	A$521 746	
1974	A$395 300	(estimated)

The 1973 expenditure was 37.7% of the Health budget, which itself accounted for 12.4% of the national budget (Avery J.G. 1975).

International Agencies (UNDP and WHO) have also contributed as follows:

1970	US$84 000	
1971	US$67 290	
1972	US$68 915	
1973	US$85 368	(estimated)
1974	US$86 484	(estimated)

4.4 Staff and Training

At the end of 1974, the MEP employed 382 persons, comprising all grades of staff. In addition to the WHO staff attached to the Programme, there have also been Volunteers from Voluntary Services Overseas (Britain), United Nations Association (Britain), and the Peace Corps (USA) over the years, and at the present time. They have given valuable help at the District level.

New recruits to the MEP first complete a selection course prior to acceptance, after which they undergo job specific training courses in laboratory and general Malariology subjects

as required. These courses are held at headquarters. In addition, there are Refresher Courses and in-service training courses run by the MEP, as well as government-run Supervisors' courses, which are attended by intermediate staff.

Senior and some intermediate staff may also be awarded WHO Fellowships and undergo further training at the Malaria Eradication Training Centre, Manila or Kuala Lumpur.

4.5 Transport

The MEP charters larger vessels from the Marine Division as require for cyclical spraying operations, supervision and Surveillance. It also has its own canoes and outboard motors which are primarily used for surveillance activities.

On the land, the MEP hires landrovers, trucks and motor-cycles as required from the Ministry of Works' Transport Pool. Where possible, technicians are encouraged to buy their own bicycles and use them.

4.6 Geographical Reconnaissance and Census

In the MEP, the basic map is the Zone Map (1:50 000) on which each village is plotted accurately, with name, total population and number of households; they also contain additional information such as Rural Health Units, schools etc. Village spot maps (1:2 500) are occasionally used for epidemiological and remedial measures. Every effort is made to revise the maps at half-yearly intervals.

A progressive Census of each zone is made by the cyclical spraying teams at each spray round. (It is this census which has been used in the preparation of this thesis). This census is nothing more than a head count. In the Consolidation areas of the Western District, and in areas where Mass Drug Administration is being carried out, a more detailed census is completed.

4.7 Spraying Operations

DDT (dichloro-diphenyl-trichloroethane) is the residual insecticide used in the MEP and is applied at the standard dose of 2.0 G per m^2 (WHO ECM 6th Report 1957) on a six-monthly basis to all sprayable resting surfaces inside dwelling houses and other village buildings, including garden houses. In areas where transmission is still a cause for concern, and as part of remedial measures in Consolidation areas, the frequency of spraying has been increased to four-monthly. The formulation used is 75% technical grade water dispersible powder for leaf structures, but for permanent structures 25% DDT emulsion concentrate is used. In addition, Malathion is sometimes added to the DDT (68.2% DDT/6.8% Malathion) on request when the bed bug problem is severe.

In 1974, it was estimated that the spray coverage by Districts was - Central 91.2%, Western 94.9%, Malaita 89.0% and Eastern 98.3%.

In addition, there is a Follow-up Spraying schedule approximately six weeks after the cyclical spraying operations, which endeavours to spray all of the missed, and any new, structures. Follow-up spraying is also used as a major factor in remedial measures around positive cases.

4.8 Surveillance

The WHO ECM Seventh Report defined surveillance as that part of a MEP designed to discover evidence of any continuation of transmission, to establish its nature and causes, to eliminate residual foci, to present or cure such residual or imported malaria infection in man as would delay the ending of transmission or threaten its resumption in a given area, and finally, to substantiate the fact that eradication has been achieved.

Since 1964, Guadalcanal and Savo have been under surveillance coverage, while New Georgia and the Shortlands group have been under cover since 1965. There has been progressive coverage since then throughout the Protectorate, full coverage being achieved last in Malaita in September 1974.

In the Solomon Islands, surveillance consists of -

(a) Active Case Detection (ACD) - in which mobile malaria technicians visit every house in every village usually on a fortnightly basis (although, in a few areas, there are also weekly and monthly visits) to enquire of each person whether he has had fever since the last visit, or is now suffering from fever. If such a person is found, a blood slide (thick and thin film) is made from him, before he is given a single-dose, presumptive treatment of chloroquine and primaquine by the technicaian.

(b) Passive Case Detection (PCD) - which is carried out by static medical staff, and occasionally volunteers, working in the Basic Health Services and else where (eg schools), who perform the same tasks as the mobile ACD technician.

In the Western District, however, where P.falciparum malaria has virtually disappeared, primaquine had been removed from the single-dose, presumptive treatment in 1974.

Both ACD and PCD rely heavily on an efficient laboratory service, and this is ensured by having two to three District microscopists, backed up by a Central Laboratory which is well staffed, and which is responsible for the cross-checking of all positive malaria slides, 10% of all negative slides and the issuing of supplies to the Districts. In addition, in close association with the Central Laboratory, there is a small, competent Statistical section which is responsible for the prompt production of MEP data.

4.9 Remedial Measures

Initially, the positive case is given the correct treatment (Tables 31, 32, 33). The Remedial Measures around a positive case were outlined in Circular 15/10 (1973), and these consisted of -

(a) Follow-up Spraying - a thorough respray of all houses in the village.

(b) Blood Surveys - to be taken from all house contacts of the positive case, and from any person in the Village with a recent history of fever.

(c) Presumptive Treatment - to be given to the whole population in the village. The treatment consisted of chloroquine-primaquine administered together. (Table 34)

(d) Case Investigation and classification of the malaria case.

DRUG	13 YEARS & OVER		5-12 YRS	3-4 YRS	1-2 YRS	4-11 MTHS
	OVER 60 Kgs	UNDER 60 Kgs				
CHLOROQUINE 150 MG. BASE	2	1½	1	½	⅓	¼
* PRIMAQUINE 7.5 MG. BASE	2	1½	1	½	⅓	¼

TABLE 31 * DAYS 1-3 ONLY MEP 15/4/3-1526 10MAY74

RADICAL TREATMENT OF P. FALCIPARUM (x5)
(ALSO 5 DAY M.D.A.)

DRUG	13 YEARS & OVER		5-12 YRS	3-4 YRS	1-2 YRS	4-11 MTHS
	OVER 60 Kg	UNDER 60 Kg				
CHLOROQUINE 150 MG. BASE	2	1½	1	½	⅓	¼
PRIMAQUINE 7·5 MG. BASE	6	5	3-4	2	1½	1

TABLE 32 MEP 15/4/3-1526 10 MAY 74

RADICAL WEEKLY TREATMENT OF P. VIVAX & P. MALARIAE. (+WEEKLY MDA)

Day	Drug	Age over 13 years		5-12 years	1-4 years	3-12 months
		Wt. over 60 Kg	Wt. under 60 Kg			
One	Chloroquine 150 mg. base	4	3	2	1	½
Sunset	Chloroquine	2	1½	1	½	¼
	Primaquine 7.5 mg. base	3	2½	1½-2	1	½
2 and 3	Chloroquine	2	1½	1	½	¼
	Primaquine	3	2½	1½-2	1	½
4 to 14	Primaquine	3	2½	1½-2	1	½

TABLE 33 MEP 15/10/-2531

14 DAY TREATMENT SCHEDULE FOR P. MALARIAE AND P. VIVAX INFECTIONS

DRUG	13 YEARS & OVER		5-12 YRS	1-4 YRS	4-11 MTHS
	OVER 60Kg	UNDER 60Kg			
CHLOROQUINE 150MG. BASE	4	3	2	1	½
PRIMAQUINE 7·5 MG. BASE	6	5	3-4	2	1

TABLE 34 MEP 15/10 13 NOV 73

PRESUMPTIVE TREATMENT

(+ MONTHLY MDA)

4.10 Chemotherapy and Treatment

Although there have been rumours of chloroquine-resistant P.falciparum infections in Papua New Guinea, these have not been confirmed there (Saint-Yves 1971), nor in any other of the malarious countries in the Southwest Pacific. There is, however, a report by Clyde and his colleagues (1974) of a strain of P.falciparum which they have designated as the Solomon Nes strain, and which was shown to be resistant to pyrimethamine, 25 mg weekly, but not to chloroquine and proguanil given in standard prophylactic doses.

Chemotherapy is further complcated by a fast relapsing, primaquine refractory strain of P.vivax, which is thought to have originated in New Guinea in 1944, (Ehrmann F.C. et alii 1945), and which has been reported from the Solomon Islands (Metcalf R.J et alii 1944). It has further been suggested that P.vivax strains from New Guinea and Guadalcanal are not quite indentical (Young M.D. et alii 1948).

(a) The drugs used in chemotherapy are the 4-Amino-quinoline, chloroquine, and the 8-Amino-quinoline, primaquine. Chloroquine is schizontocidal for all species of parasites (i.e. it destroys the asexual blood stage) and gametocytocidal for vivax and malariae sexual blood stages. Primaquine, on the other hand is gametocidal for the sexual blood stage of P.falciparum, but acts most importantly on the Exoerythrocytic stage of both P.vivax and P.malariae. They have complementary actions and are always administered together.

(b) Arnold (1954) suggested that primaquine, 45 mg base, together with chloroquine, 300 mg base, given at weekly intervals for eight weeks would be adequate for the radical treatment of vivax infections. When this regime was introduced into the Solomon Islands Programme in place

of the standard primaquine 15 mg base for 14 days regime on Savo Island, it was not found to effect a radical cure of local P.vivax infections, even though 97 per cent of persons received the full eight weeks course (Third Inter.Terr.Mal.Conf. 1964). As a result of this, a 12-weekly treatment schedule was started under supervised, but essentially field conditions, in which 149 patients with P.vivax infections were treated. Of these patients, 45 were followed for nine months, 55 were followed for seven months, seven for six months, and the remainder for not less than five months. No patient relapsed clinically or parasitologically. It was therefore felt that this was a satisfactory regime for the radical cure of South-West Pacific P.vivax (Macgregor J.D 1966) and it is now the standard regime for vivax and malariae infections throughout the MEP.

The Chesson strain of P.vivax is characterised by its refractory response to primaquine administered in a dose of 15 mg base per day for 14 days, together with the therapeutic dose of chloroquine, 1.5G base, administered over three days. However, in presumed latency, it was shown that primaquine 22.5 mg base per day for 14 days, together with the therapeutic dose of chloroquine, had reduced the incidence of subsequent malaria from 55 per cent to eight per cent in comparable groups who had been resident in New Guinea, (Black R.H. 1958). This regime is now also used in the MEP for those patients with P.vivax infection in late Attack or Consolidation areas who are able to be institutionalised to ensure full treatment.

Saint-Yves (1975) has recently carried out a supervised trial in Honiara, in which he administered single dose, presumptive treatment, chloroquine 600 mg base, primaquine 45 mg base , (with children, up to the age of 10 years, on a pro rata basis) to six patients with P.vivax infection, in which one failed to relapse over a period of twelve months, another had not relapsed after six months, three had relapsed at two, three and five months respectively, while the last had not relapsed after two months. In the same trial, seven persons with P.vivax infection were administered the standard course, while seven were administered Black's modified course. Of the seven persons treated with the modified course, none had relapsed after periods of between two and twelve months. All patients had a blood examination done at monthly intervals, and children over the age of 10 years were administered the drugs on a pro rata basis.

Of six cases of P.falciparum, three were given the single dose, presumptive treatment and three received the standard course of chloroquine, 1.5G base, over three days. In both cases, parasitaemia was cleared, and there were no recrudescences within a period of one month (Saint-Yves I.F.M. 1975); their bloods being examined daily in the first week, and then weekly for three weeks.

(c) On occasions, it has been found necessary to use a 5 days course of chloroquine and primaquine (WHO 1961), first used in India for the radical cure of P.vivax infections, but only used under epidemic conditions in the Solomon Islands in 1972-73 when it was carried out as a Mass Drug Administration (MDA) in selected areas. On evaluation, it was shown that the 5-days regime was unsatisfactory, whereas the 12-weekly regimen was satisfactory under the field conditions operative in the Solomons Islands (Saint-Yves I.F.M. 1975)

The 5 days MDA schedule is also the same as that used for the radical treatment of P.falciparum infections (Table 31).

The radical weekly treatment schedule for P.vivax and P.malariae infections is the same as is used for the weekly mass drug adminstration (Table 32). The 14 day treatment schedule for the radical cure of P.malariae infections is shown in Table 33, while the presumptive treatment schedule, which is also used for monthly MDA, is shown in Table 34.

4.11 Entomology

The vector mosquitoes of the Solomon Islands belong to the genus Anopheles Meigen, of the Punctulatus complex of the subgenus Cellia. The three vector species are:-

Anopheles punctulatus Donitz 1901

Anopheles farauti Laveran 1902

Anopheles koliensis Owen 1945

The Punctulatus complex extends from New Guinea, through the Solomon Islands to the New Hebrides and the north of Australia.

(a) The larvae of these three vector species enjoy a wide range of breeding sites from fresh water pools to swamps, and, in the case of A.farauti larvae to rock pools with a salinity in excess of sea water. A.punctulatus and A.koliensis tend to be found round human habitation. (Slooff R. 1969, Maffi M and Taylor B. 1974)

(b) It was found that in the months following the first cycle of DDT spraying, the population densities of all three species had usually fallen to a very low level and that A.punctulatus and A. koliensis had, in general, disappeared or become rare in the original area of distribution. (Slooff R. 1969)

(c) A.farauti has been shown to be markedly anthropophilic, the Human Blood Index varying between 0.25 (Koli, Guadalcanal 1965) and 0.98 at Mango, Choiseul in 1966. A summary of MPEP Entomological surveys is shown in Table 35.

(d) DDT Susceptibility Testing prior to spraying (Slooff R. 1969) and again in 1973 and 1974 (Saint-Yves I.F.M.) has failed to show any evidence of resistance of A.farauti to DDT on Guadalcanal in the standard dosages used.

(e) Distribution of all species of the Punctulatus complex is shown on Map 3. A.farauti is the most wide spread vector, although its distribution is limited. (Belkin J.N. 1965, Black R.H. 1952, Brown E.S. 1955, 1962 Maffi M. et al. 1971, Parsonson G.S. 1964, Medical Department Records 1966-1971). A.koliensis and A.punctulatus are less widely distributed. (Med.Dept.1966-71. Owen W.B. 1945).

(f) Doubt has arisen as to whether vectors were present above 600 metres. (Taylor B. 1975; Laird M 1955); however, further entomological studies showed the presence of A.punctulatus larvae in the high bush areas of Guadalcanal. (Med.Dept. 1974-1975. Peters and Christian (1960)' had already reported the ability of A.farauti to transmit malaria at an altitude of 5140 feet in New Guinea.

4.12 Parasitology

Three species of human malaria -

Plasmodium falciparum

Plasmodium vivax

Plasmodium malariae

- are present in the Solomon Islands.

Night Catches	Kolombangara Rendova, Tetepari	Choiseul	Nggela Islands	Russell Islands	Santa Ysabel	Malaita	San Cristobal	Santa Cruz	Rennell I.
Outdoor Man Biting per Man/Hour	0·2	3·1	4·7	4·2	1·3	1·5	1·6	1·3	0·3
Indoor Man Biting per Man/Hour	0·1	2·9	7·3	5·6	1·3	0·5	1·1	1·5	0·2
Total No. Salivary Glands Dissected	–	318	2 405	142	298	–	36	12	–
Sporozoite Rate	–	0·6	1·7	1·4	0·3	–	–	–	–

(A) ANOPHELES FARAUTI ON UNSPRAYED ISLANDS 1964–1968

(B) ANOPHELES FARAUTI ON DDT-SPRAYED ISLANDS 1965–1968

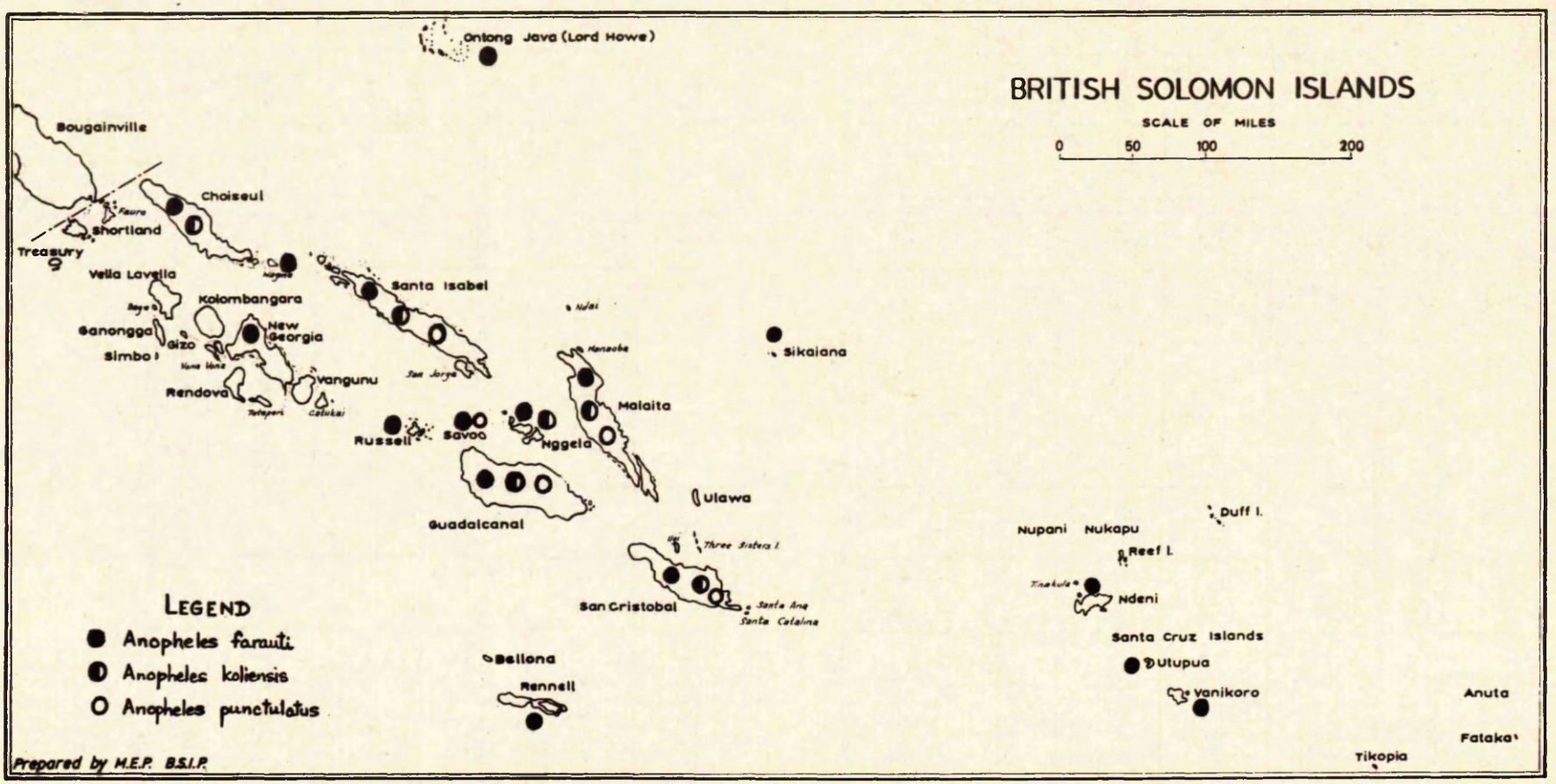
(C) PRECIPITIN TESTS-A.F.-BLOOD SMEARS

Night Catches	North C. Guadalcanal	Guadalcanal 'Bush'	South Guadalcanal	Savo Island	New Georgia Group
Outdoor Man Biting per Man/Hour	7·9	–	0·02	2·6	0·9
Indoor Man Biting per Man/Hour	1·7	–	–	0·6	0·05
Total No. Salivary Glands Dissected	26 539	–	–	766	68
Sporozoite Rate	0·004	–	–	–	–

Island	Place Year	Human Blood Index
Guadalcanal	Lunga 1965	0·49
Nggelas +	Tavulea 1965	0·78
Guadalcanal	Koli 1965	0·25
Choiseul +	Mango 1966	0·98
Guadalcanal	Lunga 1967	0·85

TABLE 35 + UNSPRAYED AT TIME OF TESTS DR. R. SLOOFF 1969

M.P.E.P. CONSOLIDATED SUMMARY OF ENTOMOLOGICAL SURVEYS 1964–1968



MAP 3 ● ALSO ON TIKOPIA, DUFFS (?) DR. R. SLOOFF 1969 BSIP 0002

DISTRIBUTION OF THE MALARIA VECTORS - B.S.I.P.

Active case detection
Passive case detection

Tables poorly explained

Location	Year	ACD	PCD	Total A+PCD	P.f.	P.v.	P.m.	Mixed	No. Inf	No. Cases	SPR
Shortland I	1966	66	205	271	5	4	4	3	13	10	3·7
	1967	182	78	260	1	20	3	–	24	24	9·2
Shortlands Group	1968	69	704	773	27	57	1	4	85	81	10·5
New Georgia	1969	5436	3290	8726	67	365	15	4	447	443	5·1
Wagina	1969	672	12	684	3	140	1	1	144	143	20·9
Western	1965	3519	53	3572	16	53	37	2	106	104	2·9
	1966	2699	2217	4916	86	195	88	34	369	335	6·8
	1967	2059	2368	4427	115	327	45	13*	487	474	10·7
	1968	2470	3465	5935	176	363	40	19*	579	560	9·4
	1969	7492	5631	13123	121	613	16	11*	750	739	5·6

Slide Laboratory Note

TABLE 36 * SPECIES NOT SPECIFIED

WESTERN DISTRICT: P.E.P. SURVEILLANCE

YEAR		ACD	PCD	TOTAL A+PCD	P.F.	P.V.	P.M.	MIXED	No. INF.	No. CASES	EST. POPULN	S.P.R.	ABER
1965		5197	5565 +	10762	780	427	209	13	1416	1403	29656	13·0	36·3
1966		5276	11103	16379	635	256	129	16	907	891	31042	5·4	52·8
1967		8863	19765	28628	1414	467	267	30	2148	2118	32427	7·4	88·3
1968		10110	18891	29001	1498	1259	188	97	2848	2751	33863	9·5	85·6
1969		18486	18688	37174	2025	2295	113	111	4433	4322	35248	11·6	105·5
1970		10585	12617	23202	914	1581	73	80	2568	2488	36539	10·7	63·5

TABLE 37 + MAINLY HONIARA YEAR FROM NOV. TO OCT.

GUADALCANAL-SAVO : P.E.P. SURVEILLANCE

As can be seen (Tables 36, 37,), each species was well represented in Central and Western Districts and this pattern was repeated in Malaita and Eastern Districts. It is interesting to note that there was quite a high level of P.malariae infection in the pre-spray period.

The responses of the local strains of P.falciparum and P.vivax have already been discussed in 2.10 above. Where ?

4113 Epidemiology and Assessment

Guadalcanal (1962), Savo (1963), New Georgia (1963) and the Shortlands group (since 1959, by the Papua New Guinea Administration) were included in the Pilot Project, and spraying started in the years indicated. Gradually, the spray cover was extended to Choiseul in 1968, Santa Ysabel in 1969 under the Pre-Eradication Programme, while the remaining islands came under spray coverage as indicated: Nggela in April 1970, Russells in August 1970, Malaita in July 1970, Ulawa in September 1970, Eastern Outer Islands in September 1971, and Eastern Inner Islands in November 1971. Of the Eastern Outer Islands, only Anuta, Tikopia and a few outlying Reef Islands have not been sprayed due to the absence of the vectors.

Cyclical spraying operations have been regularly maintained for the most part, at six-monthly intervals. There were, however, a few gaps in mid 1972, in the bush and weather coast zones of Guadalcanal. In mid 1973, the central north coast of Guadalcanal (excluding Honiara) and Nggela were phased into a four-month cycle, in conjunction with MDA, in an effort to interrupt transmission in that area - the results have been encouraging and the four-month cycle is still in operation.

The whole of Central District, except for Bellona, is covered by regular ACD and PCD activities; on Bellona, only PCD exists.

In the Western District, routine cyclical spraying was carried out at six monthly intervals, except for the north-west corner of Choiseul and Wagina, where MDA was combined with a four-month cycle for a short period. The situation in Choiseul and Wagina improved greatly and both reverted to routine spraying in mid 1974. The progress in the greater part of the New Georgia group in the latter part of 1973 (excluding Gizo and the Shortland Islands) was so good as to permit this area to enter Consolidation in May 1974 under the criteria of having an Annual Parasite Incidence of less than two cases per 1 000 on an island basis per annum, and an exceedingly good surveillance coverage (Tewari T.R., Colbourne M.J. 1973). Full surveillance had been in operation in New Georgia since 1964, and in Choiseul since 1970. However, there is still a small focus of vivax malaria among the Gilbertese community in the Shortland Islands.

Spraying in Malaita was regular until May 1972, when, due to a combination of cyclonic weather and delay of DDT supplies, delays of up to 10 months occurred in the District. By September 1973, cyclical spraying was once again regularised at six-monthly intervals.

Soon after the start of spraying in Malaita District in 1970, PCD started throughout the District, gradually, from August 1971 until September 1974; ACD expanded to cover the whole District, although the regularity of ACD visits in some of the high bush

areas requires further improvement. Progress has also been encouraging on Malaita, but there have been epidemics in 1973, centred on Kwaimela, and in 1974 centred on Olomburi in East Kwaio, and which spread up the coast to Sinerango and down to Manawai.

There have been no interruptions to regular spraying operations in the Eastern District. PCD has been in operation since soon after the start of spraying operations. ACD, on the other hand, has been difficult to establish, especially on the weather coast of San Cristobal, and in the Eastern Outer Islands, except for Santa Cruz, where it was established in 1974.

The peak in the number of cases in the Eastern District was reached in March to May 1973, and since then, the progress has been very encouraging.

(a) The Assessment of a Malaria Eradication Programme is carried out by the determination of the Annual Parasite Incidence or A.P.I. (W.H.O. 1963) which must be based on full surveillance activities, and the Annual Blood Examination Rate or A.B.E.R. (Pampana E.J. 1969) Tewari and Colbourne (1973) suggested an A.P.I: of two cases per thousand on an island basis.

WHO criterion is 1:10,000

Once these criteria have been satisfied, then consideration may be given to the withdrawal of spraying, and entry into the Consolidation Phase. This happened in a large part of the New Georgia group, Western District, in 1974.

(b) In the New Georgia group of the Western District, the Slide Positivity Rate (i.e. the proportion positive of slides examined expressed as a percentage) rose from 2.9 per cent in 1965, to a maximum of 10.7 per cent before falling to 5.6 per cent in 1969. (Table 36) Table 37 shows that there were considerable fluctuations in both Slide Positivity Rate (SPR) and the ABER in Guadalcanal and Savo.

In the Central District, there was a fall in the API (Table 38) from 96.8 per thousand in 1970 to 36.2 per thousand in 1974, although there was a peak of 71.9 per thousand in 1973, this was accompanied by a fall in the ABER from 90.2 per cent in 1970 to 49.8 per cent

in 1974. (Table 39)

Malaita District has shown steady improvement from an API of 29.0 per thousand in 1972 to 9.6 per thousand in 1974; this has been accompanied by a large increase in the ABER which has risen from 13.5 per cent in 1971 to 53.4 per cent in 1974. (Tables 38, 39).

Progress has been very satisfactory in the Eastern District as a whole, The API falling from 107.1 per thousand in 1971 to 24.0 per thousand in 1974 accompanied by an increase in the ABER from 12.6 per cent in 1971 to 46.4 per cent in 1974.

The Western District has, however, shown the best progress of all. The ABER has risen progressively from 35.6 per cent in 1970 to 66.7 per cent in 1974, while the API has fallen from 12.4 per thousand in 1972 to 2.7 per thousand in 1974. Most of the New Georgia group entered Consolidation in May 1974.

The Quarterly Malaria Case Detection trends on a District basis are clearly shown in Fig. 2 as are the Slide Positivity Rates.

What is CFU?

District	Est. Population	Year	CFU	HC Survey	From CFU, HC, Surveys						Total No. Slides*	Total No. Cases*	API ‰
					Pf	Pv	Pm	Mixed	Infection	Cases			
Central	25844†	1970	–	2129	3	5	5	–	13	13	25331	2501	96·8
	56864	1971	–	–	–	–	–	–	–	–	35447	2411	–
	60503	1972	2115	4776	124	325	27	12	476	464	39328	2331	38·5
	64375	1973	5043	2900	222	331	–	7	553	546	41695	4628	71·9
	69952	1974	4050	7065	59	262	1	4	322	318	45942	2533	36·2
Malaita	51240	1971	–	–	–	–	–	–	–	–	6910	1016	–
	51547	1972	19	3990	15	400	35	2	450	448	24883	1494	29·0
	51856	1973	334	3816	18	101	8	–	127	127	27747	1122	21·6
	52152	1974	1879	1822	33	53	2	–	88	88	31544	503	9·6
Eastern	21184	1971	–	–	–	–	–	–	–	–	2670	1013	–
	21650	1972	19	3962	75	728	75	21	878	857	9491	2319	107·1
	22126	1973	862	5829	69	521	45	8	635	627	16483	1717	77·6
	22654	1974	644	5742	5	185	15	–	205	205	16902	544	24·0
Western	32231	1970	–	–	–	–	–	–	–	–	11489	569	–
	32537	1971	–	–	–	–	–	–	–	–	18870	487	–
	34392	1972	1163	2069	2	44	1	–	47	47	26119	425	12·4
	36352	1973	1017	2079	6	34	–	–	40	40	25281	298	8·2
	37241	1974	1155	7566	–	14	–	–	14	14	33557	101	2·7

TABLE 38 +GUADALCANAL-SAVO ONLY *INCLUDES ACD-PCD SLIDES

MEP 1970-1974: CFU, HC, SURVEYS, NO. CASES, API.

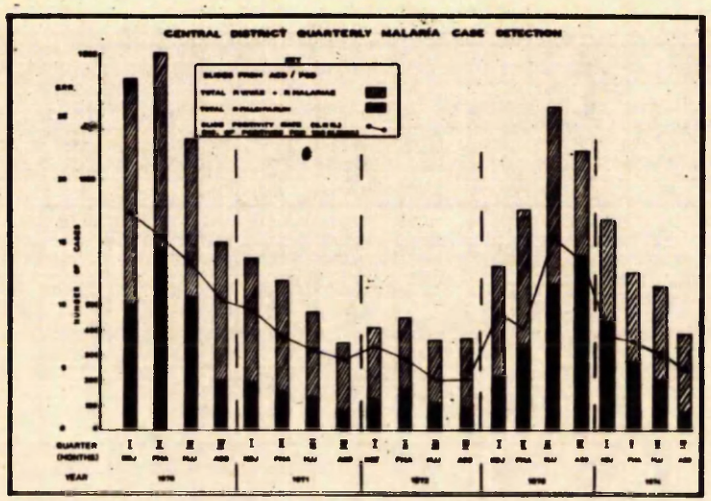
Title explic

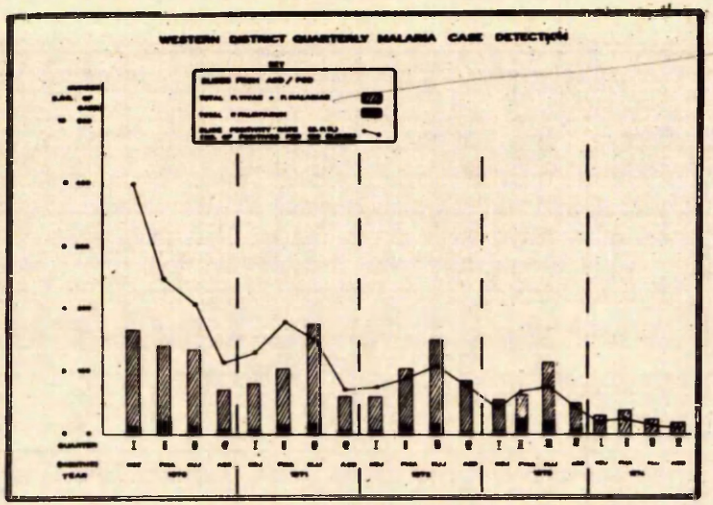
District	Est. Populn.	Year	ACD	PCD	Total A+PCD	From ACD and PCD						SPR	ABER
						P_F	P_V	P_M	Mixed	Infection	Cases		
* Central	25844	1970	10585	12617	23202	914	1581	73	80	2568	2488	10·7	90·2
	56864	1971	20036	15411	35447	647	1740	54	30	2441	2411	6·8	62·3
	60503	1972	17457	14980	32437	551	1305	31	20	1887	1867	5·7	53·6
	64375	1973	19969	13784	33752	1989	2122	7	36	4118	4082	12·1	62·4
	69952	1974	20178	14649	34827	771	1460	6	22	2237	2215	6·4	49·8
Malaita	51240	1971	155 +	6755	6910	63	940	38	25	1041	1016	14·7	13·5
	51547	1972	2331	18543	20874	73	935	29	1	1047	1046	5·6	40·5
	51856	1973	9535	14062	23597	194	778	25	2	997	995	4·2	45·5
	52152	1974	17345	10498	27843	188	215	12	–	416	415	1·5	53·4
Eastern	21184	1971	236 +	2434	2670	501	528	34	50	1063	1013	37·9	12·6
	21650	1972	785	4725	5510	209	1128	140	15	1477	1462	26·5	25·4
	22126	1973	3948	4844	8792	207	845	46	8	1098	1090	12·4	39·7
	22654	1974	6391	4125	10516	31	276	33	1	340	339	3·2	46·4
Western	32231	1970	6620 ++	4869	11489	49	517	4	1	570	569	4·9	35·6
	32537	1971	11469	7401	18870	45	432	15	5	492	487	2·6	58·0
	34392	1972	15453	6822	22275	36	333	9	–	378	378	1·7	64·8
	36352	1973	17104	5081	22185	44	210	4	–	258	258	1·2	61·0
	37241	1974	18815	6021	24836	4	83	–	–	87	87	0·4	66·7

TABLE 39 * GUADALCANAL-SAVO ONLY + PROGRESSIVE ACD

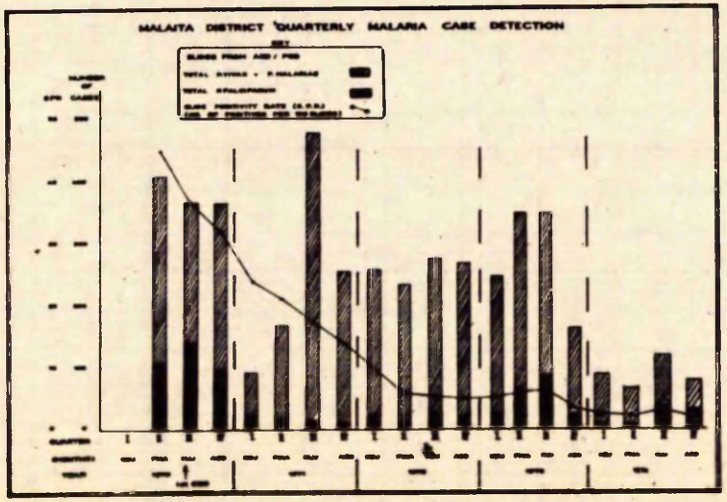
POPULATION:- 1970 CENSUS, 1971-74 MEP ++ FROM 1 MAY 1970 ONLY

MEP 1970-1974: ACD, PCD, NO. CASES, SPR, ABER.





Not legible



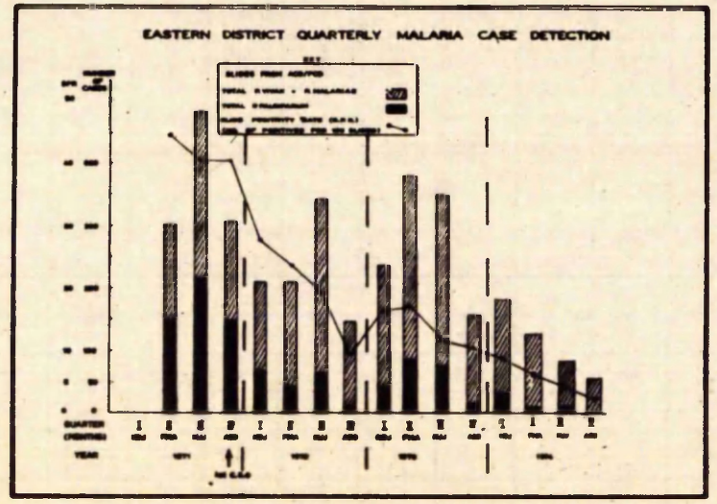


FIG.2: QUARTERLY MALARIA CASE DETECTION BY DISTRICTS - 1970 - 1974.

5.0 POPULATION

5.1 THE INTERCENSAL PERIOD 1931 - 1959

The Census of 1931, which allegedly referred to the population as of April of that year, was carried out over a period of months by District officers in each district. It was a limited census, and in many instances, especially on Malaita, it amounted to little more than a head count. In other areas, not even a head count was attempted, as on Choiseul where the number otained was based on estimates provided by missionaries and government officials. It is therefore possible that the census results of the Protectorate as a whole could be seriously in error. Nevertheless, these are the only official figures available. (Groenewegen K. 1970)

Out of an estimated total of 94 066 persons enumerated in this census, there were 89 568 Melanesians, 3 847 Polynesians, a total of 93 415 Solomon Islanders, and 651 others. (Table 40). The distribution of the Melanesians was largely confined to the major islands, while the Polynesians tended to inhabit the outlying islands.

Out of a total of 25 215 Melanesians in Central District, 14 215 were on Guadalcanal/Russells (15.87 per cent of the total Melanesian population but 53.2 per cent of the district population), while Nggelas/Savo and Santa Ysabel only accounted for 1 100 persons, or 5.92 per cent and 6.36 per cent respectively of the total Melanesian population. (Tables 41, 42) The Polynesians were confined to Rennell and Bellona Islands, and only numbered 1 500 persons, which was 39.0 per cent of the total Polynesian population but only 5.61 per cent of the total District population, and 1.6 per cent of the total Protectorate population.

ETHNIC GROUP	1931 CENSUS POPULATION	1959 CENSUS POPULATION	1970 CENSUS POPULATION	OVERALL GAIN 1931-1959	%AGE GAIN 1931-1959	OVERALL GAIN 1959-1970	%AGE GAIN 1959-1970
MELANESIANS AND POLYNESIANS	93415	122245	156066	28830	30·9	33821	27·7
MELANESIANS	89568	117620	149667	28052	31·3	32047	27·2
POLYNESIANS	3847	4625	6399	778	20·2	1774	38·3
GILBERTESE		459	2362			1903	414·6*
MELANESIANS POLYNESIANS GILBERTESE	93415	122704	158428	29289	31·3	35724	29·1
ALL COMPONENTS	94066	124076	160998	30010	31·9	36922	29·8

* Gilbertese Resettlement 1963-64

Adopted from Tables IIA and IIB. 1970 Census

TABLE 40

POPULATION INCREASE IN INTERCENSAL PERIODS 1931-59, 1959-70

Districts	Island Groups	1931 Census		1959 Census+			1970 Census		
		Melanesians	Polynesians	Melanesians	Polynesians	Gilbertese	Melanesians	Polynesians	Gilbertese
Central	Guadalcanal	14215		18666			32329	713	
	Russells						1872	746	
	Nggelas/Savo	5300		6963			6638		
	Santa Ysabel	5700		7481			8543	62	
	Rennell Bellona		1500		1804		29	1457	
	Totals	25215	1500	33110	1804		49411	2978	
Malaita	Malaitas	40067		52623			50209	92	
	Ontong Sikaiana		985		1184			1062	
	Totals	40067	985	52623	1184		50209	1154	
Western	Shortlands	1301		1706			1574		
	New Georgia	7173		9421			20929		
	Choiseul	4051		5328		459	7324		
	Totals	12525		16455		459	29827	106	
Eastern	Inner	7560		9927			12183	152	
	Outer	3718	1362	4928	1637		7072	1986	
	Totals	11278	1362	14855	1637		19255	2138	
Unclassified		447*	36*				765	23	
BSIP	Totals	89532	3883	117620	4625	459	149667	6399	2362

+ 1959 Based on 1931 Census Distribution

* Estimated Distribution of 483 Unclassified

Table: 41

Census Populations of Solomon Islanders by Ethnic Groups.

District	Island Groups	%age total population	%age Melanesian population	%age District population
Central	Guadalcanal*	15·22	15·87	53·21
	Nggelas/Savo	5·67	5·92	19·84
	Santa Ysabel	6·10	6·36	21·34
	Rennell/Bellona (P)	1·60	39·0 (P)	5·61
Malaita	Malaitas	42·89	44·74	97·60
	Ontong Java/Sikaiana (P)	1·05	25·60 (P)	2·40
Western	Shortlands	1·39	1·45	10·39
	New Georgia	7·68	8·01	57·27
	Choiseul	4·34	4·52	32·34
Eastern	Inner	8·09	8·44	59·81
	Outer	5·44 (3·98 (M), 1·46 (P))	4·19 (M), 35·40 (P)	40·19
Unclassified		0·53	0·49 (M), 0·04 (P)	
Central		28·60	28·16	
Malaita		43·94	44·75	
Western		13·40	13·48	
Eastern		13·53	12·65	

* Includes Russell Islands (P) Polynesian remainder Melanesian

TABLE 42

PERCENTAGE DISTRIBUTION OF ETHNIC GROUPS BY DISTRICTS AND ISLAND GROUPS. CENSUS 1931.

The 40067 Melanesians on Malaita, on the other hand, accounted for 44.74 per cent of the total Melanesian population and 42.89 per cent of the total Protectorate population. The Polynesians, numbering 985 persons, were restricted to Ontong Java and Sikaiana, and only accounted for 1.05 per cent of the total population.

The Solomon Islanders in the Western District numbered 12 525, all of whom were considered to be Melanesians; of these, 10.39 per cent were on the Shortland islands group, 57.27 per cent were on the New Georgia group and 32.34 per cent were on Choiseul. The Western District accounted for 13.40 per cent of the indigenous population.

In the Eastern District, there were 7 560 and 3 718 Melanesians in the Inner and Outer Islands respectively --- a total of 11 278, accounting for 12.65 per cent of the total Melanesian population. The Polynesians, numbering 1 362 in the Outer Islands, accounted for 35.40 per cent of the total Polynesian population and only 1.46 per cent of the overall population. The Eastern District as a whole accounted for 13.53 per cent of the total indigenous population.

Long-term residents with an interest in the local situation (Low R., Fox N. Fr. 1975) have stated that, in their opinion there was minimal inter-island migration until the mid 1960s. Table 43 was constructed on this basis, using the 1931 percentage distribution of populations to assess the 1959 Island groups and Districts populations.

District	Island Groups	%age Population as per 1931 Census	1959 Estimated Population
Central	Guadalcanal*	15·87	18666
	Nggelas/Savo	5·92	6963
	Santa Ysabel	6·36	7481
	Total	28·15	33110
Malaita	Malaitas	44·73	52623
Western	Shortlands	1·45	1706
	New Georgia	8·01	9421
	Choiseul	4·53	5328
	Total	13·99	16455
Eastern	Inner	8·44	9927
	Outer	4·19	4928
	Total	12·63	14855
Unclassified		0·49	576
BSIP	Melanesians	95·85	117620(c)
Central+	Rennell/Bellona	1·62	1804
Malaita+	Ontong Java/Sikaiana	1·06	1184
Eastern+	Outer	1·47	1637
BSIP	Polynesians	4·15	4625(c)

*Includes Russell Islands +Includes Unclassified (c) Census

TABLE 43

1959 ESTIMATED POPULATIONS DERIVED FROM 1931 POPULATION PERCENTAGE DISTRIBUTIONS

The 1959 census was a de jure census -- that is one in which persons are classified according to the place that is their usual or legal place of residence as of census night. Because there was little internal movement the total de jure population can be considered as virtually equal to the de facto population (i.e persons are enumerated in the place where they happen to be at the time of the census) on that date, and so, the 1959 results can be validly compared to the 1970 data, which were based on a de facto count. (Groenewegen K. 1970)

On this basis, it can be seen (Table 43) that Central District had an estimated Melanesian population of 33 110, of which Guadalcanal and the Russell Islands accounted for 18 666 persons. The Melanesian population of Malaita was estimated at 52 623, the Western District at 16 455, of which New Georgia accounted for 9 421, while the Eastern Inner and Outer Islands accounted for 9 927 and 4 928 persons respectively.

There was a total Polynesian population of 4 625, of which it was estimated that 1 804 were in Central District, 1 184 in Malaita District and 1 637 in the Eastern District. (Table 43)

During the period 1931-1959, there was an overall gain of 28 830 persons (30.9 per cent) in the indigenous population, of which Melanesians accounted for 28 052 and Polynesians for 778 persons. There was a percentage gain of 31.9 per cent for all components of the population. (Table 40)

5.2 INTER-CENSAL PERIOD 1959-1970 (CENSUS 1970)

In this Inter-censal period, there was an overall gain in

(a) the Melanesian population of 32 047 (27.2 per cent)

(b) the Polynesian population of 1 774 (38.3 per cent)

(c) the Gilbertese population of 1 903 (414.6 per cent)

(d) All components of 36 922 (29.8 per cent)

The Gilbertese resettlement started about 1958, but the large migration took place about 1963-1964, the migrants being settled on Wagina island at the eastern end of Choiseul. (Table 40)

Of the total indigenous population, now taken to include the Gilbertese component, there was a total population of 158 428, of which Melanesians accounted for 149 667 (94.5 per cent), Polynesians for 6 399 (4.0 per cent) and Gilbertese for 2 362 (1.5 per cent) (Table 41).

On a district basis, the annual growth rate for Melanesians between 1959 and 1970 was:

(a) Central District: 3.7 per cent. Of this, Guadalcanal alone accounted for 5.6 per cent. This rapid rate of growth in Guadalcanal was largely due to the establishment of Honiara as the capital of the Protectorate and to the establishment of a variety of primary industries on the fertile plain of the north central coast. Malaita provided the greatest proportion of the influx of labourers, followed by Western District and Eastern District. In Honiara itself, the rate of growth has been estimated at 11.0 per cent annually. (McFadden C. 1975)

(b) Malaita District: a negative rate of 0.4 per cent, the population falling to 50 409 from an estimated 52 623 in 1959. This was due to large scale emigration, primarily to Guadalcanal, but also to the Western District.

(c) Western District: 5.5 per cent, the greatest rate of increase being in the New Georgia group, where the population rose from 2 421 in 1959 to 20 929 in 1970. This large increase was also dependent upon immigration from Malaita, the people arriving as labourers for the expanding timber industry and elsewhere. The Shortland Islands group also showed a negative growth rate of 0.7 per cent, due largely to emigration to more prosperous areas.

(d) Eastern District: 2.3 per cent overall, the Inner Islands expanding at 1.9 per cent annually, while the Outer Islands expanded at 3.4 per cent annually.

The overall growth rate for Melanesians was 2.2 per cent. (Table 44) For the Polynesian population, the overall growth rate in this period was 3.0 per cent annually, the greatest rate being found in Central District at 4.7 per cent, the least on Malaita, where there was a negative growth rate of 2.6 per cent annually. (Table 45)

However, to obtain a true estimate of the growth rate, it is necessary to enumerate the population according to their council area by birth;(Table 46) from this the amount of population movement can be assessed and the actual growth rates can be determined. The movement of population is depicted on Map 4.

When the Protectorate population is adjusted for internal migration, the following annual growth rates emerge:

(a) Central District 2.1 per cent. The reduction from 3.7 per cent was basically due to a fall in the Guadalcanal rate, as Guadalcanal accounted for the greatest proportion of immigrants from the other districts and islands.

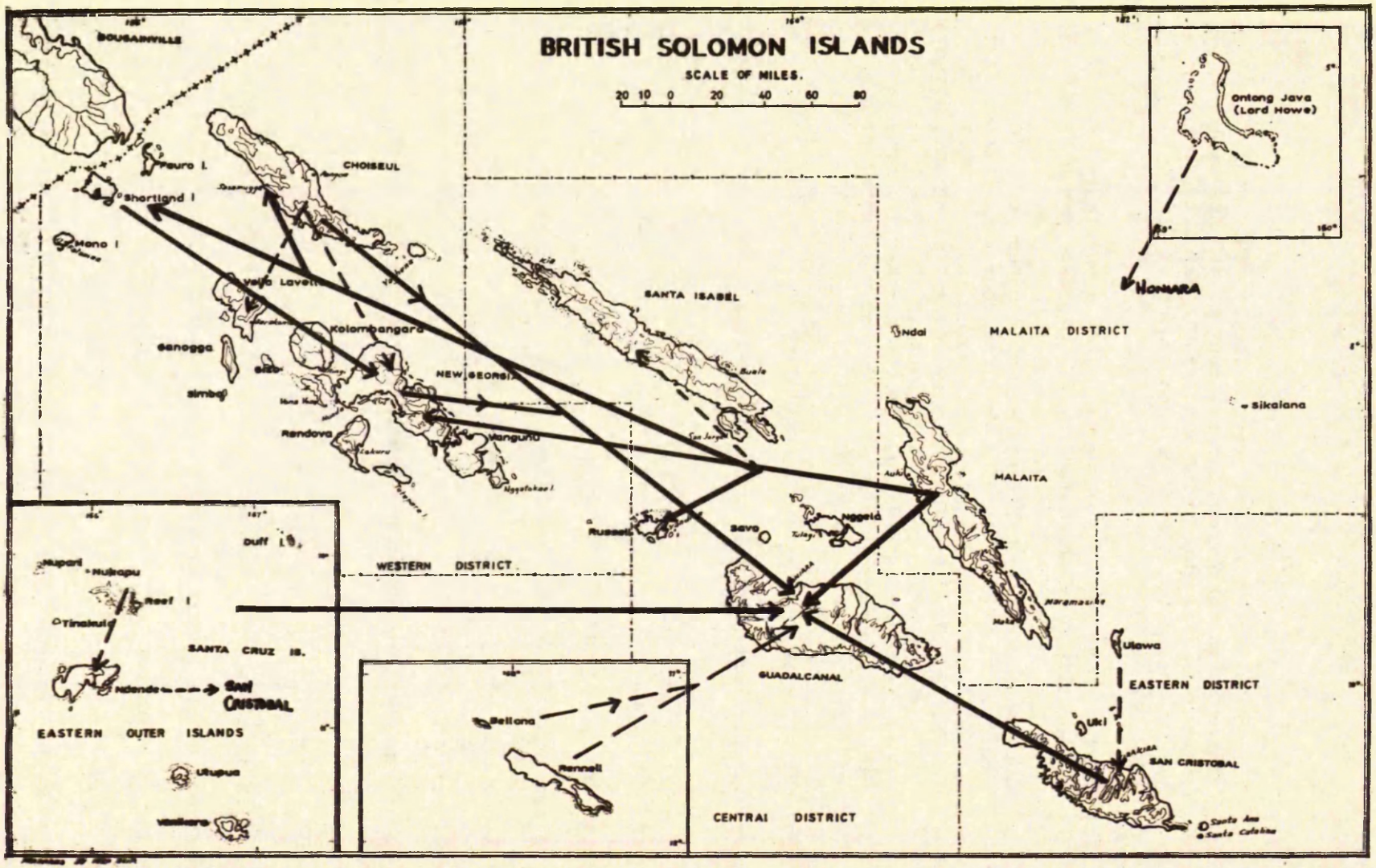
(b) Malaita District: 1.0 per cent. This meant that there was, in reality, an emigration rate of 1.3 per cent annually to other islands.

District	Island Groups	Annual Growth Rate 2.43%. Estimated Population	1970 Census Population	Difference in Populations	Percentage Difference	Actual Annual 1959-1970 Growth Rate
Central	Guadalcanal*	24307	34205	+9898	+41.2	5.6
	Nggelas/Savo	9066	6619	-2447	-27.0	-0.5
	Santa Ysabel	9742	8558	-1184	-12.1	1.3
	Rennell/Bellona	—	29	29		
	Totals	43115	49411	+6296	+14.6	3.7
Malaita	Malaitas	68531	50409	-18122	-26.4	-0.4
Western	Shortlands	2220	1574	-646	-29.1	-0.7
	New Georgia	12267	20929	+8662	+70.6	7.5
	Choiseul	6938	7324	+386	+5.6	2.9
	Totals	21425	29827	+8402	+39.2	5.5
Eastern	Inner	12990	12184	-806	-6.2	1.9
	Outer	6357	7071	+714	+11.2	3.4
	Totals	19347	19255	-92	-0.5	2.3
Ships		760	765	+5	+0.65	
BSIP	Totals	153178	149667	-3511	-2.3	2.2

* INCLUDES RUSSELL ISLANDS

TABLE: 44

MELANESIANS: COMPARISON OF ESTIMATED AND ACTUAL POPULATIONS, WITH ACTUAL ANNUAL GROWTH RATE 1959-70



MAP 4 : POPULATION MOVEMENTS

(c) Eastern District: 2.8 per cent. The Outer Islands showed an increase from 3.4 per cent to 4.2 per cent annually --- an emigration rate of 0.8 per cent every year. The Inner Islands were unchanged at 2.0 per cent per annum.

(d) Western District: 5.3 per cent. This means that immigration only accounted for 0.2 per cent annually over the period 1959-1970. Choiseul showed an increase rate (3.5 per cent) while both the New Georgia group (6.9 per cent) and the Shortland Islands, group (a negative 0.9 per cent) showed reduced rates. On the Shortland Islands, this may mean a permanent, large scale migration of the younger peoples in the early intercensal period or a fall in the birth-rate/increase in the death rate; the latter eventually is considered unlikely. (Table 47)

For the native-born Polynesian population, the overall growth rate was 2.9 per cent annually in the inter-censal period. Of this (a) Central District showed a reduced adjusted growth rate of 2.2 per cent annually, showing large-scale movement into the District from other districts. (b) Malaita showed an increased growth rate of 1.3 per cent annually, showing an emigration rate of 1.5 per cent annually. (c) In the Western District, there was a permanent increase of 30 persons (d) The Eastern District, on the other hand, had an increased growth rate of 4.6 per annum, showing that there was an emigration rate of 2.1 per cent per annum, almost entirely from the Outer Islands. (Table 48)

Table 49 shows the breakdown of the Melanesian and Polynesian populations by age groups with their annual growth rates. The 'earning' population, 15-54 age group, fell from 48.8 per cent in 1970. There was a proportionately greater decrease in the Melanesian population who accounted for 93.0 per cent of the total. The newly arrived Gilbertese, 2 362 persons, accounted for 1.5 per cent of

District	1970 Population at 2·1½ p.a. Growth	1970 Census Population	Difference	Percentage Difference	Annual Growth Rate 1959-70
Central	2269	2978	+709	+31·2	4·7
Malaita	1489	1154	−335	−22·5	−2·6
Western	−	106	+106		
Eastern	2058	2138	+80	+3·9	2·4
BSIP	5816	6399*	+583	10·0	3·0

TABLE 45

* INCLUDES 23 ON SHIPS

POLYNESIANS - COMPARISON OF ESTIMATED AND CENSUS POPULATIONS (1970), WITH ACTUAL ANNUAL GROWTH RATES

COUNCIL AREA BY ENUMERATION

COUNCIL AREA BY BIRTH	CENTRAL DISTRICT					MALAITA			WESTERN				EASTERN			SHIPS		BSIP
	Gc/R	Nc/S	Sm.Y	R/B	TOTAL	MAL	OT/S	TOTAL	SHORT	NG	CHOIS	TOTAL	INNER	OUTER	TOTAL			
GUADAL/RUSSELL	24210	95	111	9	24425			291				451			184	125		
NGGELAS/SAVO	534	6074	29	-	6637			31				29			89	34		
SANTA YCABEL	684	105	7924	4	8717			34				49			134	66		
RENNELL/BELLONA	2			4	6			1				6						
TOTAL					39785			357				535			411	225		41313
MALAITAS						49702		49702										
ONTONG/SIKAIANA						2		2										
TOTAL					7429			49704				1410			297	278		59118
SHORTLANDS					58	3		3	1373	62	25	1460			3	12		
NEW GEORGIA					783			118	36	18211	428	18675			24	52		
CHOISEUL					215			17	41	675	6689	7405			4	85		
TOTAL					1056			138				27540			31	149		28914
INNER					563			147				61	11363	27	11390	87		12248
OUTER					485			34				43	192	6931	7123	22		7707
TOTAL					1048			181				104				109		19955
BSIP					49318			50380				29589			19252	761		149300

TABLE 46

PROTECTORATE BORN MELANESIANS BY BIRTH-ENUMERATION AREAS - 1970 CENSUS

Island Groups	1959 Census Population	1970 Census Population	Adjusted 1970 Population	Census 1959-70 Growth Rate P.A	Adjusted 1959-70 Growth Rate P.A.
Guad/Russ.*	18666	34271	25480	5·6	2·9
Nggelas/Savo	6963	6672	6820	-0·4	-0·2
Sta. Ysabel	7481	8600	9000	1·3	1·7
Central	33110	49543	41313	3·7	2·1
Malaita	52623	50658	59118	-0·3	1·0
Inner	9927	12269	12248	2·0	2·0
Outer	4928	7092	7707	3·4	4·2
Eastern	14855	19361	19955	2·4	2·8
Shortlands	1706	1553	1536	-0·8	-0·9
Choiseul	5328	7370	7726	3·0	3·5
New Georgia	9421	20815	19652	7·5	6·9
Western	16455	29738	28914	5·9	5·3
Unclassified	577	-	-		
BSIP	117620	149300	149300	2·2	2·2

TABLE 47 * INCLUDES RENNELL-BELLONA

ANNUAL GROWTH RATES, 1959-70, ADJUSTED AND NON-ADJUSTED FOR INTERNAL MIGRATION IN PROTECTORATE-BORN MELANESIANS

District	1959 Census Population	1970 Census Population	Adjusted 1970 Population	Growth Rate p.a. 1959–70	Adjusted Growth Rate p.a. 1959–70	Comment
Central	1804	294·2	2295	4·6	2·2	Immigration
Malaita	1184	1160	1357	−0·2	1·3	Emigration
Eastern	1637	2152	2668	2·5	4·6	Emigration
Western	–	96	30			Immigration
BSIP	4625	6350	6350	2·9	2·9	

TABLE 48 1970 CENSUS FIGURES

POLYNESIANS - ADJUSTED FOR INTERNAL MIGRATION

Age Group	1959 Census Population	Percentage of 1959 Population	1970 Census Population	Percentage of 1970 Population	Growth Rate P.A. 1959-70
0-4	21000	16·9	26700	16·6	2·2
5-9	18000	14·5	24142	15·0	2·7
10-14	15940	12·8	20919	13·0	2·5
15-54	60530	48·8	76994	47·8	2·2
55+	8630	7·0	12243	7·6	3·2
Total BSIP	124100	100·0	160998	100·0	2·4
MELANESIANS					
0-4	20095	16·2	24918	15·5	2·0
5-9	17175	13·8	22540	14·0	2·5
10-14	15225	12·3	19608	12·2	2·3
15-54	56800	45·8	71151	44·2	2·1
55+	8325	6·7	11450	7·1	2·9
Total	117620	94·8	149667	93·0	2·2
POLYNESIANS					
0-4	580	0·5	1010	0·6	5·2
5-9	610	0·5	874	0·5	3·5
10-14	600	0·5	799	0·5	2·7
15-54	2670	2·1	3240	2·0	1·7
55+	165	0·1	476	0·3	10·1
Total	4625	3·7	6399	3·9	3·0
Others	1855	1·5	4932*	3·1*	9·1

TABLE 49

* INCLUDES 2362 GILBERTESE (1·5%)

BSIP POPULATIONS, 1959 AND 1970, BY RACE AND AGE GROUPS, SHOWING ANNUAL GROWTH RATES 1959-1970.

the total population. The Polynesian component of the population rose from 3.7 per cent in 1959 to 3.9 per cent in 1970.

5.3 THE INTER-CENSAL PERIOD 1970-1976

The 1970 MEP population figures used are estimates of all components of the population, as are the 1974 figures. It was necessary to correlate the accuracy of the 1970 figures with the Census figures. It was shown that the MEP figures underestimated the census figures by 3.2 per cent overall; the range of the percentage differences was between 6.0 and -5.6 per cent, in the Shortland Islands and New Georgia group respectively. (Table 50). The growth rates using the 1970 and 1974 MEP figures are shown in Table 51. There was an annual growth rate of 3.9 per cent in this period.

However, when the MEP population figures were adjusted by the percentage difference for each island group (Table 52), the following trends emerged:-

(a) In Central District, the growth rate was 6.4 per cent per annum; Guadalcanal was 6.8 per cent and Nggelas/Savo was 6.2 per cent annually.

(b) In Malaita District, the growth rate was 0.6 per cent per annum.

(c) In the Eastern District, the growth rate was 2.2 per cent annually, the Inner Islands being 4.2 per cent and the Outer Islands with a negative growth rate of 0.8 per cent annually.

(d) In the Western District, there was an annual growth rate of 5.7 per cent, of which Choiseul was 7.4 per cent and New Georgia was 5.4 per cent. Again, there was large scale migration into Choiseul together with an increasing annual rate of natural growth.

Island Groups	Total Population 1970 Census	1970 MEP Population	Percentage Difference		Island Groups	Total Population 1970 Census	1970 MEP Population	Percentage Difference
Guadalcanal	35187	33903	-3·7		Inner Is	12390	12080	-2·5
Nggelas/Savo	6703	6802	1·5		Outer Is.	9078	8648	-4·7
Russells	2715	2601	-4·2		Eastern	21468	20728	-3·4
Rennell/Bellona	1504	1514	0·7		Shortlands	1950	2067	6·0
Santa Ysabel	8653	8624	0·3		New Georgia	22264	21027	-5·6
Central	54762	53444	-2·4		Choiseul	8017	7688	-4·1
Malaitas	50659	49831	-1·6		Western	32231	30782	-4·5
Ontong/Sikaiana	1063	1103	3·8					
Malaita	51722	50934	-1·5		BSIP	160998*	155888	-3·2

TABLE 50

*INCLUDES 815 ON SHIPS

PERCENTAGE DIFFERENCES BETWEEN 1970 CENSUS AND MEP POPULATIONS

Island Groups	Melanesian Polynesian Census 1959	Melanesian Polynesian Census 1970	Melanesian Polynesian GR pa 1959-70	Total Population Census 1970	Total Population MEP 1970	Total Population MEP 1974	MEP Growth Rate per annum 1970-74
Guadalcanal	18666*	33031	5·3	35187	33903	44909	7·3
Rennell/Bellona	1804	1490	-0·7	1504	1514	1620	1·7
Russells	-	2624	-	2715	2601	2892	2·7
Ngg Elas/Savo	6963	6645	-0·2	6703	6802	8653	6·2
Santa Ysabel	7481	8599	1·3	8653	8624	10314	4·6
Central	34914	52389	3·8	54762	53444	68388	6·4
Malaitas	52623	50501	-0·4	50659	49831	50836	0·5
Ontong/Sikaiana	1184	1061	-1·0	1063	1103	1316	4·5
Malaita	53807	51562	-0·4	51722	50934	52152	0·6
Inner Is.	9927	12335	2·0	12390	12080	14251	4·2
Outer Is.	6565	9058	3·0	9078	8648	8403	-0·7
Eastern	16492	21393	2·4	21468	20728	22654	2·2
Shortlands	1706	1574	-0·7	1950	2067	2168	1·2
New Georgia	9421	21034	7·6	22264	21027	26044	5·4
Choiseul	5328	7324	2·9	8017	7688	10260	7·5
Western	16455	29932	5·5	32231	30782	38472	5·7
BSIP	121668	156066	2·3	160998+	155888	181666	3·9

TABLE 51 * INCLUDES RUSSELLS +815 ON SHIPS

TOTAL POPULATIONS, COMPARISON 1970 CENSUS AND MEP POPULATIONS, ANNUAL GROWTH RATES 1959-70, 1970-74

Island Groups	1970 Census Population	% Age Difference between 1970 Census + MEP Population	Adjusted 1974 MEP Population	Adjusted Growth Rate 1970-74	Estimated 1976 Adjusted MEP Population	1976 Non-Adjusted MEP Population
Guadalcanal	36187	-3·7	46571	6·8	53120	51705
Rennell/Bellona	1504	0·7	1610	1·7	1665	1675
Russells	2715	-4·2	3013	2·9	3190	3050
Nggelas/Savo	6703	1·5	8523	6·2	9612	9759
Santa Ysabel	8653	-0·3	10365	4·5	11318	11284
Central	54762	-2·4	70082	6·4	78905	77473
Malaitas	50659	-1·6	51649	0·5	52166	51346
Ontong/Sikaiana	1063	3·8	1266	4·5	1382	1437
Malaita	51722	-1·5	52915	0·6	53548	52783
Inner Is.	12390	-2·5	14607	4·2	15859	15473
Outer Is.	9078	-4·7	8798	-0·8	8658	8285
Eastern	21468	-3·4	23405	2·2	24517	23758
Shortlands	1950	6·0	2038	1·1	2083	2220
New Georgia	22264	-5·6	27502	5·4	30552	28933
Choiseul	8017	-4·1	10681	7·4	12320	11857
Western	32231	-4·5	40221	5·7	44955	43010
BSIP	160998	-3·2	186623	3·9	201925	197024

TABLE 52 * OFFICIAL GROWTH RATE 3·1% P.A.

MEP POPULATIONS 1970-76: ADJUSTED AND NON-ADJUSTED, WITH ADJUSTED GROWTH RATES.

The next census is scheduled for 1976. In an attempt to forecast the population of the Protectorate prior to the census, extrapolations were made for 1976, using the growth rates for the period 1970-1974, with both adjusted (3.2 per cent) and unadjusted MEP populations. (Table 32) The adjusted population of the Protectorate in 1976 has been estimated at 201 925 persons at a growth rate of 3.9 per cent per annum. At this rate of growth, the population of the Protectorate is capable of doubling every 18.2 years.

5.4 FERTILITY AND MORTALITY

In the absence of accurate vital statistics in the Protectorate, the only reliable information stems from (a) the 1970 Census data and (b) the on-going Medical Department Births Survey, in which every mother giving birth to a baby is questioned, inter alia, as to whether her previous children are still alive or not.

In Table 53, the data suggests that the Melanesian women were subject to a decline in fertility in the inter-censal period, as the women at each class reported less ever born children in 1970 than in the inter-censal period. However, the sample areas in 1959 may not have been representative for the Protectorate as a whole with regard to the number of children ever born, resulting in a more apparent than real decrease. The age group 30 to 35 years was over estimated in 1959 but under - estimated in 1970, and it is in this group that the difference is most marked.

Age of Women	MELANESIAN				POLYNESIAN			
	Mean per Woman		Mean per Mother		Mean per Woman		Mean per Mother	
	1959	1970	1959	1970	1959	1970	1959	1970
15–19	0·16	0·10	1·32	1·23	0·14	0·12	1·44	1·38
20–24	1·30	0·92	2·15	1·86	1·16	0·86	1·99	1·84
25–29	2·86	2·34	3·47	3·02	2·45	2·17	3·32	3·12
30–34	4·73	3·79	5·20	4·35	3·56	3·22	4·58	4·27
35–39	5·50	5·06	5·98	5·61	4·53	4·31	5·26	5·38
40–44	6·49	5·85	6·99	6·45	4·58	5·01	5·62	6·38
45–49	6·32	6·07	6·94	6·71	3·98	4·78	5·55	5·98
50–59	5·99	5·64	6·75	6·41	4·80	4·55	5·14	5·73
60+	5·03	4·98	6·10	5·87	5·91	4·28	6·09	5·07

TABLE 53 K. GROENEWEGEN – CENSUS 1970

MEAN NUMBER OF CHILDREN EVER BORN PER WOMAN AND PER MOTHER IN EACH AGE GROUP IN THE MELANESIAN AND POLYNESIAN POPULATION, 1959 & 1970.

Misstatements in age may therefore be involved in the discrepancy in fertility data. The Polynesian population also suggested a decrease in fertility between 1959 and 1970, but to a lesser degree. In 1959, the Reef Islanders were classified as Melanesians but as Polynesians in 1970, therefore the deviations between the various arrays for the two census years should not be considered significant. (Groenewegen K. 1970)

From Table 54, it can be seen that the level of fertility in the Western District was the highest in the Protectorate. Except for the 15 to 19 years age group, the mean number of children per woman and mother was higher than in any of the other districts -- this is in agreement with the relatively low proportions of women who never had a child. There was, in addition, a relatively high frequency of unmarried mothers reported in this District. Similarly, the Eastern District showed a relatively high level of fertility, where a relatively greater proportion of women participated in the reproductive process. On the other hand, in the Central and Malaita Districts, the fertility levels were lower. In Malaita, fewer women married, and this was related to the disproportionate number of childless women. These factors were probably associated with a high level of emigration, predominantly by the males. In the Central District, there were proportionately less single women while more were married than in the Protectorate as a whole. Despite this, the mean number of children per mother is comparable to that of Malaita and Eastern Districts up to the age of 30 years, but for age groups at the end of the reproductive age range, it fails to attain the level reached by the other districts.

Age Group of Women	Western District		Malaita District		Central District*		Eastern District		Honiara	
	Mean per Woman	Mean per Mother	Mean per Woman	Mean per Mother	Mean per Woman	Mean per Mother	Mean per Woman	Mean per Mother	Mean per Woman	Mean per Mother
15–19	0·10	1·26	0·06	1·25	0·14	1·22	0·13	1·21	0·20	1·29
20–24	1·15	1·93	0·66	1·83	1·04	1·83	1·04	1·91	1·01	1·80
25–29	2·80	3·28	2·00	2·94	2·42	2·98	2·56	3·00	2·66	3·24
30–34	4·46	4·79	3·36	4·04	3·84	4·35	3·91	4·45	3·94	4·69
35–39	6·00	6·36	4·57	5·27	4·90	5·41	5·59	5·97	4·77	5·64
40–44	7·37	7·72	5·49	6·10	5·31	5·93	6·19	6·94	5·43	6·54
45–49	7·64	7·98	5·71	6·48	5·67	6·19	6·38	7·24	5·61	6·57
50–59	7·15	6·74	5·39	6·26	5·11	5·84	5·58	6·36	5·67	6·28
60+	5·92	6·81	4·90	5·80	4·40	5·22	4·63	5·45	6·16	6·42

TABLE 54 * INCLUDES HONIARA K.GROENEWEGEN – CENSUS 1970

MEAN NUMBERS OF CHILDREN EVER BORN TO MELANESIAN WOMEN AND MOTHERS IN EACH AGE GROUP IN EACH OF THE FOUR DISTRICTS AND HONIARA. B.S.I.P.

In the Central District, and Honiara in particular, there were a great number of male immigrants who inflated the size of the population, but did not contribute substantially to the number of births, and consequently the adjusted Crude Birth Rates were low. Calculation of the female Crude Birth Rates gave values of approximately 44 per thousand for the District and urban areas, assuming a sex ratio at birth of 515 per thousand and an annual rate of increase equal to that of the Protectorate. The Crude Birth Rate for Malaita, similarly calculated, gave a value of just under 40 per thousand. (Table 55)

It is suggested that the levels of fertility have been affected by the influence of Western culture on local customs and practices. Local methods of spacing children, although still practised in rural areas, are declining in importance. An example was the restriction placed on sexual intercourse while the mother was still breast-feeding her baby. The easy availability of dried and tinned milks have also contributed to this decline in traditional methods. Education too has played an important part. Added to these factors has been the influence of the Health Services, and of the MEP in particular. It is suggested that the MEP has been a major factor in both lowering the Infant and Child Mortality Rates, and in possibly raising the fertility rates, although the data is inconclusive for the Inter-censal period. The Western District and Guadalcanal were fully covered in 1970 by spraying operations, whereas operations only started in the remaining areas of the

Age of Women	Western District	Malaita District	Central District*	Eastern District	Honiara	B.S.I.P.
15-19	0·068	0·048	0·084	0·073	0·102	0·066
20-24	0·322	0·194	0·256	0·274	0·226	0·249
25-29	0·376	0·280	0·299	0·350	0·256	0·308
30-34	0·390	0·256	0·277	0·270	0·218	0·290
35-39	0·285	0·231	0·204	0·232	0·156	0·228
40-44	0·145	0·128	0·130	0·132	0·090	0·130
45-49	0·027	0·032	0·034	0·064	0·008	0·035
Total Fertility	8·1	5·8	6·4	7·0	5·3	6·5
Current Births						
Reported	1165	1 596	1 867	667	282	5 288
Adjusted	1 363	2 059	1 942	847	254	6 211
Crude Birth Rate						
Reported	39·6	32·1	38·2	35·0	33·1	35·8
Adjusted	46·3	41·4	39·7	44·4	29·8	41·9

TABLE 55 * INCLUDES HONIARA K.GROENEWEGEN - CENSUS 1970

AGE SPECIFIC FERTILITY RATES AND CRUDE BIRTH RATES AFTER ADJUSTMENT FOR TIME REFERENCE ERRORS IN EACH OF THE FOUR DISTRICTS & HONIARA MELANESIANS ONLY.

Protectorate in that and the following year. Most of the other islands of the Central District were malarious and unprotected in 1970, and this was undoubtedly reflected in the fertility and crude birth rates. In the Western District, these rates refelected the additonal benefits provided by a successful DDT attack. Malaita and Eastern Districts were not protected; the situation in the Eastern District was eased by the hypoendemicity or non-existence of malaria in many of the Outer Islands, although Santa Cruz and San Cristobal showed mesoendemicity, and even areas of holoendemicity.

It can be seen that the differences in the mortality levels between the 1959 and 1970 data appear to be much more pronounced in the young ages of child survivorship. All the children of the women aged between 15 and 25 years on census date in 1970 were born after the Anti-Yaws Campaign, and many were also in DDT protected areas as from 1962, and have spent all their lifetime under improve/health conditions. (Table 56)

The slow improvement in the health conditions might explain why the values of the life expectancies at birth found for 1959, showed a decreasing trend with age. (Table 56).

It has been estimated that the resulting average crude death rate among Solomon Islanders of both sexes in the census interval was 13.4 per thousand. (Groenewegen K. 1970)

In the Western District, much of which had been under spraying since 1962, the probability of surviving to exact age three was 0.915 which corresponded to a mortality experience of

Age Group of Women	Age a of Child Survivorship	Melanesians 1970		Melanesians and Polynesians			
				1959		1970	
		p(a)	$^{\circ}e_{\circ}$	p(a)	$^{\circ}e_{\circ}$	p(a)	$^{\circ}e_{\circ}$
15-19	1	0·930	59·8	0·847	44·5	0·925	58·9
20-24	2	0·910	58·8	0·814	45·2	0·908	58·4
25-29	3	0·884	56·0	0·802	45·8	0·882	55·8
30-34	5	0·849	53·0	0·772	44·5	0·848	52·9
35-39	10	0·819	51·2	0·750	44·3	0·818	51·1
40-44	15	0·783	48·2	0·740	44·7	0·779	48·7
45-49	20	0·750	47·3	0·690	42·1	0·748	47·3
50-54	25	0·706	45·6	0·618	38·1	0·707	45·8
55-59	30	0·654	43·7	0·638	41·9	0·655	43·7
60-64	35	0·626	43·8				
P_1/P_2		0·112		0·125		0·114	
$\bar{m}$		30·9		28·9		30·9	

TABLE 56 K.GROENEWEGEN – CENSUS 1970

LIFE TABLE SURVIVORSHIP RATIOS [p(a)] & LIFE EXPECTANCIES AT BIRTH ($^{\circ}e_{\circ}$) DERIVED FROM PROPORTIONS DEAD AMONG ALL CHILDREN BORN TO WOMEN IN EACH AGE GROUP.

85 per thousand up to age three years. In the Malaita District, on the other hand, which only began to come under DDT coverage in 1970 and was still highly malarious, the corresponding figure was 0.851 (i.e. 149 per thousand mortality). This is a difference of approximately 65 per thousand mortality in favour of the non-malarious district. However, other factors such as the comparatively higher level of education and better medical coverage in the Western District may have been involved. (Ministry of Health and Welfare 1974)

It was further stated that the spraying operations in Malaita led to a fall in the reported mortality of 35 per thousand in the first two years, although this was still some 25 per thousand more than the average mortality for the malaria-controlled areas in the four years 1968-1971. In 1972, the extrapolated Infant Mortality Rates in Malaita, under DDT coverage since 1970, and the Western District, largely under DDT coverage since 1962, were already very similar at 71 and 65 per thousand respectively.

In a comparison of the broad age groups per thousand of the population in selected areas, it was found that there tended to be a degree of variation between the 1959 and 1970 values. This was marked in the 0-4 years and 15-59 years age groups. It is suggested that in the younger age group, there was more difficulty in estimating the ages of the children in the sample; further, the sample areas in the 1959 census may not have corresponded to the 1970 areas, and in addition, may not have been representative of the area as

a whole. In the 15-59 years age group, the effects of migration are clearly shown, massive inter island migration not starting until the mid-late 1960s. In the Central District in 1970, there is a suggestion of a predominantly male immigration, with a predominantly male emigration from Rennell and Bellona, Ontong Java and Sikaiana, Malaita, and Eastern District; Roviana experienced an immigration of males and females, and a loss of Polynesians. (Table 57) This table has to be interpreted with care as a proportionate increase in one age group affects all the other age groups.

Island Gp. District	Sex	Melanesians								Polynesians							
Age Group		0-4		5-14		15-59		60+		0-4		5-14		15-59		60+	
Year		1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970	1959	1970
Guadalcanal	M	164	174	252	278	528	479	56	69								
	F	163	184	258	277	538	497	41	42								
Rennell Bellona	M									157	148	250	300	587	478	6	74
	F									132	146	227	253	634	546	7	55
Central	M	160	152	254	244	530	548	56	56								
	F	168	177	263	276	529	509	40	38								
Ontong Java Sikaiana	M									143	211	308	286	531	445	18	58
	F									152	176	255	253	557	524	36	47
Malaita	M	168	165	292	312	483	449	57	74								
	F	161	152	281	271	522	535	36	42								
Roviana(W.D)	M	191	165	279	282	458	500	72	53	—	132	143	162	857	662	—	44
	F	200	188	286	300	465	474	49	38	167	132	111	316	722	500	—	52
Eastern	M	184	171	289	311	475	462	52	56	114	156	288	305	567	481	31	58
	F	185	175	290	297	482	490	43	38	102	147	308	250	572	561	18	42

TABLE NO. 57 N. McARTHUR-1959 SAMPLE CENSUS: K. GROENEWEGEN-1970 CENSUS

SOLOMON ISLANDERS IN BROAD AGE GROUPS PER THOUSAND IN SELECTED AREAS.

6.0 DISCUSSION

The British Solomon Islands Protectorate is a developing country which has embarked upon a Malaria Eradication Programme. The Malaria Eradication Programme, which began in 1970, now covers the Protectorate.

As a developing country, its population can be placed in the 'Transitional' stage, where the birth rates continue to be high (and are in fact rising) while the death rates are falling. This stage is marked by a reduction of death rates without at first much change in birth rates. These changes bring a very rapid population growth, an increase in the proportion of children under 15 years of age and a change in the average age of the population. As a consequency, the time required to double the population is considerably reduced. (Snyder J.C. 1972)

Undoubtedly, disease eradication programmes and other public health measures make a considerable improvement in the standard of living, and in the increased expectation of life. However, there is by no means a direct cause and effect relationship between declining mortality in developing countries and advances in public health. A stable system of government, progress in education, better communications and an administrative infrastructure play an important role in reaching the developmental take-off point, which is a prerequisite to rapidly falling mortality. (W.H.O. 1974) It is once the decline is underway that

public health measures become increasingly important. Health should therefore not be viewed as a separate entity from other socio-economic, institutional and policy factors in the development process.

The Solomon Islands have also been influenced by certain aspects of Western culture and technology. Western contact in these islands has resulted in a population increase as modern medicine brings health, while Western culture has tended to destroy the traditional family planning methods. Due to the improved communications, epidemics are promptly dealt with and education directly and indirectly influences both the birth and death rates. The most significant change in mortality however, will result from the lowering of child mortality through the reduction of common infections, and the eradication of malaria. The Infant Mortality Rate is a very sensitive indicator both to the level of exposure to infection (this fact is made use of in the Infant Parasite Rate, which is an index of recent malaria transmission) and to the level of resistance to such infection. Malaria is known to exert its greatest effect in the infant and young child, though passive immunity in a child up to three months of age may exert a degree of protection in endemic areas. Accurate Infant Mortality Rates for the Protectorate are not available, though it was estimated that the rate was 73.4 per thousand overall, with considerable variation between the districts; the better rates were obtained in the Western District, parts of which had

been under spray coverage since 1962, and which had enjoyed a comparatively higher standard of education and health care. The Infant Mortality Rate may thus serve as an index of social and economic development in a developing country.

In the Western Pacific Region, out of 18 originally malarious countries and political units, four have achieved malaria eradication, six more (one of which is the Solomon Islands) have eradication programmes and six have limited malaria control programmes. (W.H.O. 1974)

The anti-malarial operations carried out in these islands have exerted a considerable effect on general health, population growth and socio-economic development. In addition to health measures, population movements in relation to economic development have played a major part in altering the population structure and stability in most island groups. This movement probably started from the malarious islands (e.g. Malaita) to the relatively non-malarious ones (e.g. New Georgia and Guadalcanal) in the first instance. There has always been a considerable population movement within each island, but it has only been relatively recently that there has been large scale inter-island movement; the trend is said to have started in the mid-1960s at the earliest. As the economic development has been greatest in the Central District, and on Guadalcanal and Russell Islands in particular, it is not surprising that Melanesian immigration to these islands accounted for 2.7 per cent of the 5.6 per cent annual growth rate in the 1959 to 1970 period. (Census 1970). As the annual increase in

population is not a steady progression, it is safe to say that most of the population increase has taken place since 1965. (Table 47). Nggelas/Savo and the Shortland islands apparently had a declining population during this period, even after adjustment for internal migration; however, in the case of Nggelas/Savo emigration was partly responsible for the decline, while in the Shortland Islands there had actually been a small inflow of migrants to offset the natural decline. The highest rate of increase was in the Western District, where the Melanesian annual growth rate was 5.5 per cent of which immigration only accounted for 0.2 per cent. The Western District is also the most advanced in the malaria programme, with most of the New Georgia group now in the Consolidation Phase (Map 5). It is the New Georgia group which showed the greatest annual rate of increase from 1959-1970, of 7.5 per cent, of which immigration only accounted for 0.6 per cent. On Choiseul island, there was an emigration rate of 0.5 per cent annually, the adjusted intercensal growth rate being 3.5 per cent annually. However, it would appear that Malaita and Eastern Districts provide most of the immigrants to the other districts. Between 1959 and 1970, Malaita had a negative growth rate of 0.3 per cent annually, but on adjustment for internal migration, actually had a growth rate of 1.0 per cent per annum --- there was an emigration rate of 1.3 per cent annually to the other Districts, and to Central District in particular. In the Eastern Districts, the Outer Islands

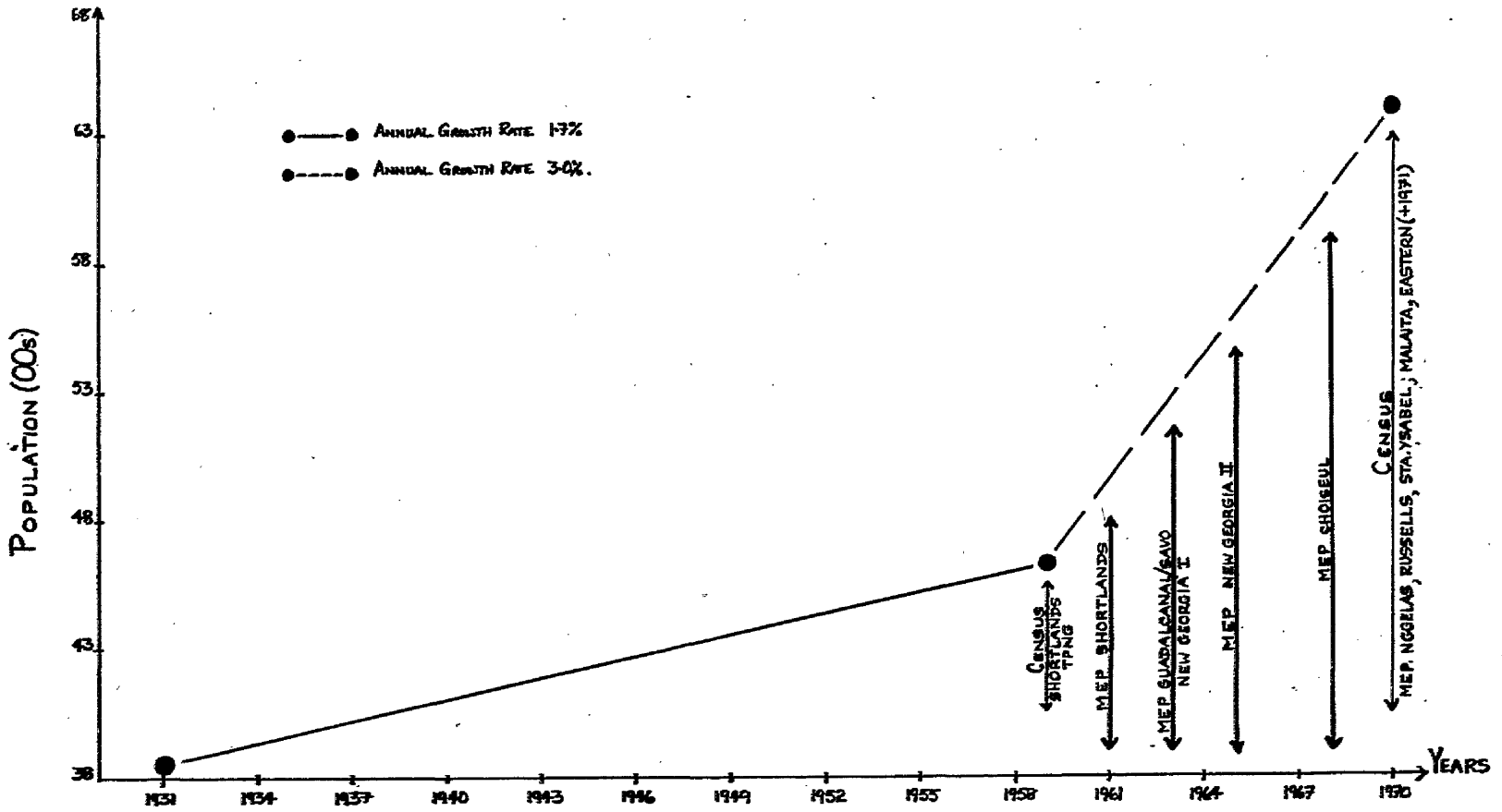


FIG:- 3

BSIP - POLYNESIAN POPULATION-1931-1970

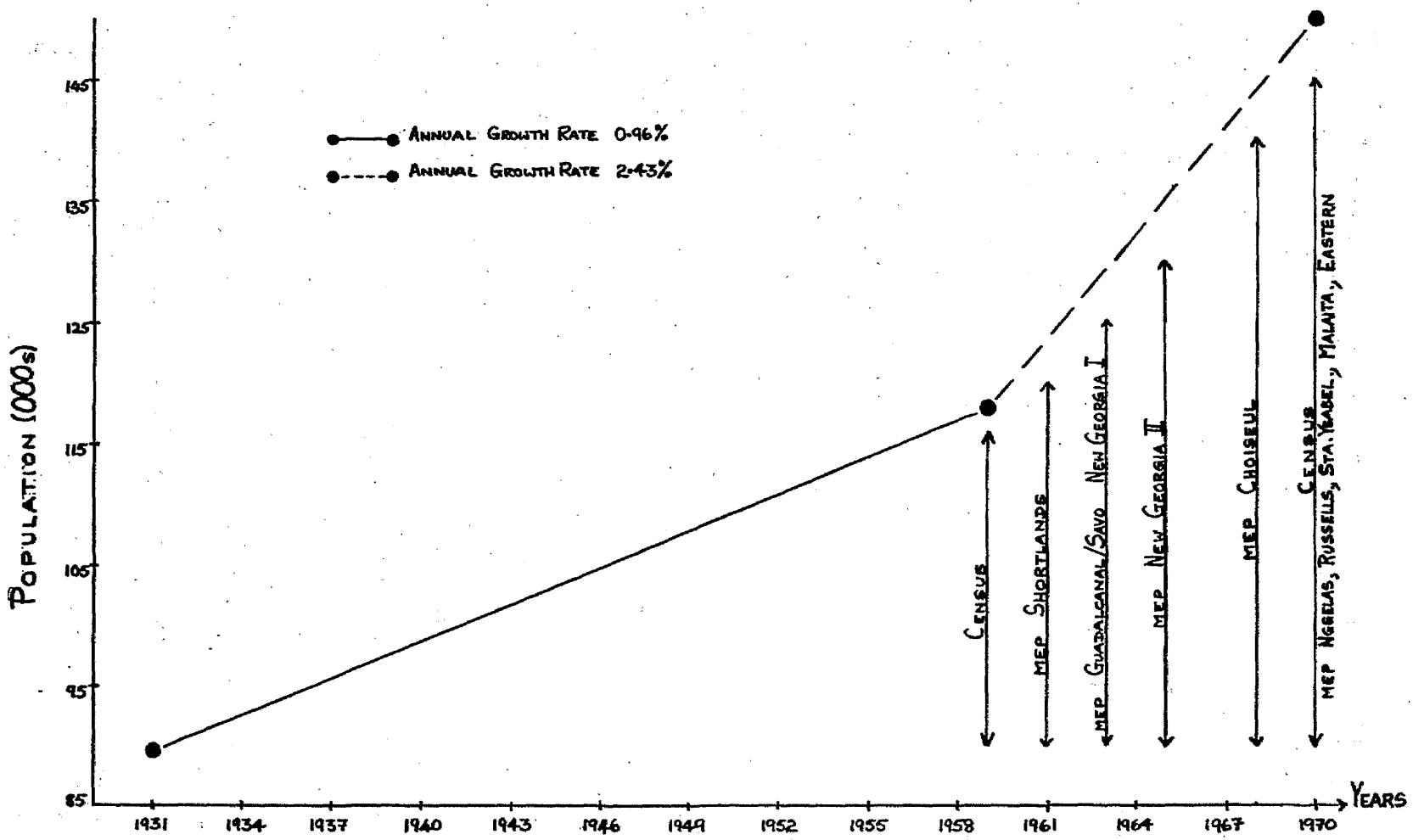


FIG. 4 BSIP - MELANESIAN POPULATION - 1931-1970

provided the emigrant population, the overall growth rate being 3.4 per cent annually, while the adjusted rate was 4.2 per cent, a loss of 0.8 per cent of the population each year.

The Polynesian populations showed similar trends (Table 48) with immigration to the Central and Western Districts, and emigration from the Malaita and Eastern Districts.

The annual growth rates for each district on an Islands Group basis are clearly outlined in Table 44 for the Melanesian population, and in Table 45 for the Polynesian population. The overall annual growth rates in the period 1959-1970 were 2.2 per cent and 3.0 per cent for the Melanesians and Polynesians respectively, which may be a reflection of the more malaria-free environment of the Polynesians. The population of the Solomon Islands was given an additional boost with the resettlement of 2 362 Gilbertese, principally in the Western and Central Districts.

As the 1970 MEP population estimates were based purely on head-counts and did not take into account the ethnic composition of the population, growth rates and populations for the following years up to, and including 1976, were based on all components of the population. The MEP population for 1970 was underestimated by 3.2 per cent compared to the official Census population; most island groups were underestimated. However, there tended to be a considerable percentage variation in those islands with very small populations. (Table 50)

Following the introduction of the MEP in 1970, there appears to have been a marked increase in the rate of population growth; this new growth rate is considerably greater than that of the growth rate from 1959-1970. The combined Melanesian-Polynesian growth rate between 1959-1970 was 2.3 per cent per annum, while the estimated MEP growth rate between 1970 and 1974 was estimated at 3.9 per cent for all components of the population (but as Melanesians and Polynesians accounted for 96.9 per cent of the total BSIP population in 1970, the rates may be assumed to be comparable). Once again, Central District has had the greatest annual growth rate at 6.4 per cent, and although this may be in some measure due to immigration because of increased job opportunities, there has also been a considerable reduction in the malaria burden as is shown by the fall in the Annual Parasite Incidence (API) from 96.8 per thousand in 1970 to 36.2 per thousand in 1974. (Tables 38, 51) Guadalcanal/Russell islands again top the list with 7.3 per cent annually, but it is important to note that Nggelas/Savo had a rate of 6.2 per cent annually in the period 1970-1974 as compared to a negative growth rate 0.2 per cent annually in the period 1959-1970 (Table 47); this improvement was due to a reduction in the malaria case load, principally in the Nggelas where the MEP only started in 1970, and where the number of cases fell from 430 in 1972 to 149 in 1974 to two in the first months of 1975. The reduction in Savo was less dramatic, from

from nine in 1972 to zero in the first two months of 1975. Malaita district has shown a similar turnaround, and, in spite of a steady or increasing emigration rate, the population growth rate is averaging 0.6 per cent annually. This increase corresponds with the start of the MEP in Malaita in 1970. Migration from the Eastern Outer Islands appears to be continuing at about the same rate, most of the people going to San Cristobal or to Central District. In the Western District, the rate of growth has increased from 5.5 per cent to 5.7 per cent annually. The biggest change was on Choiseul where the rate jumped from 3.0 per cent to 7.5 per cent, and where the anti-malarial operations only began late in 1968. In New Georgia, however, there was a fall in the estimated rate. Again there has been a reversal of the population trend, this time in the Shortland Islands, where the growth rate was estimated at 1.2 per cent; this may be due to immigration to some extent, but there has also been a considerable improvement in the standard of malaria field operations over this period. In the Protectorate as a whole, the annual growth rate has risen from 2.2 per cent to 3.9 per cent in a period of little more than four years, the same duration as the full Malaria Eradication Programme.

In an attempt to estimate the BSIP population for all components in 1976, the year of the Official Census, these same growth rates were used. From these extrapolations, it is estimated that the total population of the Protectorate will lie between 197 024 (based on unadjusted MEP figures) and 201 925 people (based on a MEP population adjusted by 3.2 per cent), of which Central District will account for 77 473 persons (78 905),

Malaita District for 52 783 persons (53 548), Eastern for 23 758 persons (24 517) and Western for 43 010 persons (44 955) (Table 52). Macgregor (1966) forecast that the population of the Solomon Islands would exceed 200 000 before the end of the decade 1969-1979.

It is not claimed that anti-malarial operations are the sole cause of an increasing population growth rate, but it is claimed that they do exert a major effect, and may indeed be the most important factor in the long run, being the only major environmental change which has resulted in a change in the rate of growth of the population. There was a gradual rise in the population, all components, from 1931 to 1959 (each component with a distinctive growth rate), but from 1959 onwards even assuming a steadily increasing population from year to year, there was a marked change in the rate of increase for each population component. (Fig. 3, 4) The rate of growth increased each year as more of the country came under insecticide spray coverage and the burden of malaria was reduced. There was again a change in the rate of growth after 1970, the start of the MEP on a Protectorate wide basis, although the whole of the Eastern District did not come under full spray coverage until 1971. (Fig. 5) There is a distinct relationship between these significant changes in the annual growth rates and the spread and totality of anti-malarial operations, even when improved health coverage, education and economic development are taken into consideration; the growth rates bear an almost direct relationship to the duration of the cyclical

spraying operations, although migration between islands must also be considered. (Table 58)

When do spraying operations begin to affect community health? It is suggested that the effects of efficient spraying operations may be noticed at the end of one year of cyclical spraying, although this also depends on the local situation and the level of endemicity prevailing prior to the start of operations. The effects are certainly wide spread after four years of efficient spraying (a classical MEP should be completed within four years under favourable circumstances) as is evidenced by the fall in APIs in all districts, and in the Western District in particular (Table 38). The improvement can continue after the cessation of spraying due to the eradication of malaria, the continuing improvement in health care, education and socio-economic conditions, until the stage is reached when the country becomes 'Modern', and birth rates and death rates are both low, the drop in the birth rates being dramatic. (Snyder J.C. 1972) The trend of morbidity reflects the success, or lack of it, in eradicating malaria, and not the trend in mortality. It has been shown that malaria mortality decreases independently of the successful progress of the programme towards eradication. (Gramiccia G., Hempel J. 1972)

How much of the increased growth rate since 1970 can be apportioned to the MEP? It has already been stated that health cannot, and must not, be considered in isolation from socio-economic development. Although socio-economic development has been a stimulus to health, it too has benefitted from the availability

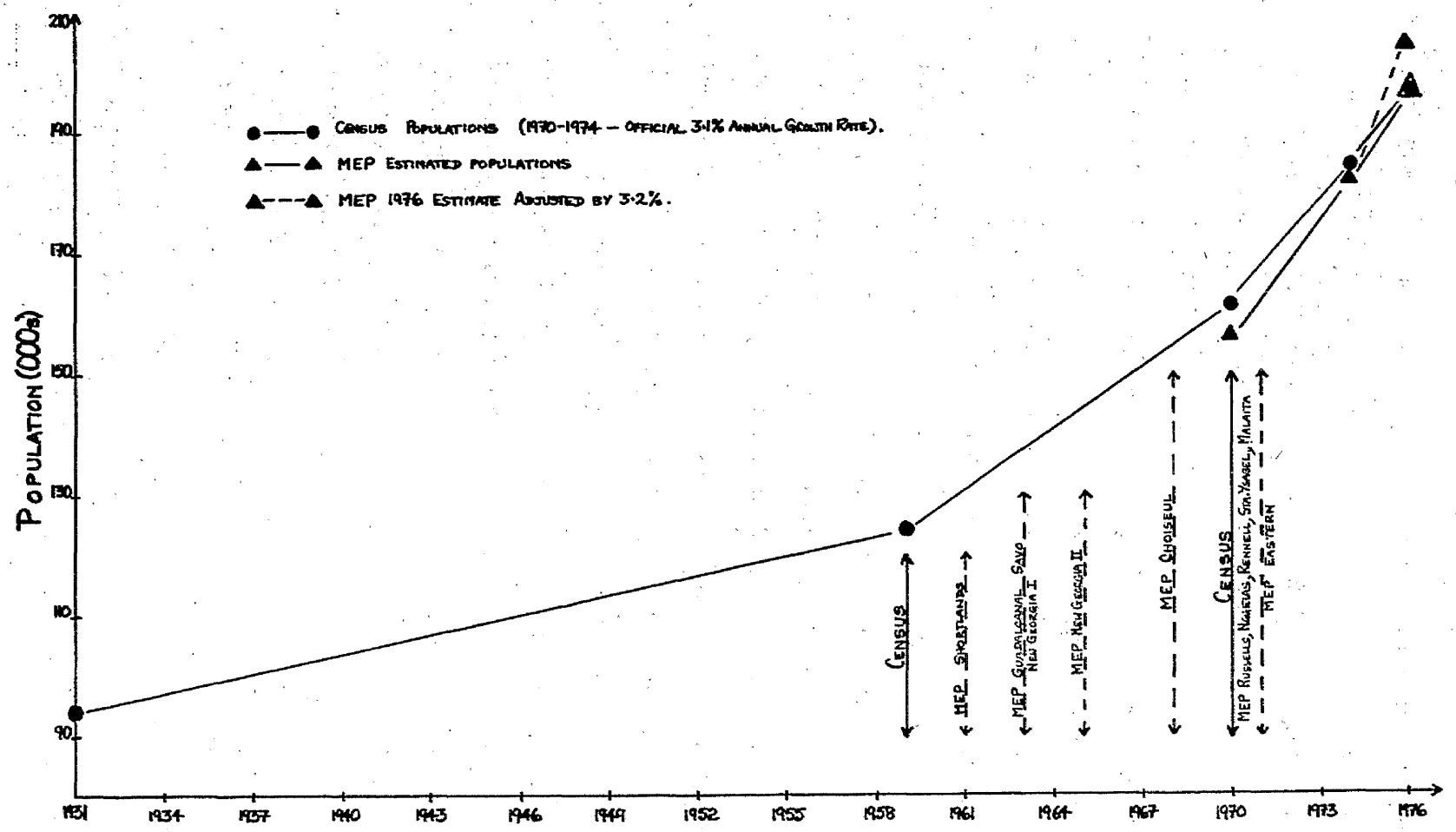


FIG:- 5 BSIP - ALL POPULATION COMPONENTS - CENSUS, OFFICIAL, MEP ESTIMATES - 1931-1976

Island Groups	Annual Growth Rate 1959-70	No. Years of MEP	Adjusted Growth Rate 1970-74	No. Years of MEP	Adjusted 1976 MEP Population
Guadalcanal	5·3	7	6·8	11	53120
Rennell/Bellona	-0·7	-	1·7	Rennell 1	1665
Russells	-	-	2·9	4	3190
Nggelas/Savo	-0·4	0/7	6·2	4/11	9612
Santa Ysabel	1·3	-	4·5	4	11318
Central	3·8	0,7	6·4	1,4,11	78905
Malaitas	-0·4	-	0·5	4	52166
Ontong/Sikaiana	-1·0	-	4·5	4	1382
Malaita	-0·4	-	0·6	4	53548
Inner Is.	2·0	-	4·2	3	15859
Outer Is.	3·0	-	-0·8	3	8658
Eastern	2·4	-	2·2	3	24517
Shortlands	-0·7	9	1·1	13	2083
New Georgia	7·6	7	5·4	11	30552
Gloiseul	2·9	2	7·4	6	12320
Western	5·5	2,7,9	5·7	6,11,13	44955
BSIP	2·3	0,2,7,9	3·9	0,1,3,4,11,13	201925

TABLE [redacted] 58

GROWTH RATES 1959-70, 1970-74 RELATED TO DURATION OF ANTI-MALARIA OPERATIONS

of a progressively healthier and better educated work force. Apart from the Yaws Eradication Programme, which succeeded in its aims, the programmes against Leprosy and Tuberculosis have not had a dramatic impact on the population; the improvement in Filariasis is gradual and goes hand in hand with the MEP. These diseases are still a problem in the country. For all practical purposes, the Yaws programme had finised before the major anti-malarial operations had started, and had therefore already exerted its effect on the general health of the population. There has also been a recent improvement in rural sanitation and the establishment of safe-water supplies, although the coverage so far obtained is only moderate. Health Education is once again playing an important part in the education of the public, great use being made of the radio. Nevertheless, it is felt that all thse factors would account for a growth rate not much in excess of the 1959-1970 growth rate of 2.3 per cent annually (up to, but not in excess of 2.8 per cent per annum) especially when it is considered that anti-malarial operations were being carried out in large areas of the Protectorate (Guadalcanal was highly endemic) from as early as 1962. The fall in the trend of malaria morbidity as expressed by the API rates in 1974 is an accurate index of the success of the MEP. It is felt that the official estimated growth rate of 3.1 per cent per annum, is an underestimate, that a truer rate would be 3.9 per cent per annum, and that the MEP may be responsible for an annual rate of increase of between 1.1 per cent and 1.6 per cent. At a growth rate of 3.9 per cent per annum, the population can be expected to double every 18.2 years.

There has been a population explosion for several years. On a few of the peripheral islands, (e.g. Reefs, Tikopia, Bellona) there is already a population problem, with heavy migration to other areas. Overpopulation is defined as 'Where the population is increasing faster than the economy'. (Williams C.D. 1966) The Chief Minister of the Protectorate made this same point when he said that the rate of population increase in these islands was greater than the rate of increase of the economy. (Mamalone S. 1975). Even now, by this definition, the Solomon Islands are over-populated.

The effects of overpopulation are clearly recognisable and may be disastrous:

(a) There is a diminishing per capita food supply. Although a great deal of the rural agriculture is at subsistence level, the population growth rate may outstrip the rate of change to profit farming. Further, it has to be recognised that of the 11 000 square miles of land in the Protectorate, it is estimated that only 10.0 per cent is cultivable (Todd M. 1975) There has been a progressive increase in the population density (Table 59) from 8.56 per sq. mile in 1931 to 14.66 in 1970 and an estimated 18.38 persons per sq. mile in 1976 for all components of the population.

(b) There is increasing unemployment. There are already relatively few job opportunities available to school leavers, although these opportunities should increase as the economy develops; the increase, however, will not be able to keep pace with the population increase. In 1970, only 13 690 people (8.5 per cent of the population) were recorded as being in wage or salary earning employment (Annual Abstract of Statistics 1971), although 76 994 persons (47.8 per cent) were in the 15-54 years age group, the wage-earning group. (Table 29) Nevertheless, it has been argued by Black (1974) that the shortest commodity for development is the lack of labour, and therefore an increase in the potential work-force should not present a problem

Island Groups	Area in Sq. miles	Density 1931	Density 1959	Density 1970	Density 1974**	Density 1976**
Guadalcanal	2180	6·52	8·56	16·14	20·60	23·72
Russells	50			54·30	57·84	61·00
Mageias/Savo	165	32·12	42·20	40·62	52·44	59·14
Rennell/Bellona	276	5·43	6·54	5·45	5·87	6·07
Sta. Ysabel	1550	3·68	4·83	5·58	6·65	7·28
Central	4221	6·40	8·37	12·46	16·20	18·35
Malaitas	1750	22·89	30·07	28·95	29·05	29·34
Ontong/Swaiana	4	246·25	296·00	265·75	329·00	359·25
Malaita	1754	23·40	30·68	29·42	29·73	30·09
Inner Is.	1376	5·49	7·21	9·12	10·36	11·24
Outer Is.	322	15·78	20·39	27·70	26·10	25·73
Eastern	1698	7·44	9·71	12·64	13·34	13·99
Shortlands	160	8·13	10·66	12·19	13·55	13·87
New Georgia	1950	3·68	4·83	11·42	13·36	14·84
Choiseul	1200	3·38	4·44	6·68	8·55	9·88
Western	3310	3·78	4·97	9·74	11·62	12·99
BSIP	10983	8·50 (8·56)	11·17 (11·30)	(14·66) 14·42	16·54 (16·99)	17·94 (18·38)

TABLE 59

** NON-ADJUSTED (ADJUSTED) MEP FIGURES

POPULATION DENSITIES PER SQUARE MILE. BSIP.

(c) Impossible demands in schools and hospitals, and on other essential services. These demands are especially felt in urban centres, due to a progressive migration from the rural areas. The population of Honiara, the capital, was estimated to have grown by 11.0 per cent in 1974. Clearly, the essential services cannot keep pace with this rate of growth, and are already finding it increasingly difficult to cope with the lower rate of rural growth. The estimates of the Ministry of Education reflect this difficulty.

The economic benefits of the MEP are difficult to apportion. However, it is worth noting that the Gross Domestic Product, at factor costs, had risen from Aust.$ 111 per capita in 1960 to $ 162 per capita in 1970 and $ 173 per capita in 1973 (the population growth rate being 3.1 per cent per annum, based on mid-year estimates). In the same period, the population had risen from an estimated 126 833 to 174 343 in 1973. (McFadden C. 1975) For the first time too, there has been a positive balance of trade of Aust.$ 1.3 millions, in 1974 (Fig. 6)

That there was a fairly substantial rise in the population of the Weather Coast of Guadalcanal in 1963 was documented by Chapman and Pirie (1974); however, they failed to provide an adequate explanation for this change. It is suggested that it was directly due to DDT residual spraying in this area, as spraying operations began in 1962. (Fig. 7) This also tends to confirm that efficient spraying exerts an effect on populations within a period of 12 months.

The problem of increasing population has been recognised by the Government. In 1974, a Family Health Programme was begun, a major component of it being Family Planning. The BSIP Government has been offered financial assistance by the British Government and by the United Nations Fund for Population Activities and the

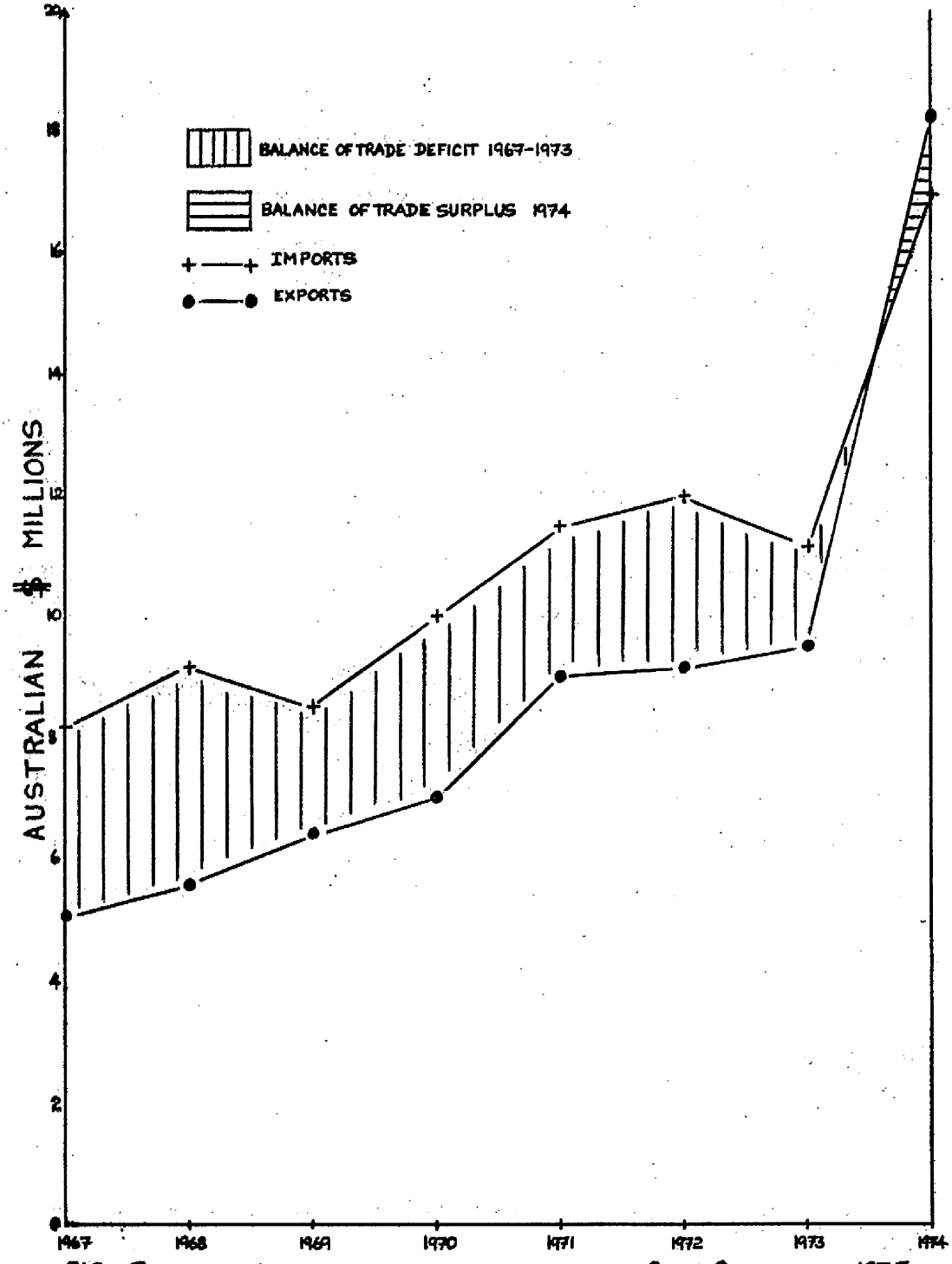


FIG: 6 GOVT. STATISTICIAN 1975

BALANCE OF TRADE - B.S.I.P. - 1967-1974

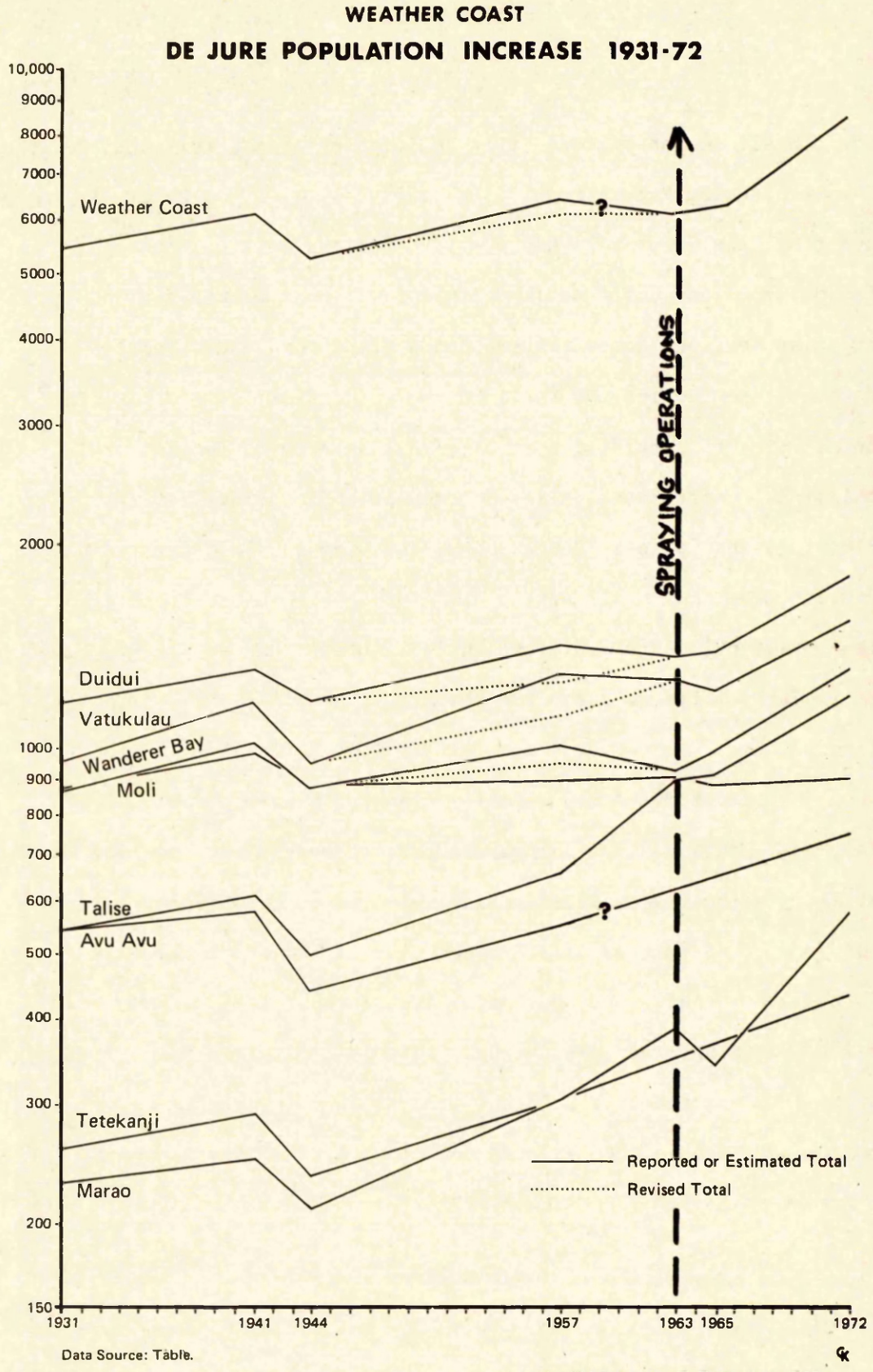


FIG: 7

M.CHAPMAN, R PIRIE 1974

POPULATION INCREASE — S. COAST GUADALCANAL

World Health Organisation; it is anticipated that a full scale Family Planning Programme will be started in 1975. However, in the meantime, the Government has provided limited services through its Maternal and Child Health clinics, while a voluntary organisation, has concentrated on educating the leaders of the community on the reasons for, and the methods of, family planning, in addition to providing a small clinic service in Honiara. All religious denominations in the Solomon Islands support Family Planning; the Catholic Church holds teaching sessions for the Ovulation Method in all areas. It can be seen that there are no real obstructions to family planning; in fact, the people are well aware of its need and are keen to receive all the available information.

How successful could a Family Planning Programme be in the Solomons? This can only be guessed at. However, a close look at Fiji, a country similar in many respects to the Solomon Islands but free of endemic malaria, showed that it had a 4.2 per cent birth rate in 1959, and that after the start of the Government Family Planning Programme in 1962, the birth rate had been successfully reduced to 2.96 per cent in 1971. There is no reason why the Solomon Islands could not also achieve as good a result as Fiji. (IPPF-SEAOR 1972)

This is not usually ex-pressed as % but 47 p. 1000

CONCLUSIONS

1. The British Solomon Islands Protectorate has a comprehensive and well integrated Basic Health Service, which has provided, and is providing, an adequate standard of health care.

2. The Medical Department, in conjunction with the World Health Organisation, has successfully carried out a Yaws Eradication Programme, which exerted an effect on the population growth rate. Leprosy and Tuberculosis are still major health problems in the Protectorate. There is a suggestion that Filariasis as a health problem is assuming less importance the more successful the Malaria Eradication Programme is. These three latter diseases have had no discernible effect on the growth of the population, during the period under consideration.

3. A successful BSIP/WHO Malaria Eradication Pilot Project was the signal for the start of a Pre-Eradication Programme leading up to a full Malaria Eradication Programme in 1970. The MEP in the period 1970 - 1974 has shown satisfactory progress, and has reduced the burden of malaria in the community as is shown by the fall in the Annual Parasite Incidence levels in all districts.

4. The socio-economic progress has been steady since the early 1960s. With the establishment of new primary industries recently, the rate of development is showing signs of accelerating.

5. The political stability, rising levels of education and increased economic activity have, together with better health, all influenced the annual rate of growth of the population.

6. The annual growth rate for all components of the population between 1931 and 1959 was estimated at 0.97 per cent, between 1959 and 1960 at 2.4 per cent, while the growth rate between 1970 and 1976 has been estimated at 3.9 per cent per annum. This is well in excess of the official estimated rate of 3.1 per cent per annum.

7. At a growth rate of 3.9 per cent per annum, the population is capable of doubling every 18.2 years. The socio-economic consequences of this rate of growth are discussed. It is estimated that the 1976 population will be in the region of 202 000 people.

8. It is not suggested that the Malaria Eradication Programme is solely responsible for this dramatic increase in the rate of growth, but it is suggested that it is a major factor and may account for between 1.1 per cent and 1.6 per cent of the 3.9 per cent per annum rate of population increase.

9. The growth rates of island groups are considered in relation to the migration patterns. All Districts now show a positive rate of growth.

10. The data suggests that the growth of the population in the inter-censal period 1959 - 1970 was primarily due to a reduction in mortality, especially in children. However, it is known that a reduction in malaria influences the birth rate, and it is anticipated that the data for the inter-censal period 1970 - 1976 will reflect this influence and show an increase in an already high birth-rate.

11. There is an urgent need for an efficient and fully comprehensive, nation-wide family planning programme. The people are demanding it.

ACKNOWLEDGEMENTS

Dr F.J. Dy, Regional Director for the Western Pacific Region of the World Health Organisation, Manila, Philippines, has kindly permitted the author to submit this work. The author wishes to thank Mr C. McFadden, Government Statistician, Honiara, and Dr K. Groenewegen, South Pacific Commission, Noumea, New Caledonia, for thir advice and encouragement in the preparation of this thesis. Dr J.D. Macgregor, the Acting Under-Secretary, and Dr J.G. Avery, Chief Medical Officer, Community Health, Ministry of Health and Welfare, Honiara, who read the drafts, have kindly permitted the use of all medical and malaria data presented, and have consented to the preparation and publication of this thesis.

I also wish to acknowledge my gratitude to the staff of the Malaria Eradication Programme, without whose activities these results would not have been achieved. In particular, Mr S. Hong and Mr B. Riolo of the MEP are to be thanked for the preparation of the maps and statistical data respectively.

Finally, I wish to thank Mr F. Nelson and his staff of the Provincial Press, Honiara, for their interest and work in the printing of this thesis.

BIBLIOGRAPHY

1. ALVING A.S., TARLOV A.R., BREWER G.J., CARSON P.E., LONG W.K. (1960)

Glucose 6 phosphate dehydrogenase deficiency. An inborn error of metabolism.

p 1108-119

Proc. VIII Internat. Cong. Haemat. Tokyo. September 1960.

2. ANNUAL ABSTRACT OF STATISTICS (1971)

Government Printer. Honiara. BSIP

3. APPLEBAUM I.L., SHRAGER J. (1944)

Pneumonitis associated with malaria.

Arch. Int. Med. 74., 155-162

4. ARNOLD J. (1954)

The effect of continuous and intermittent primaquine therapy on the relapse rate of Chesson strain vivax malaria.

J. Lab. Clin. Med. 44., 429

5. AVERY J.G. (1973)

A review of the Malaria Eradication Programme in the British Solomon Islands 1970 - 1972.

Papua New Guinea Med. J. 17., 1., 50 - 60

6. AVERY J.G. (1975)

Malaria Eradication Programme Annual Review 1974

Ministry of Health and Welfare 6/1. 1-410. Honiara.

7. AVERY J.G. (1975)

The epidemiology of disappearing malaria in the British Solomon Islands Protectorate.

Proposed M.D. Thesis for the University of Sheffield. In preparation.

8. BAKER W.G. (1973)

Report of the WHO Independent Assessment Team on the Malaria Eradication Programme in the British Solomon Islands Protectorate. Economic Aspects.

WPRO 2002-E of October 1973. Manila.

9. BARRATT-CONNOR E. (1972)

Anaemia and Infection.

Amer. J. Med. 52., 242 - 253

10. BELKIN J.N. (1965)

Mosquito studies (Diptera:Culicidae) IV. The mosquitoes of the Robinson-Peabody Museum of Salem Expedition to the South West Pacific 1965.

Contrib. Amer. Ent. Inst. 1., 11-34.

11. BLACK R.H. (1952)

A survey of malaria on the British Solomon Islands Protectorate.

Tech. Pap. No. 33., 1-31. S. Pacific Commission Noumea.

12. BLACK R.H. (1958)

Results of the clinical use of Primaquine for the eradication of relapsing vivax malaria of South West Pacific origin. A Report to the Royal Australian College of Physicians reported in Australasian Annals of Medicine 7., 259

13. BLACK R.H. (1974)

Malaria.

Papua New Guinea Medical Journal 17., 1., 1-3

14. BROOKFIELD H.C., HART D. (1971)

Melanesia. p.72

Methuen and Co. Ltd. London.

15. BROWN E.S. (1955)

Medical Department. Honiara.

16. BROWN E.S. (1962)

quoted by Belkin J.N. (1962) in

The Mosquitoes of the South Pacific (Diptera:Culicidae)

University of California Press. Berkeley and Los Angeles. 2 vols.

17. CHAPMAN M., PIRIE P. (1974)

Tasi Mauri. A Report on Population and Resources of the Guadalcanal Weather Coast.

East-West Population Institute, East-West Center and University of Hawaii. Honolulu.

18. CHIEF EXECUTIVE OFFICER (1972)

Report for Director of Audit and Report for Accountant General. BSIP

19. CLYDE D.F., McCARTHY V.C., MILLER R.M., WOODWARD W.E. (1974)

Characteristics of Plasmodium falciparum from the Solomon Islands.

J. Trop. Med. Hyg. 77., 9-12

20. CRANE G.G., KELLY A. (1972)

The effect of malaria control on haematological parameters in the Kaiapit subdistrict.

Papua New Guinea Med. J. 15., 1., 38-43

21. DOWNS W.G., HARPER P.A., LISANSKY E.T., (1947)

Malaria and other insect-borne diseases in the South Pacific Campaign 1942-1945.

II. Epidemiology of Insect-borne diseases in Army troops.

Am.J. Trop. Med. Hyg. 27., 3., 69-89. Suppl.

22. EDESON J.F.B., WILSON T. (1964)

The Epidemiology of Filariasis due to Wuchereria bancrofti and Brugia malayi.

Ann. Rev. Ent. 9., 245-248

23 EDESON J.F.B. (1972)

Filariasis.

Br. Med. Bull. 28., 1., 60-64

24. EDITORIAL (1970)

Burkitt Lymphoma and Malaria.

Lancet. 2., 300-301

25 EDUCATION FOR WHAT? (1974)

A Report on the findings of the British Solomon Islands Protectorate Educational Policy Review Committee.

Government Printer. Honiara.

26 EHRMANN F.C., ELLIS J.M., YOUNG M.D. (1945)

Plasmodium vivax: Chesson strain.

Science 101., 377

27 FOX N. FR. (1975)

Personal communication.

Roman Catholic Church. Kukum. Honiara.

28. GRAMICCIA G., HEMPEL J. (1972)

Mortality and Morbidity from Malaria in countries where malaria eradication is not making satisfactory progress.

J. Trop. Med. Hyg. 75., 187-192

29. GROENEWEGEN K. (1970)

Report on the Census of the Population of the British Solomon Islands Protectorate 1970.

Western Pacific High Commission. British Solomon Islands Protectorate.

30. HABASH O.K. (1974

Unpublished. Presented at Malaria Technical Operations Committee 12/74 Honiara.

31. HACKETT L.W. (1944)

Spleen measurement in Malaria.

J. Nat. Mal. Sec. 3., 121-133

32. HARRISON K.A., IBEZIAKO P.A., (1973)

Maternal anaemia and Fetal birthweight.

J.Obstet. Gynaec. Brit. Cmwlth. 80., 798-804

33. INNES J.R. (1938)

Report of a Leprosy Survey of the British Solomon Islands Protectorate.

Suva. Fiji.

34. INTERNATIONAL PLANNED PARENTHOOD FEDERATION - SOUTH EAST ASIA AND OCEANIA REGION (1972)

Facts and Figures on Family Planning in South East Asia and Oceania Region (IPPF) p. 12 Kuala Lumpur, Malaysia.

35. 3rd INTER-TERRITORIAL MALARIA CONFERENCE FOR SOUTH WEST PACIFIC (1964)

Quoted by Macgregor J.D. (1966) Honiara.

36. IYENGAR M.O.T., DE ROOK H., VAN DIJK W.J.O.M. (1959)

Interruption of transmission of Anopheles-borne filariasis by indoor residual spraying in Netherlands New Guinea.

Trop. geogr. Med. 11., 287-290

37. JANSEN A.A.J., WILLMOTT J.V. (1970)

Nutrition and Dietary Survey - British Solomon Islands Protectorate.

WHO/SPHS/BSIP WPRO 148/FR/8

38. KARNEY W.W., TONG M.J. (1972)

Malabsorption in Plasmodium falciparum malaria.

Am. J. Trop. Med. Hyg. 21.,1.,1

39. LAIRD M. (1955)

Mosquitoes and malaria in the hill country of the New Hebrides and Solomon Islands.

Bull. Ent. Res. 46., 275-289

40. LEPROSY PLAN OF WORK BSIP (1973)

Annex to Master Plan of Operations for District Health Services in the British Solomon Islands Protectorate (0500) Project.

Manila. WPRO 1301 (BSIP)

41. LOPEZ-BRAVO L. (1974)

Assignment Report

Manila WPRO 1301-E (BSIP) of 29 March 1974

42. LOWE R. (1975)

Personal communication

District Commissioner, Central District. Honiara.

43. MACDONNELL M. (1970)

Filariasis in Eastern District.

Eastern District Annual Medical Report. Kira Kira. BSIP

44. McFADDEN C. (1975)

Personal communication

Government Statistician. Honiara

45. MACGREGOR J.D. (1966)

Malaria in the Island Territories of the South West Pacific.

Thesis for MD. University of St Andrews.

46. MACGREGOR J.D., AVERY J.G. (1974)

Malaria Transmission and Fetal growth.

Brit. med. J. 3., 433-436

47. McMILLAN B. (1968)

Effect of residual insecticide (DDT) on transmission of Wuchereria bancrofti in New Guinea.

Presented at 8th Internat. Cong. Trop. Med. Mal.
Teheran. Iran. 7-15 September 1968

48. MAFFI M., MACDONNELL M. (1971)

Malaria in the Eastern Outer Islands, British Solomon Islands Protectorate.

Parassitologia 13., 3., 455-503

49. MAFFI M., TAYLOR B. (1974)

The mosquitoes of the Santa Cruz faunal subarea of the South West Pacific (Diptera:Culicidae)

J. Med. Ent. 11., 197-210

50. MALARIA ERADICATION PROGRAMME (1973)

Remedial measures around a positive malaria case.
Circular 15/10 of 16 November 1973

51. MAMALONI S. (1975)

Chief Minister, speaking to the Seventh Development Plan Bill.
House of Assembly. 29th April 1975. Honiara

52. MATAIKA J.U. (1965)

A study of filariasis in the Solomon Islands.
A report to the Medical Department. BSIP.

53. MEDICAL DEPARTMENT (1938)

Annual Report. Honiara.

54. MEDICAL DEPARTMENT (1958)

Annual Report. Honiara.

55. MEDICAL DEPARTMENT (1966-1971)

MEP Entomology section records. Honiara

56. METCALF R.J., UNGAR J. (1944)

Relapsing malaria - analysis of cases from the Solomons.
U.S. nav. med. Bull. 43., 859

57. METSELAAR D., VAN THIEL P.H. (1959)

Classification of Malaria
Trop. geogr. Med. 11., 157-161

58. MINISTRY OF HEALTH AND WELFARE (1974)

Child Mortality in BSIP
Circular 14-3 of 13 September 1974

59. MINISTRY OF HEALTH AND WELFARE (1975)

Leprosy 1974. File 7-1 Honiara.

60. MINISTRY OF HEALTH AND WELFARE (1975)

Tuberculosis Annual Report 1974. File 7-3 Honiara.

61 NORMAN-TAYLOR W. (1964)

Public Health in the South Pacific.
Am. J.P.H. 54., 780-790

62. OWEN W.B. (1945)

A new Anopheline from the Solomon Islands with notes on its biology.
J. Parasitol. 31., 236-240

63. NEWMAN P. (1965)

Malaria Eradication and Population Growth with Special Reference to Ceylon and British Guiana.
Ann Arbor School of Public Health, The University of Michigan.

64. PAMPANA E.J. (1969)

A Textbook of Malaria Eradication. 2nd. ed.
Oxford University Press. London.

65. PARSONSON G.S. (1964)

Quoted by Taylor B. (1975)

66. PARSONSON G.S. (1966)

La Australia del Espiritu Santo. ed. Kelly C. (1966)
2 vols.

67. PARSONSON G.S. (1968)

The Problem of Melanesia.
Mankind. 6., 11., 571-583

68. PETERS W., CHRISTIAN S.H. (1960)

Studies on the epidemiology of malaria in New Guinea. IV Unstable Highland malaria -- the clinical picture.
Trans. roy. soc. Trop. Med. Hyg. 54., 6., 529-536

69. RIECKMANN K.H., BREWER G.J., POWELL R.D. (1968)

Effects of Diaphenylsulphone (Dapsone) against Plasmodium vivax of South West Pacific origin.
Trans. roy. Soc. Trop. Med. Hyg. 62., 5., 649-653

70. SAINT-YVES I.F.M. (1967)

A Pattern of malnutrition in the Territory of Papua New Guinea.
Med. J. Aust. 1., 557-560

71 SAINT-YVES I.F.M. (1971)

The alleged resistance of Plasmodium falciparum to chloroquine in the Milne Bay District.
Papua New Guinea Med. J. 14., 3., 77-78

72. SAINT-YVES I.F.M. (1975)

An analysis of the results of two treatment schedules for Plasmodium vivax infections in the Solomon Islands Malaria Eradication Programme.

WHO/MAL 75.848

73. SAINT-YVES I.F.M. (1975)

Unpublished work. Honiara.

74. SCHOFIELD F.D., PARKINSON A.D., KELLY A. (1964)

Changes in Haemoglobin values and hepatosplenomegaly produced by control of holoendemic malaria.

Brit. med. J. 1., 587-591

75. SIXTH DEVELOPMENT PLAN (1971-1973)

of the British Solomon Islands Protectorate.

Government Printer. Honiara.

76. SIXTH DEVELOPMENT PLAN BSIP-1971-1974 (1973)

Second Annual Review.

Governing Council Paper No. 22/73. Honiara. March 1973

77. SLOOFF R. (1969)

Assignment Report for WHO. BSIP

WPR/47/69 Manila

78. SNYDER J.C. (1972)

Population and Disease Control.

Am. J. Trop. Med. Hyg. 21., 4., 386-391

79. SOLOMON ISLANDS ANNUAL REPORT (1973)

Government Printer. Honiara. 1974

80. SPITZ S. (1946)

The pathology of acute falciparum malaria.

Milit. Surg. 99., 555-572

81. TAO J.C. (1973)

Field Trip Report to British Solomon Islands Protectorate.
Manila (WP)T9/80/1 of 31 October 1973

82. TAYLOR B. (1975)

Observations on malaria vectors of the Anopheles punctulatus complex in the British Solomon Islands Protectorate.
J. Med. Ent. 11., 6., 677-687

83. TEDDER J.O.L (1971)

quoted by Brookfield H.C. in'Melanesia' (1971) above.

84. VAN DIJK W.J.O.M. (1964)

Control of Wuchereria bancrofti in West New Guinea.
Trop. geogr. Med. 16., 54-60

85. TODD M. (1975)

Personal Communication.
Ministry of Agriculture and Rural Economy. Honiara.

86. WATSON T.M. (1973)

Malaria and Filariasis survey. Graciosa Bay.
A Report to the Medical Department. Solomon Islands.

87. WEBBER R.H. (1973)

Filariasis in the Solomon Islands and its reduction by vector control methods.
University of London DTPH dissertation.

88. WEBBER R.H. (1974)

Filariasis in the Solomon Islands.
Medical Department. Honiara.

89. WILLIAMS A.H. (1974)

Personal communication.
Laboratory Supervisor. Medical Department. Honiara.

90. WILLIAMS C.D. (1966)

Population problems in Developing Countries.
Trans. roy. Soc. Trop. Med. Hyg. 60. 1., 23-29

91. WORLD HEALTH ORGANISATION (1951)

Report of the Malaria Conference in Equatorial Africa. Geneva.
Wld. Hlth. Org. techn. Rep. Ser. No. 38

92. WORLD HEALTH ORGANISATION (1957)

Expert Committee on Malaria. Sixth Report.
Wld. Hlth. Org. techn. Rep. Ser. No. 123

93. WORLD HEALTH ORGANISATION (1961)

Parasitology of Malaria.
Wld. Hlth. Org. techn. Rep. Ser. 433., 17-18

94. WORLD HEALTH ORGANISATION (1963)

Terminology of Malaria and of Malaria Eradication. Report of a Drafting Committee.
p.41. Geneva.

95. WORLD HEALTH ORGANISATION (1963)

Terminology of Malaria and of Malaria Eradication.
Geneva

96. WORLD HEALTH ORGANISATION (1967)

Standardisation of procedures for the study of Glucose - 6-phosphate dehydrogenase.
Wld. Hlth. Org. techn. Rep. Ser. No. 366

97. WORLD HEALTH ORGANISATION (1968)

Expert Committee on Malaria. Fourteenth Report.
Wld. Hlth. Org. techn. Rep. Ser. No. 382

98. WORLD HEALTH ORGANISATION (1974)

The Malaria situation in 1973.

W.H.O. Chronicle 28., 479-487

99. WORLD HEALTH ORGANISATION (1974)

Mortality trends and prospects.

Presented at the World Population conference. Bucharest. August 1974.

W.H.O. Chronicle 28., 529-538

100 YOUNG G.P., SMITH M., WOODFIELD D.G. (1974)

Glucose-6-phosphate dehydrogenase deficiency in Papua New Guinea using a simple methylene blue reduction test.

Med. J. Aust. 1., 876-878

101 YOUNG M.D., EYLES D.E., BURGESS R.W. (1948)

Studies on imported malaria. 10.

J. nat. Mal. Soc. 7., 171

APPENDIX I

HOSPITAL AND CLINIC BIRTHS BY AREAS 1972

These tables (Tables 60, 61, 62) were prepared from 1972 data of notified Hospital and Clinic births in five areas of the Solomon Islands. Unfortunately, although data for the years 1969 to 1972 had been previously available, only the data for 1972 were available at the time of writing.

It has been estimated that approximately 74 per cent of the total births were delivered in hospitals and clinics throughout the country in 1972. The ages of the women enumerated were, for the most part, only estimates.

The five areas under analysis included all of the four districts; in addition, Honiara was excluded from Central District and was treated as a separate entity. In 1970, the total population of

(a) Central District was 49 411. The growth rate for the District has been estimated at 6.4 per cent annually (Tables 51); the estimated 1972 population was therefore 55 938. Further, it is estimated that the total births have been 2 276 for the year, the crude birth rate of 40.7 per thousand. The API was 38.5 per thousand after 10 years of spraying (Table 38)

(b) Eastern District was 21 468, with an estimated growth rate of 2.2 per cent annually; the estimated 1972 population was therefore 22 422. The total birth estimate was 849 for the year, the crude birth rate being 37.9 per thousand. The API was 107.1 per thousand after one year of spraying.

(c) Malaita District was 51 722, with an estimated growth rate of 0.6 per cent per annum; the estimated 1972 population was therefore 52 344. The total birth estimate for the year was 1 989, the crude birth rate being 38 per thousand. The API was 29.0 per thousand after one year plus of spraying.

AREA	No. BIRTHS	No. ALIVE	No. DEAD	UNACCOUNTED
HONIARA	849	809 (95%)	23 (3%)	17 (2%)
CENTRAL (excl. Hon)	835	794 (95%)	38 (4·6%)	3 (0·4%)
EASTERN	628	578 (92%)	43 (7%)	7 (1·0%)
MALAITA	1472	1400 (95%)	44 (3%)	28 (2%)
WESTERN	1241	1125 (91%)	100 (8%)	16 (1%)
BSIP	5025	4706 (93·6)	248 (5%)	71 (1·4%)

TABLE 60 MINISTRY OF HEALTH 1974

LEGITIMATE HOSPITAL & CLINIC BIRTHS 1972

AGE GROUP	HONIARA	CENTRAL (excl. Hon.)	EASTERN	MALAITA	WESTERN
UNDER 20	105(2)	73(0)	39(2)	103(0)	128(2)
20-24	302(5)	226(1)	153(1)	387(6)	362(4)
25-29	247(3)	260(1)	199(2)	486(11)	296(5)
30-34	119(3)	144(0)	142(1)	277(3)	212(0)
35-39	64(3)	101(0)	62(0)	180(5)	168(4)
40-44	11(0)	25(0)	26(0)	32(1)	58(0)
45+	1(0)	6(0)	7(0)	7(0)	17(1)
TOTAL	849(16)	835(2)	628(6)	1472(26)	1241(16)

TABLE 61 MINISTRY OF HEALTH

CURRENT BIRTHS (STILL-BIRTHS) BY AGE GROUPS IN HOSPITALS-CLINICS-1972

PARITY	HONIARA	CENTRAL (excl. Hon.)	EASTERN	MALAITA	WESTERN	3SIP
0	220(5)	178(0)	115(3)	338(8)	219(5)	1070(21)
1	195(2)	143(1)	93(1)	216(3)	180(3)	827(10)
2	131(2)	119(0)	81(0)	220(4)	156(2)	707(8)
3	88(2)	105(1)	86(1)	203(1)	184(2)	666(7)
4	67(0)	74(0)	80(1)	138(2)	119(0)	478(3)
5	53(0)	65(0)	53(0)	107(3)	112(0)	390(3)
6+	95(5)	151(0)	120(0)	250(5)	271(4)	887(14)
TOTAL	849(16)	835(2)	628(6)	1472(26)	1241(16)	5025(66)

TABLE 62 MINISTRY OF HEALTH

CURRENT BIRTHS & (STILL-BIRTHS) BY PARITY AND AREA-1972

(d) Western District was 32 231, with an estimated growth rate of 5.7 per cent per annum; the estimated 1972 population was therefore 36 010. The total birth estimate for the year was 1 677 the crude birth rate being 46.6 per cent. The API was 12.4 per thousand.

(e) Solomon Islands was 166 714, with an estimated growth rate of 3.9 per cent per annum; the estimated 1972 population was therefore 166 714. The total birth estimate for the year was 6 790, the crude birth rate being 40.7 per thousand. The API was 39.4 per thousand.

From Tables 60 and 62, the following patterns emerge:

i. In Honiara, the 35-39 years age group had the highest still-birth rate (SBR) of 4.7 per cent, while the Para 6 group had a SBR of 5.3 per cent. The overall SBR was 1.9 per cent.

ii. In the Central District, excluding Honiara, the 20-24 years and 25-29 years age groups had the highest SBR with 0.4 per cent, while the Para 3 group had the highest SBR with 0.9 per cent. The overall SBR was 0.2 per cent.

iii. In the Eastern District, the under 20 years age group has the hightestSBR with 5.1 per cent, while the Para 0 group had the highest SBR with 2.6 per cent. The overal SBR was 1.0 per cent.

iv. In Malaita District, the 40-44 years age group had the highest SBR with 3.1 per cent, while the Para 5 group had the highest SBR with 2.8 per cent. The overall SBR was 1.8 per cent.

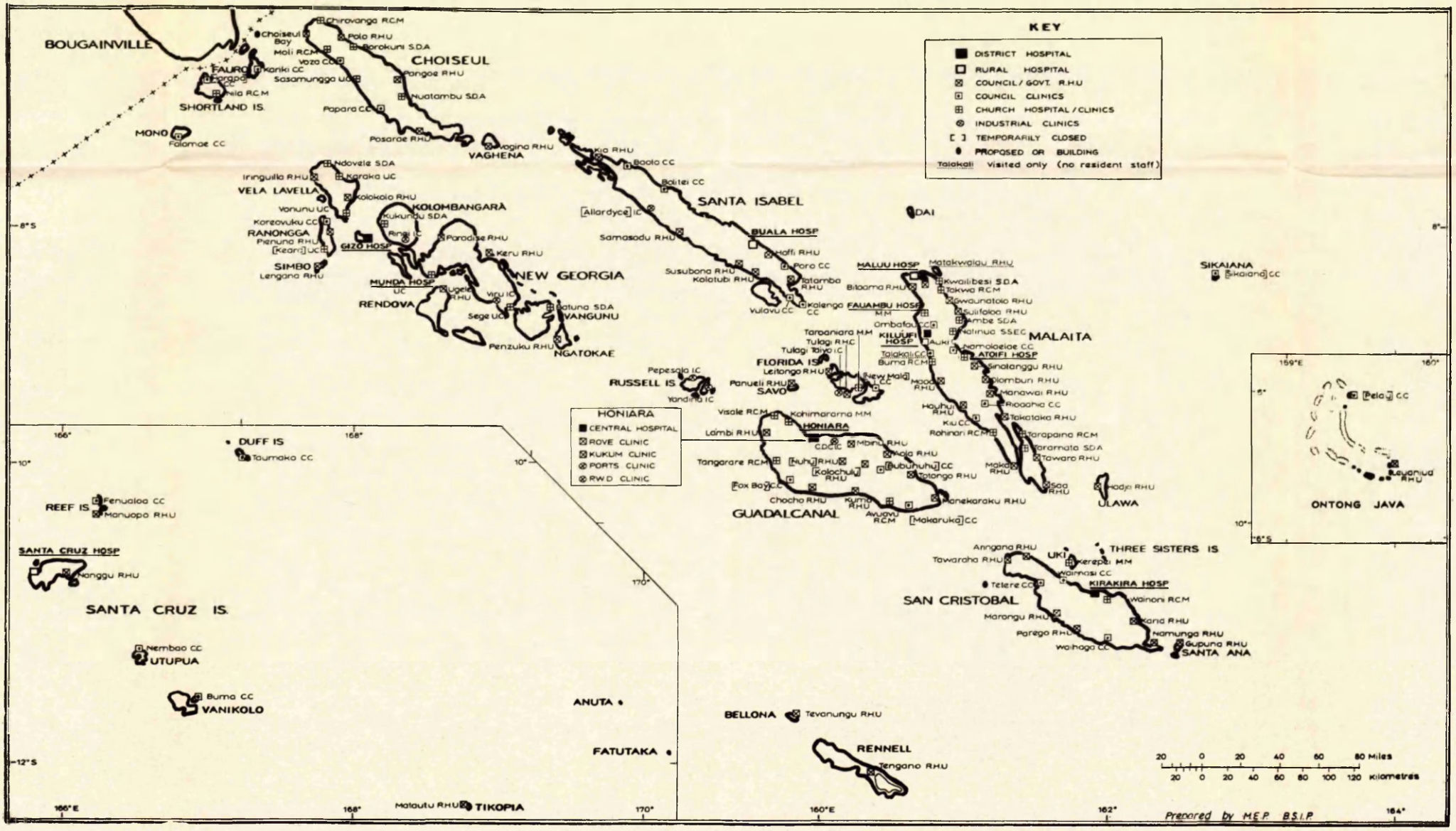
v. In Western District, the over 45 years age group had the highest SBR with 5.9 per cent, while the Para 0 group had the highest SBR wtih 2.3 per cent. The overall SBR was 1.3 per cent.

vi. For the Protectorate as a whole, the over 45 years age group had the highest SBR with 2.6 per cent, while the Para 0 group had the highest SBR with 2.0 per cent.

The over 45 years age group was affected by increasing, age, and by the previous hazards of ill-health, possibly largely due to malaria, in the past; on the other hand, the Para 0 group tend to belong to the very young, under 20 years, age group, who tend to be married early in their society. There is a possibility that maternal immaturity may have played a greater part in the group, as they would have, on the whole, been minimally affected by malaria at this stage in 1972.

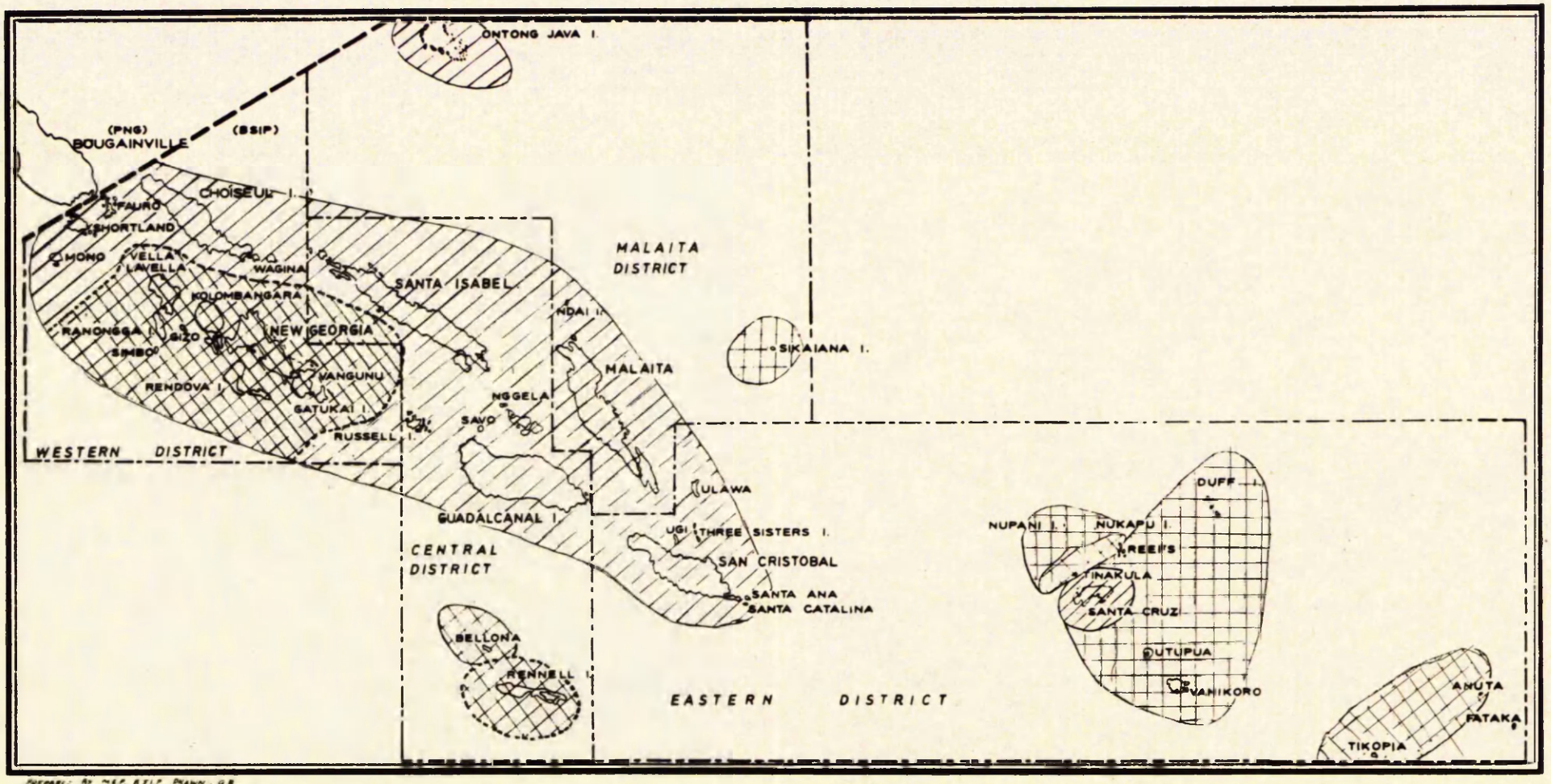
*Appendix 2 is enclosed in the envelope.

GLASGOW UNIVERSITY



ADDITIONAL MAP NO. 1 : DISTRIBUTION OF HEALTH SERVICES - ACTUAL AND PROPOSED - B.S.I.P. - 1975

STATE OF OPERATIONS – B.S.I.P. – JANUARY 1975



Full Sp. op. + Surveillance

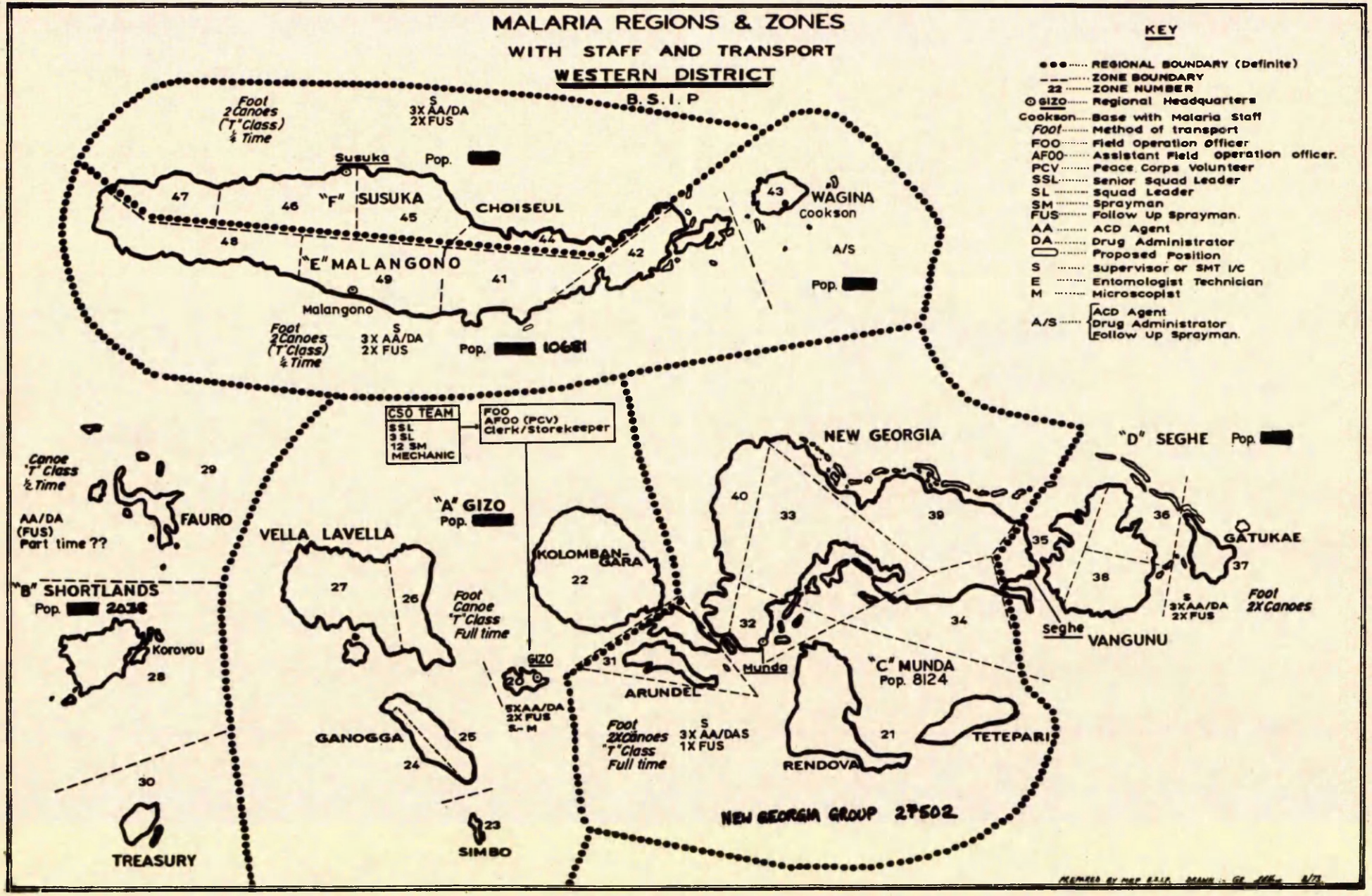
Full Sp. op. + P.C.D.

No spraying – Full surveillance (CONSOLIDATION PHASE).

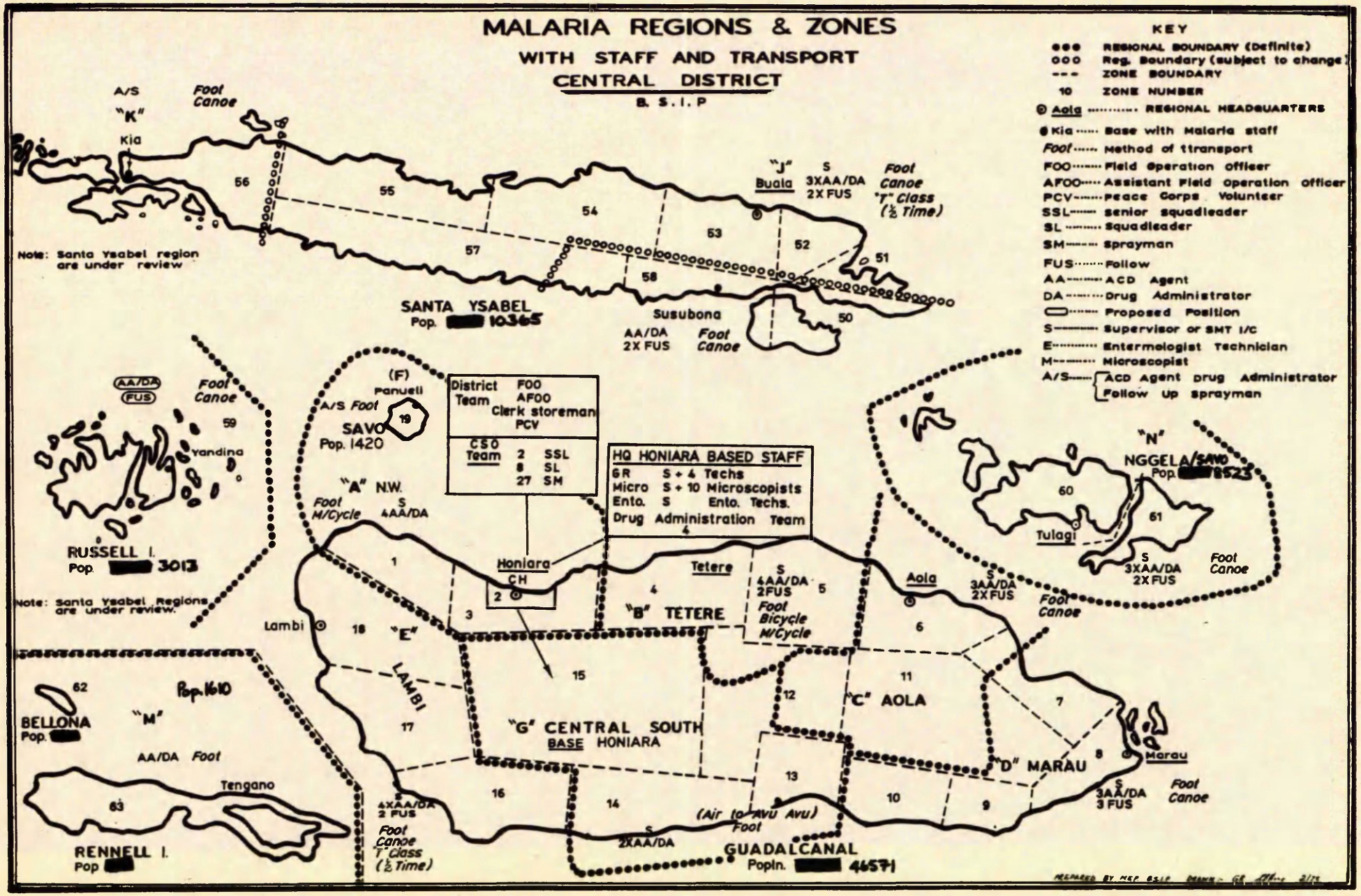
No spraying – P.C.D. only

MAP 5

M.E.P. STATE OF OPERATIONS - JANUARY 1975 - B.S.I.P.



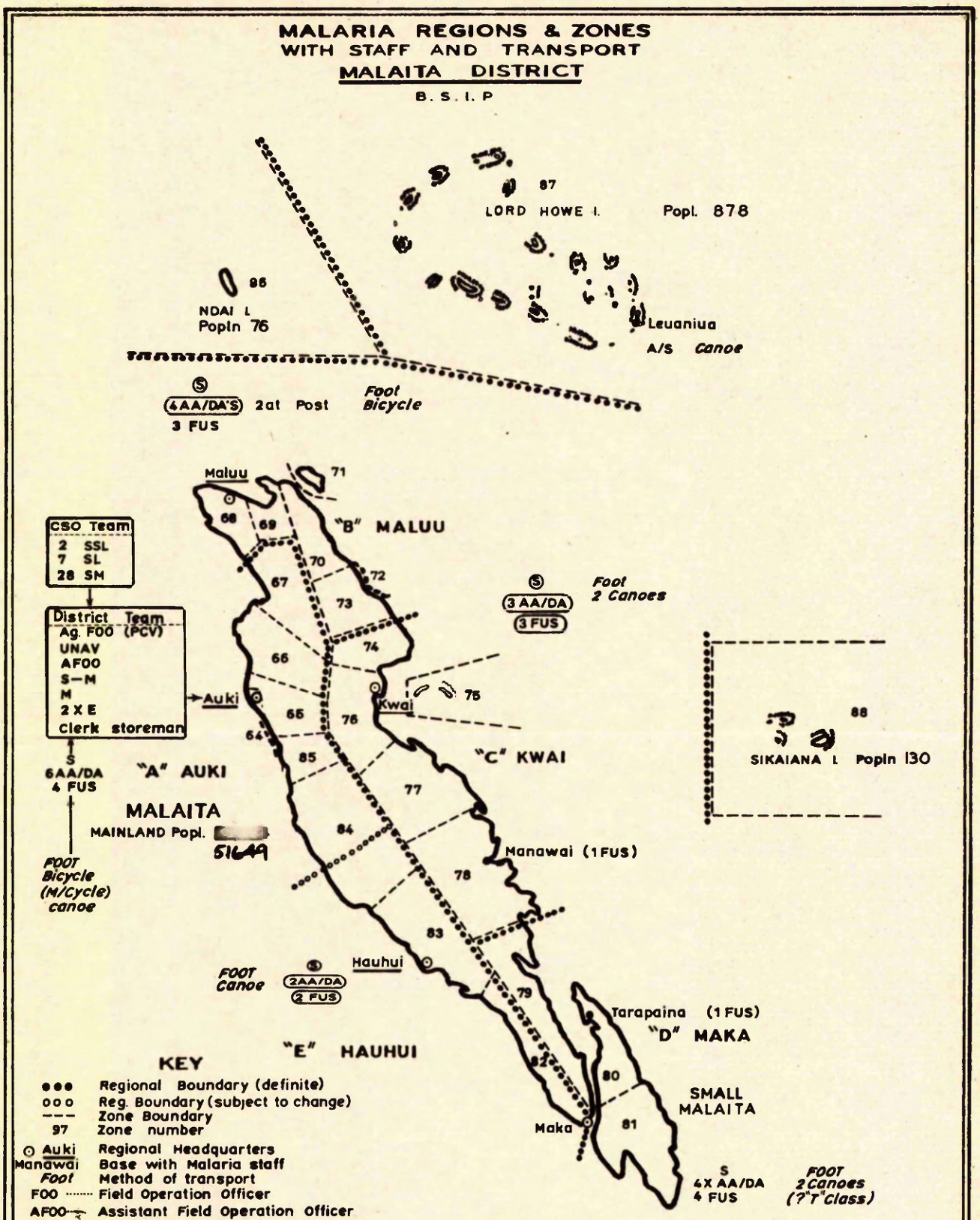
ADDITIONAL MAP 2: WESTERN DISTRICT- M.E.P. REGIONS AND ZONES- STAFF, TRANSPORT.



ADDITIONAL MAP 5: CENTRAL DISTRICT - M.E.P. REGIONS AND ZONES - STAFF, TRANSPORT

MALARIA REGIONS & ZONES
WITH STAFF AND TRANSPORT
MALAITA DISTRICT

B. S. I. P



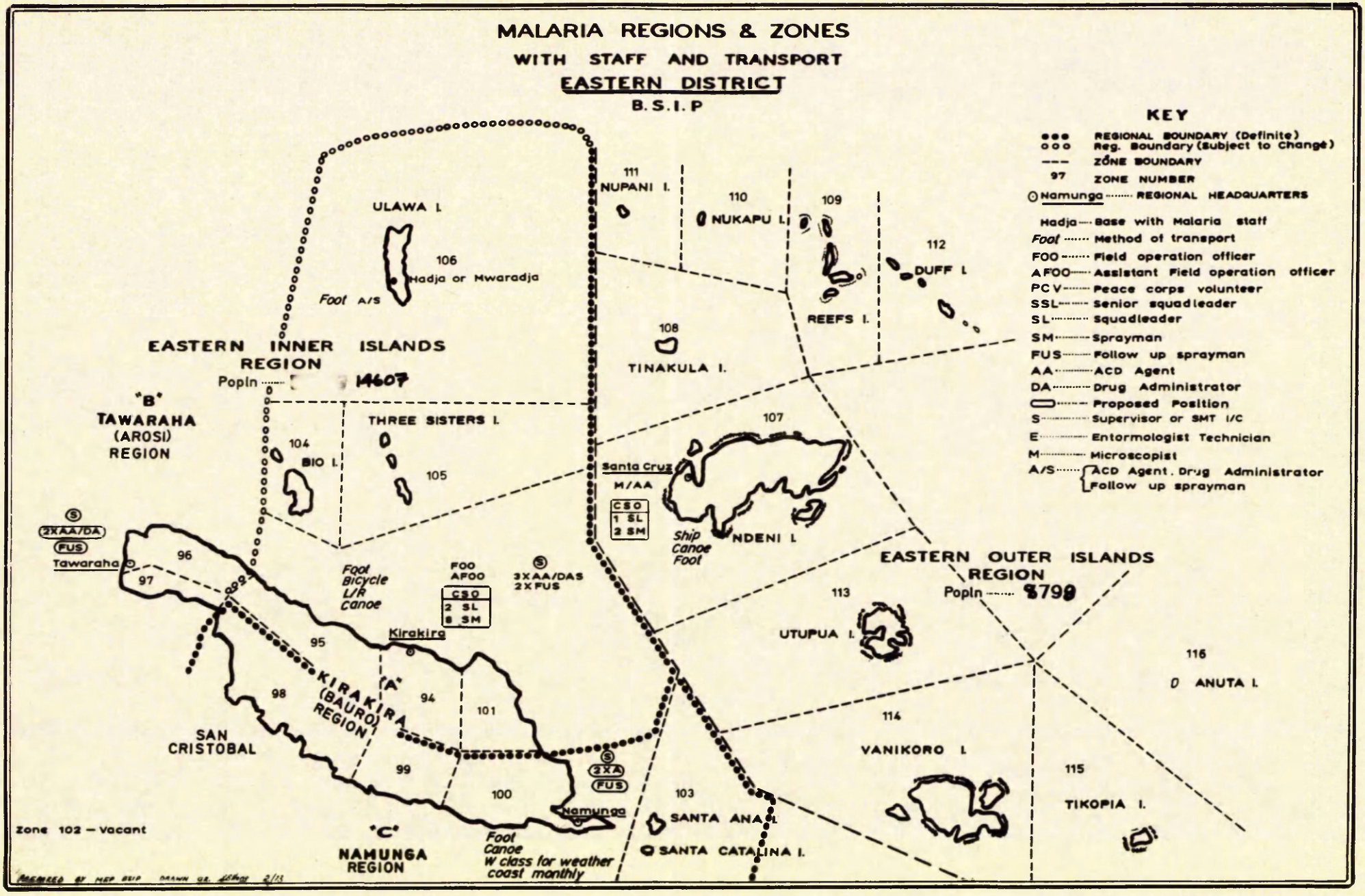
KEY

- ●●● Regional Boundary (definite)
- ooo Reg. Boundary (subject to change)
- --- Zone Boundary
- 97 Zone number
- ⊙ Auki Regional Headquarters
- Manawai Base with Malaria staff
- Foot Method of transport
- FOO ..... Field Operation Officer
- AFOO ..... Assistant Field Operation Officer
- PCV ..... Peace Corps Volunteer
- UNAV ..... Unite Nation Association Volunteer
- SSL ..... Senior Squad leader
- SL ..... Squadleader
- SM ..... Sprayman
- FUS ..... Follow up sprayman
- AA ..... ACD Agent
- DA ..... Drug Administrator
- ⊂⊃ ..... Proposed Position
- S ..... Supervisor or SMT I/C
- E ..... Entormologist Technician
- M ..... Microscopist
- A/S ..... ACD Agent Drug Administrator / Follow up sprayman

ADDITIONAL MAP 3.

MALAITA DISTRICT- M.E.P. REGIONS AND ZONES WITH STAFF AND TRANSPORT.

PREPARED BY MEP SEC'D HONIARA, G.I. 8/73



ADDITIONAL MAP 4: EASTERN DISTRICT- M.E.P. REGIONS AND ZONES- STAFF, TRANSPORT

APPENDIX II

PILOT CENSUS: MAY-JUNE 1975

A Pilot Census was carried out in selected Enumerator Areas throughout the Solomon Islands. The Enumerator Area was based on an estimated population of 300 persons, although, on occasion, an Enumerator Area of 100 persons was counted. This Pilot census was carried out during the last two weeks of May and the first week of June, 1975.

Unfortunately, the Enumerator Areas did not correspond closely with the Enumerator Areas used in the 1970 Census; as a result, it is only possible to compare individual villages in some cases rather than comparable areas. It should be pointed out that Pilot Census aims at testing out the procedures and techniques to be used during the official census rather than obtaining an accurate count of the population and other related factors. As a result, it is not possible to come to any definite conclusions regarding the probable growth rate of the population, although there appears to be some slight evidence of a population increase overall in the areas enumerated.

(a) Central District:

i. Russells: The three areas of Banika, New Development and White Beach had a total population of 429 persons in the 1970 census but only 352 in the recent Pilot census, the population decreasing from 149 to 67 in the New Development area, the others remaining almost static.

ii. Santa Ysabel: Tatamba, Hovi, Ligara, Roja and Regi had a 1970 population of 248 persons, but only 169 persons in 1975, there being a fall from 108 to 7 persons in Regi. Enumerator error may be a partial explanation as it is known that some returns were not recorded in the Pilot Census.

(b) Western District:

i. New Georgia: The village of Pela had a population of 160 in 1970 and 242 in 1975.

ii. Vella Lavella: The villages of Zutapati, Sosolakama, Boro and Megoju had a combined population of 237 in the 1970 census and a combined population of 324 in the Pilot Census.

iii. Choiseul: In the area enumerated, consisting of the villages of Mamarana, Kokoenego and Sirovanga, the population fell from 161 in 1970 to 95 in 1975, the population of Mamarana falling from 84 to 28.

(c) Malaita District:

i. Malu'u: The population rose from 65 to 111 in 1975.

ii. Toibata Area: The villages of Bina, Ololo, Sidu and Gwa'lalamoa were counted; the population fell from 94 in 1970 to 72 in 1975.

iii. Fauabu Area: This area included the villages of Mamalade, Anafalake and Otakwane, where the population rose in 1975 to 77 from 69 in 1970.

iv. Bula'abuu: The population rose in this village from 64 to 69.

(d) Eastern District:

i. Bauro West (Makira): In 1970, the two villages of Nukukaisi and Kaokaona had a population of 109 persons, but had 268 in 1975.

ii. Bauro Central (Makira): In the two villages of Manibene and Manihuki there was a total population of 106 in 1970 and 139 in 1975.

iii. Ulawa: In 1970, Su'u Moli had a population of 162, which had risen to 205 in 1975.

Overall, the enumerated population in 1960 totalled 1904 while in 1975 it was 2123.

Information supplied by Mr G. Dudley, Census Commissioner, Honiara.

ON HER MAJESTY'S SERVICE

SUMMARY

BRITISH SOLOMON ISLANDS PROTECTORATE

THE MALARIA ERADICATION PROGRAMME AND POPULATION DYNAMICS IN THE BRITISH SOLOMON ISLANDS PROTECTORATE 1970-76

SUMMARY

The British Solomon Islands Protectorate lies within the Malarious area of the South-West Pacific Region. In this area, the malaria vectors belong to the Anopheles Punctulatus complex, and, to-date, have not shown any resistance to the residual insecticide . DDT.

There is a comprehensive Rural Health infrastructure which provides adequate services to the population widely scattered over many islands. In addition, mass health programmes have been, and are being carried out (e.g. Yaws Eradication Campaign, TB Control and Leprosy Control Programmes); however, the most important health programme in progress is the Malaria Eradication Programme (MEP), which officially started in 1970, and is due to be completed in 1980.

The effect on population growth of these Programmes has been discussed in this thesis. It is felt that although the Malaria Eradication Programme may not be the only factor influencing the increased growth rate, it is undoubtedly the major one.

The Geopolitical set-up of the Protectorate is described in the opening chapters. Then, the organisation of the Malaria Eradication Programme is briefly outlined, together with a brief description of the entomological, parasitological and epidemiological factors involved. The decline of the "malaria burden" on the population is emphasised.

Using data obtained from all Census sources (1931, 1959, 1970) and from Malaria Eradication on-going census figures., extrapolations have been made about the possible growth rates on Island groups, Districts & Protectorate bases in 1974 and 1976. (1976 is the next Census year). In addition, growth rates for the inter-censal periods have also been determined. The rate of growth, in most cases, in the period 1970-1974, has been quite remarkable.

In addition, the impact of the MEP on the general health of the people has been assessed in relation to hospital morbidity and mortality and to the number

of hospital deliveries. Reference has been made to data from the Malaria Eradication Pilot Project and the Malaria Pre-Eradication Programme, as well as to Medical Department Annual Reports. Unfortunately, vital statistics are incomplete in very many instances, similarly, the improved health status of the population has been discussed in relation to education, trade and industry - although it is difficult to prove a really close association.

That there is "population explosion" is not questioned, the official growth rate has been estimated at 3.1 per cent per annum for the country as a whole. However, the author believes this to be an underestimate, his estimate being 3.9 per cent per annum, of which the MEP is thought to contribute between 1.1 and 1.6 per cent annually. Only the official 1976 Census will provide the answer.

At an annual growth rate of 3.9 per cent, the population of the Solomon Islands will double every 18.2 years, and will reach 202000 by the time of the 1976 census. The social and economic consequences of this 'explosion' are discussed, and a fully comprehensive family planning service is advocated as a matter of urgency. The people themselves are demanding it.

Ian F. M. Saint Yves