Technical Paper No. 66

DISTRIBUTION OF FILARIASIS IN THE SOUTH PACIFIC REGION

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Noumea, New Caledonia
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South Pacific Commission
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IN THE

SOUTH PACIFIC REGION

by

M.O.T. IYENGAR

South Pacific Commission
Noumea, New Caledonia
September, 1954

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LIST OF MAPS

DISTRIBUTION OF FILARIASIS IN THE SOUTH PACIFIC REGION

ADDENDA AND CORRIGENDA

Page 7. After last line of Section 3, New Hebrides, insert the following

Futuna	"No microfilaria seen"		Mills, 195
Ambrym, Aneityum, Aniwa, Banks, Efate, Malekula, Oba, Tangoa and Torres	60	36.7	Buxton, 19

Page 9. Section 10. After last line, insert the following :

Nauru (adults)		17.8	Official c munication dated 20/8

Page 21. Section 3. New Hebrides. After last line, insert the following

Futuna	"No cases of elephantiasis"		Mills, 1954
Ambrym, Aneityum, Aniwa, Banks, Efate, Malekula, Oba, Tangoa and Torres.	60	5.0	Buxton, 192

Page 26. Line 7, for "Brennerman", read "Brenneman"

Page 44. Section 13, for "Funafuti Aedes pseudoscutellaris", read "Funafuti Aedes polynesiensis"

Page 45. Section 19, items 4 and 5, for "Aedes pseudoscutellaris", read "Aedes polynesiensis"

Page 45. Section 19, in last item, for "75", read "73"

Page 48. Line 20, for "Brennerman", read "Brenneman"

Page 51. After second line, insert the following :

"MILLS A.R., 1954. Sth. Pac. Comm., Qrtly. Bull., 4: 26-28."

INTRODUCTION

Various investigations in filariasis have been carried out in different parts of the South Pacific region. The results of the majority of these have appeared in numerous scientific periodicals, while many of them are confined to official reports and other records not easily accessible to a worker. The need was felt for collating all the data and presenting the available information in the form of maps so as to give a bird's-eye view of the different aspects of filariasis in the region.

Summary data for each of the following four items are here furnished, giving details of the observations made and the sources of the information:

1. Distribution and incidence of microfilarial infection in the South Pacific region;
2. Distribution and incidence of elephantiasis;
3. Distribution of the periodic and the non-periodic forms of Wuchereria bancrofti;
4. The vectors of filarial infection.

All available periodicals, reports and other records were studied for the preparation of these summaries. It is not claimed that this is a complete record of all previous observations, and it is possible that quite a number of observations have been missed. It is planned to issue supplementary lists later, giving details of records that may subsequently be found.

This brochure is divided into four parts, dealing with each of the four aspects mentioned above. Each part consists of a discussion, summary data, and a map presenting the data on a geographical basis. These maps will serve to bring out one conspicuous fact, namely, that in spite of the very considerable amount of work that has been done on filariasis in the South Pacific region, there are still quite extensive areas for which we have absolutely no data at all. For many others, we lack definite information on the incidence of filarial infection and of elephantiasis; for some, we do not know whether the infection present is the periodic form or the non-periodic form, while in many others we have no knowledge of the vectors of the infection. Such basic information is of vital importance in understanding the epidemiology of filariasis in any particular area.

The South Pacific Commission is endeavouring to complete the information on all these points, both by investigations carried out by the Commission's staff and also by getting research institutions and individual investigators interested in the problems, giving them such assistance as it can.

It is hoped that this brochure will serve to stimulate the interest of various agencies, private and governmental, in the region, and that it will further the cause of the intensive investigations needed to fill the lacunae that we now have in our knowledge of the distribution of the disease.

The help received from Madame S. Monlaü, Technical Assistant, in the preparation of this technical paper is gratefully acknowledged.

* * * * *

PART I

DISTRIBUTION AND INCIDENCE OF MICROFILARIAL INFECTION IN THE SOUTH PACIFIC REGION

Autochthonous filarial infection in the South Pacific region consists of one or the other of the two forms of Wuchereria bancrofti, the nocturnal periodic form and the non-periodic form. There have been no authentic reports of the occurrence of endemic Wuchereria malayi infection in any part of the South Pacific region - it is presumed that this infection is not endemic in this region. Imported cases of W. malayi infection have been reported among Indo-Chinese immigrants in the New Hebrides and among Javanese immigrants in Dutch New Guinea; it is possible that such cases may occur elsewhere also. In the absence, in these areas, of suitable mosquito vectors for this infection, the infection is not being transmitted.

Summary data of observations made on the incidence of microfilarial infection in the different parts of the South Pacific region are furnished on pages 3 to 16. Map 1 presents the distribution and incidence of filarial infection in this region. The incidence of microfilarial infection is shown in three grades: (1) under 5 per cent, (2) from 5 to 15 per cent, and (3) over 15 per cent. For localities where more than one record is available, the more recent finding or that in which a larger sampling was made, has been taken into account and represented on the map. Areas, where as a result of examinations of the population no infections were observed, are shown as free from filarial infection. For quite extensive areas, no data are available. Areas with a high incidence of filarial infection (microfilaria rates of over 15 per cent) are: certain coastal areas of New Guinea and New Britain; Guadalcanal and San Cristobal in the Solomons; most of the islands of the New Hebrides; a few coastal areas in New Caledonia; most of the islands of the Carolines; Tarawa in the Gilberts; Nauru; the Ellice Islands; Vanua Levu, Kadavu and the Lau group in Fiji; the Tonga Islands; Eastern and Western Samoa; the Tokelau Islands; the Cook Islands; the Society Islands.

The infection is largely restricted in its distribution to flat low-lying coastal areas. Undulating hilly areas in the interior are ordinarily free from the infection, but this is not always true for many areas in the South Pacific. The interior hilly areas of New Guinea, about which we have no data at present, are in all probability free from the infection as the main vector in that area has a coastal and flat land distribution. In New Caledonia also, the interior hilly areas are likely to be free from the infection as the vector is a species that breeds in saline marshes along the coast. On the other hand, in Western Samoa, the writer observed that elevated and undulating areas in the

interior, several miles from the sea coast, had a high incidence of filarial infection. In Viti Levu and Vanua Levu (Fiji Islands), Lynch (1905) observed that the infection was prevalent in the interior highland areas, and he recorded an infection rate of 30.8 per cent in the mountain villages of Colo.

Although endemic filarial infection is normally restricted to low-lying coastal areas, it is not necessarily limited to such areas. The occurrence of the infection depends largely on several factors such as the numerical prevalence of the local vector of the infection, its breeding habits, and the facilities available for its breeding and feeding on man.

SUMMARY DATA REGARDING PREVALENCE OF ENDEMIC MICROFILARIAL INFECTION IN THE SOUTH PACIFIC REGION

Locality	No. of Persons Examined	Microfilaria Rate %	Authority
	1. N E W G U I N E A		
(a) MAINLAND:			
Lambringi	7	71.4 (daytime)	Fülleborn, 1912
Maclay Coast	44	47.7 (daytime)	Fülleborn, 1912
Patep (Lae area)	15	0.0	Bearup & Lawrence, 1950
Markham area (North)	184 (adult males)	30.0	Bern & Hamsen, 1950
Kaiapit (Markham area)	25	44.0	Bearup & Lawrence, 1950
Wahgi Valley & Upper Ramu	220	0.0	Heydon, 1940
Busama (Huon Gulf)	24	20.8	Bearup & Lawrence, 1950
Milne Bay	200	51.0	Hopla, 1946
Samarai district	318	30.5	Avery, 1946
Port Moresby to Mambare	166	17.0 (daytime)	Breinl, 1915
Mekeo	180	"High percentage"*	Clements, 1936
(* All persons above the age of 45 were positive for microfilariae)			
Port Moresby to Daru	166	5.0 (daytime)	Breinl, 1915
Purari Delta	10	30.0	Bearup & Lawrence, 1950
Different districts of Australian New Guinea	-	10.0 - 60.0	de Rook, 1938
Marindineezen (along Merauke River)	-	40.0 - 52.0	de Rook, 1938
Lower Digoel	93	12.9	Elsbach, 1937 A
Upper Digoel	32(adults)	25.0 (by night)	de Rook, 1930
Upper Digoel	216(adults)	11.0 (by day)	de Rook, 1930
Koholombo, Wap (Mappier area)	64	9.3	Elsbach, 1937 A

Locality	No. of Persons Examined	Microfilaria Rate %	Authority
Fak-Fak	37	10.8	Leimena, 1928
Fak-Fak	79	2.5 (by day)	Aboe Bakar, 1928
Inanwatan	284	51.1	Ting Soei Hoo, quoted by Brug & de Rook, 1933
Inanwatan	290	51.3	de Rook, 1938
Inanwatan	-	30.0	Van Hoeve, 1949 (unpublished)
Inanwatan and Sarmi	Several thousands (adults)	25.0	Van der Hoeven, 1952
Konda (West Coast)	-	0.5	Van Hoeve, 1949 (unpublished)
Vogel Kop (North coast villages)	793	33.4	Kariadi, 1937
Manokwari (Vogel Kop)	91	19.8	Leimena, 1928
(b) ISLANDS:			
Noemfoor	89	3.4	Kariadi, 1937
Japen	-	Infection present	de Rook, 1930
Amsterdam	46	10.9	Kariadi, 1937
Salawati	127	26.8	Kariadi, 1937
Gam	49	22.4	Kariadi, 1937
Waigeo	185	46.4	Kariadi, 1937
Matty (two villages)	249	25.3	Backhouse & Heydon, 1950
Tami	55	23.6 (by day)	Fülleborn, 1912
Papitalai (Manus)	51	33.3	Fülleborn, 1912
Mussau (St. Matthias I.)	53	9.4	Fülleborn, 1912
Emirau	62	39.0	Levine & Harper, 1947
Kavieng (New Ireland)	-	14.0	Cilento, 1923
Makada (two villages)	220	22.7	Backhouse & Heydon, 1950

Locality	No. of Persons Examined	Microfilaria Rate %	Authority
Rabaul	427 (Indentured labourers from different districts)	19.4	Backhouse & Heydon, 1950
Rahujana (New Britain)	14 (adults)	50.0 (by day)	Fülleborn, 1912
Forsayth	18	11.1 (by day)	Fülleborn, 1912
Liebliche	10	50.0 (by day)	Fülleborn, 1912
Goodenough	30	6.7	Ford (unpublished) 1938
Kiriwina	65	16.9	Bearup & Lawrence, 1950
Sudest (Louisiade Group)	-	"Infection present"	Clements, 1936
2. SOLOMON ISLANDS			
Guadalcanal	155	40.6	Byrd & St. Amant, 1950
Guadalcanal	157	10.2	Schlosser, 1945
Guadalcanal	114 (daytime)	14.0	Vincent, 1944
Guadalcanal	137	19.0	Reiber (unpublished), 1945 A
Guadalcanal	2,500	22.0	Levine & Harper, 1947
Malaita	548	10.2	Schlosser, 1945
Malaita	481	10.0	Byrd & St. Amant, 1950
Malaita	157	9.0	Vincent, 1944
San Cristobal	558	31.5	Schlosser, 1945
San Cristobal	244	40.5	Byrd & St. Amant, 1950
San Cristobal	50	22.0	Vincent, 1944
Rennel	13	0.0	Black, 1952

Locality	No. of Persons Examined	Microfilaria Rate %	Authority
Savo	147	2.0 (by day)	Vincent, 1944
Florida	37	2.7 (by day)	Vincent, 1944
Bellona	50	0.0	Black, 1952
Sikaiana	24	4.1	Black, 1952
Ontong Java	20	10.0	Black, 1952
Mono	-	0.7	Perry, 1949
Santa Cruz	No data		

3. NEW HEBRIDES

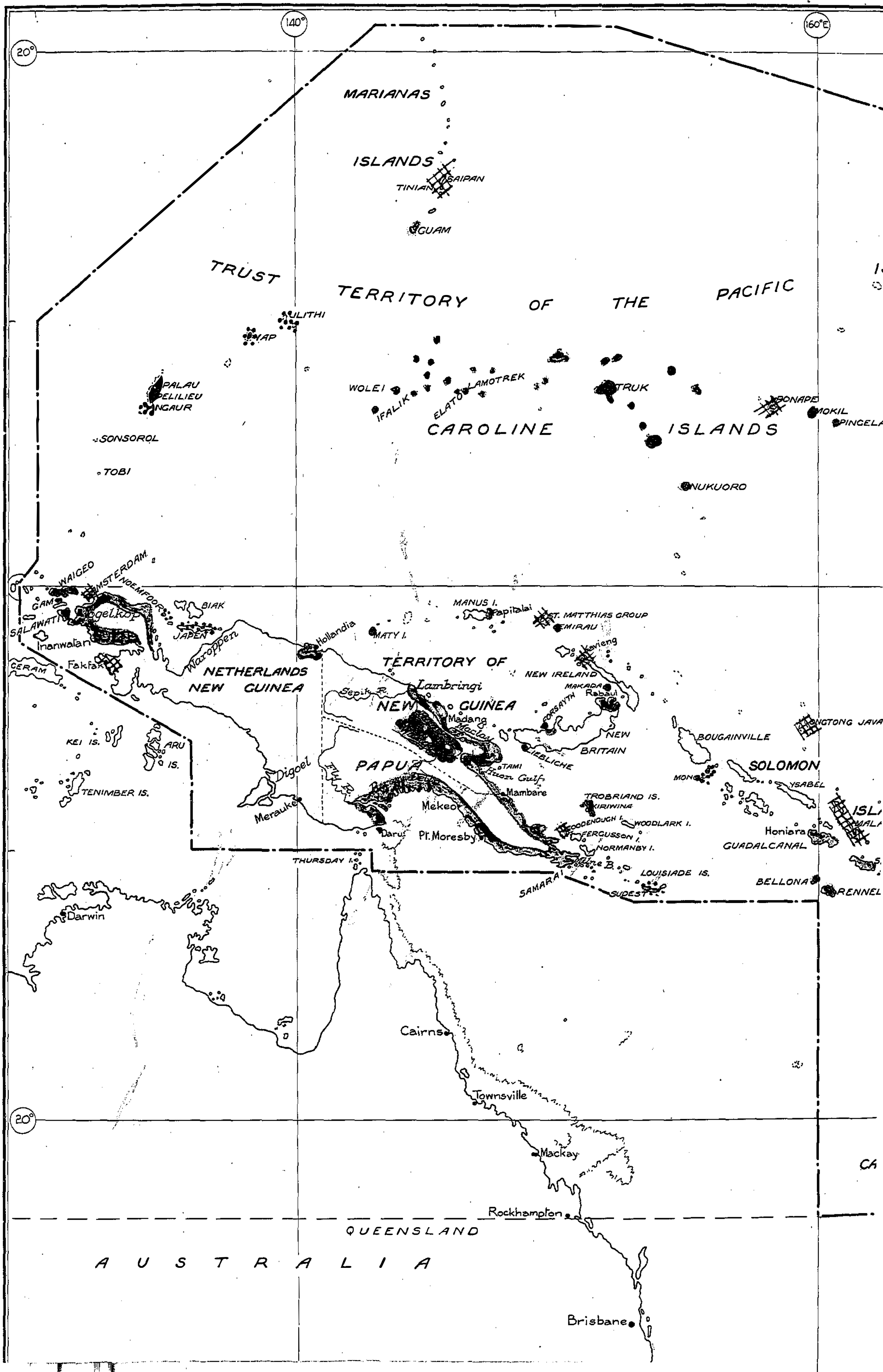
New Hebrides	732	27.5	Tully (unpublished), 1931
Torres Group	6	50.0	Byrd & St. Amant, 1950
Banks Group	80	33.8	Byrd & St. Amant, 1950
Espiritu Santo	121	38.0	Buxton, 1928
Espiritu Santo	113	21.2	Byrd & St. Amant, 1950
Pentecost	20	60.0	Buxton, 1928
Pentecost	36	30.6	Byrd & St. Amant, 1950
Maewo	21	47.6	Buxton, 1928
Aoba	15	40.0	Byrd & St. Amant, 1950
Malo	1	100.0	Byrd & St. Amant, 1950
Malekula	29	48.3	Byrd & St. Amant, 1950
Ambrym	2	0.0	Byrd & St. Amant, 1950
Paama	23	4.3	Buxton, 1928

Locality	No. of Persons Examined	Microfilaria Rate %	Authority
Epi	22	31.8	Buxton, 1928
Araki	32	0.0	Byrd & St. Amant, 1950
Tangoa	71	0.0	Byrd & St. Amant, 1950
Efate	110	17.0	Levine & Harper, 1947
Efate	8	0.0	Byrd & St. Amant, 1950
Tanna	51	2.0	Buxton, 1928
Tanna	3	0.0	Byrd & St. Amant, 1950
Futuna	-	"May be free from filariasis"	Buxton, 1928

4. NEW CALEDONIA

New Caledonia	117	3.4	Lang & Noc, 1903
New Caledonia	247	4.0	Levine & Harper, 1947
Oubionne	45	24.4	Merlet, 1950
Oungo	129	24.0	Merlet, 1950
Boyen	65	1.5	Merlet, 1950
Puebo	85 (adults)	56.0 (Males) 41.0(Females)	Merlet, 1950
Puebo	81 (adults)	59.3	Kerrest, 1951
Ponerihouen	57 (adults)	49.1	Merlet, 1950
New Caledonia	104	5.7	Sanner, 1950
Koumac	24 (adults)	16.6	Kerrest, 1951
Gomen	13 (adults)	7.7	Kerrest, 1951
Mou	86	37.2	Iyengar, 1954
Embouchure	66	1.5	Iyengar, 1954

MAP I : SHOWING DISTRIBUTION AND INCIDENCE OF MICROFILARIAL INFECTION


140°
160°E
20°
MARIANAS
ISLANDS
TINIAN
SAIPAN
GUAM
TRUST
TERRITORY
OF
THE
PACIFIC
ULITHI
YAP
PALAU
PELILIEU
ANGAUR
SONSOROL
TOBI
WOLEI
IFALIK
ELATO
LAMOTREK
TRUK
CAROLINE
ISLANDS
PONAPE
MOKIL
PINGELAP
NUKUORO
WAIGEO
AMSTERDAM
NOEMFOOR
GAM
SALAWATI
Vogelkop
Inanwatan
Fakfak
CERAM
BIAK
JAPEN
Waropen
Hollandia
NETHERLANDS
NEW GUINEA
KEI IS.
ARU IS.
TENIMBER IS.
Digoel
Merauke
MANUS I.
Papitalai
ST. MATTHIAS GROUP
EMIRAU
MATY I.
TERRITORY OF
NEW GUINEA
Lambringi
Sepik R.
Madang
Kavieng
NEW IRELAND
MAKADA
Rabaul
FORSAYTH
NEW BRITAIN
LIEBLICHE
TAMI
Huon Gulf
Mambare
PAPUA
Fly R.
Mekeo
Daru
Pt. Moresby
THURSDAY I.
TROBRIAND IS.
KIRIWINA
GOODENOUGH I.
WOODLARK I.
FERGUSSON I.
NORMANBY I.
Milne B.
LOUISIADE IS.
SAMARAI
SUDEST
BOUGAINVILLE
ONTONG JAVA
MONO
SOLOMON
YSABEL
ISLANDS
MALAITA
Honiara
GUADALCANAL
BELLONA
RENNELL
Darwin
Cairns
Townsville
Mackay
Rockhampton
QUEENSLAND
AUSTRALIA
Brisbane

THE SOUTH PACIFIC COMMISSION

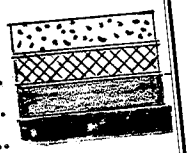
Commission boundary: ·—·—·—·—·

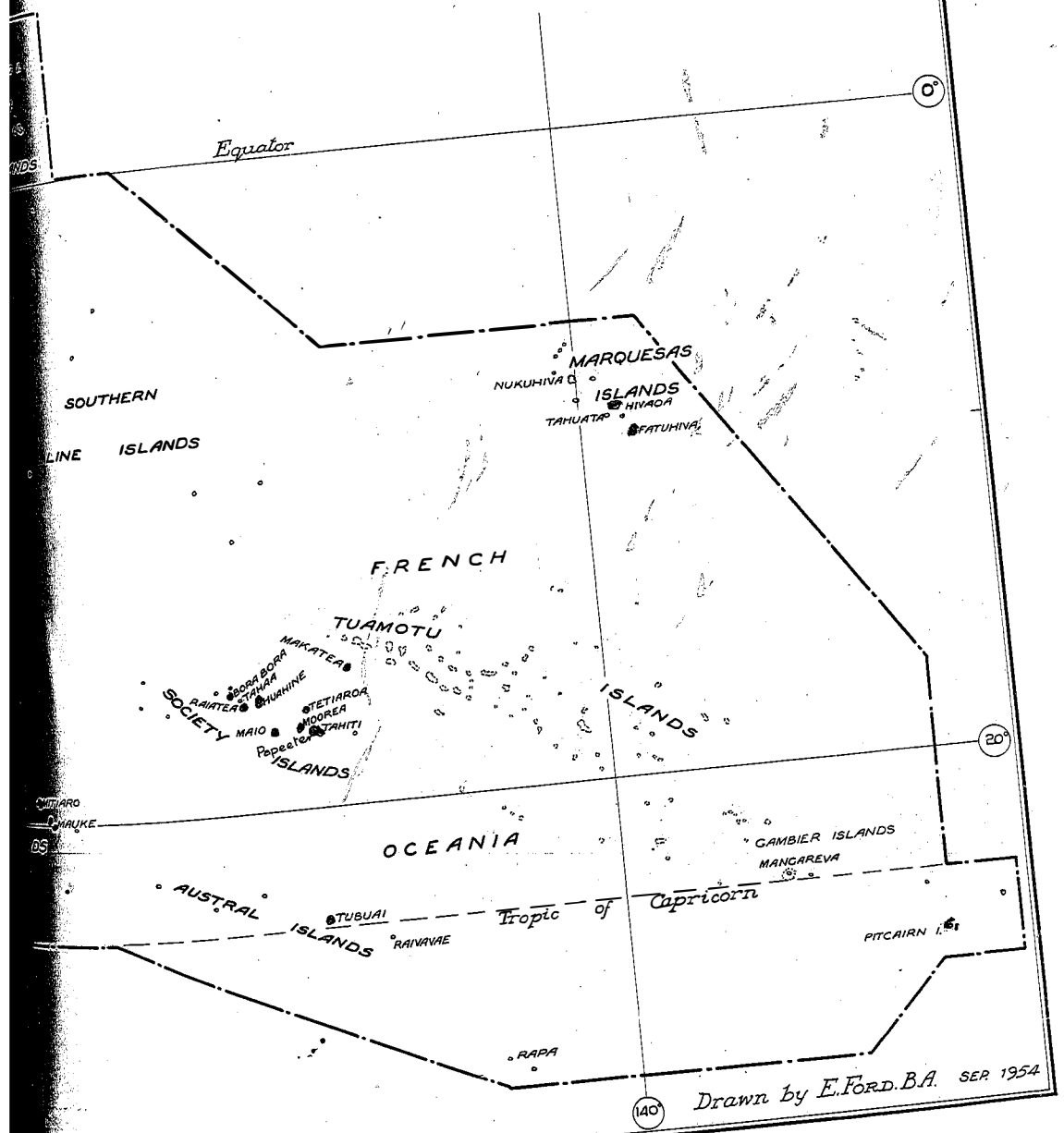
Equatorial Scale in Miles:
0 100 200 400 600 800 1000

DISTRIBUTION AND INCIDENCE OF ENDEMIC MICROFILARIAL INFECTION

es:

Areas with infection rates of 5 per cent or under .. ..
Areas with infection rates of 5 to 15 per cent .. ..
Areas with infection rates over 15 per cent. .. ..
Areas reported to be free from filarial infection .. ..
Areas with no available data .. ..





Drawn by E. Ford. B.A. SEP. 1954

PART II

DISTRIBUTION AND INCIDENCE OF ELEPHANTIASIS IN THE SOUTH PACIFIC REGION

In the summary data on the incidence of elephantiasis (pages 19 to 28) only elephantiasis of the limbs is taken into consideration. Map 2 presents the distribution and incidence of elephantiasis in the South Pacific region. The incidence of this manifestation of filariasis is shown in three grades, namely: under 1 per cent; 1 to 3 per cent, and over 3 per cent. Areas with elephantiasis rates of over 3 per cent are the following: small areas in the north-western part of New Guinea; Makada and Matty Islands; Guadalcanal in the Solomons; a few of the islands in the New Hebrides; the Ellice Islands; Lakemba in Fiji; Savaii, Upolu and Tutuila in Samoa; Atafu in Tokelau; Aitutaki in the Cook Islands; Tahiti, Moorea, Raiatea and Huahine in the Society Islands; the Marquesas Islands.

The distribution of elephantiasis is restricted to areas with filarial infection. Although, generally speaking, the incidence of elephantiasis is proportional to the incidence of filarial infection in the population, this is not always true. In the coastal areas of New Guinea, and many of the islands of the Solomons, New Hebrides and the Carolines, fairly high infection rates (often over 25 per cent) have been recorded. And yet, the incidence of elephantiasis in these areas is low. It has been observed that grosser manifestations of filariasis, such as elephantiasis, are of less frequent occurrence in areas with the periodic form of W. bancrofti than in areas with the non-periodic form. Attention to this has been drawn by Manson-Bahr and Muggleton (1952), Backhouse (1953), and others.

Some workers are of the view that the non-periodic form of W. bancrofti has a greater degree of pathogenicity in comparison with the periodic form and that the markedly lower incidence of cases of elephantiasis in the western part of this region in comparison with the eastern part, could be due to the type of infection involved. Although in the South Pacific region, the occurrence of the periodic form of W. bancrofti is associated with a low incidence of the grosser manifestations of filariasis, it does not happen elsewhere in the same way. Several areas with this form of infection in south-eastern Asia, as for example, the endemic areas in India, Ceylon and the Maldive Islands, have a very high incidence of elephantiasis. On the other hand, areas with the non-periodic form of W. bancrofti do not always have a high incidence of elephantiasis. We have the instance of certain coastal areas in New Caledonia where, in spite of a high incidence of infection with the non-periodic form of W. bancrofti, cases of elephantiasis are of extremely rare occurrence.

It is evident from these considerations that the comparatively low incidence of cases of elephantiasis in the western parts of the South Pacific region and the high incidence of this type of manifestation in eastern parts of this region is not attributable to any difference in the pathogenicity of the two forms of W. bancrofti infection, but to differences in local conditions as regards the opportunities for the establishment of hyperfilariation in the human host.

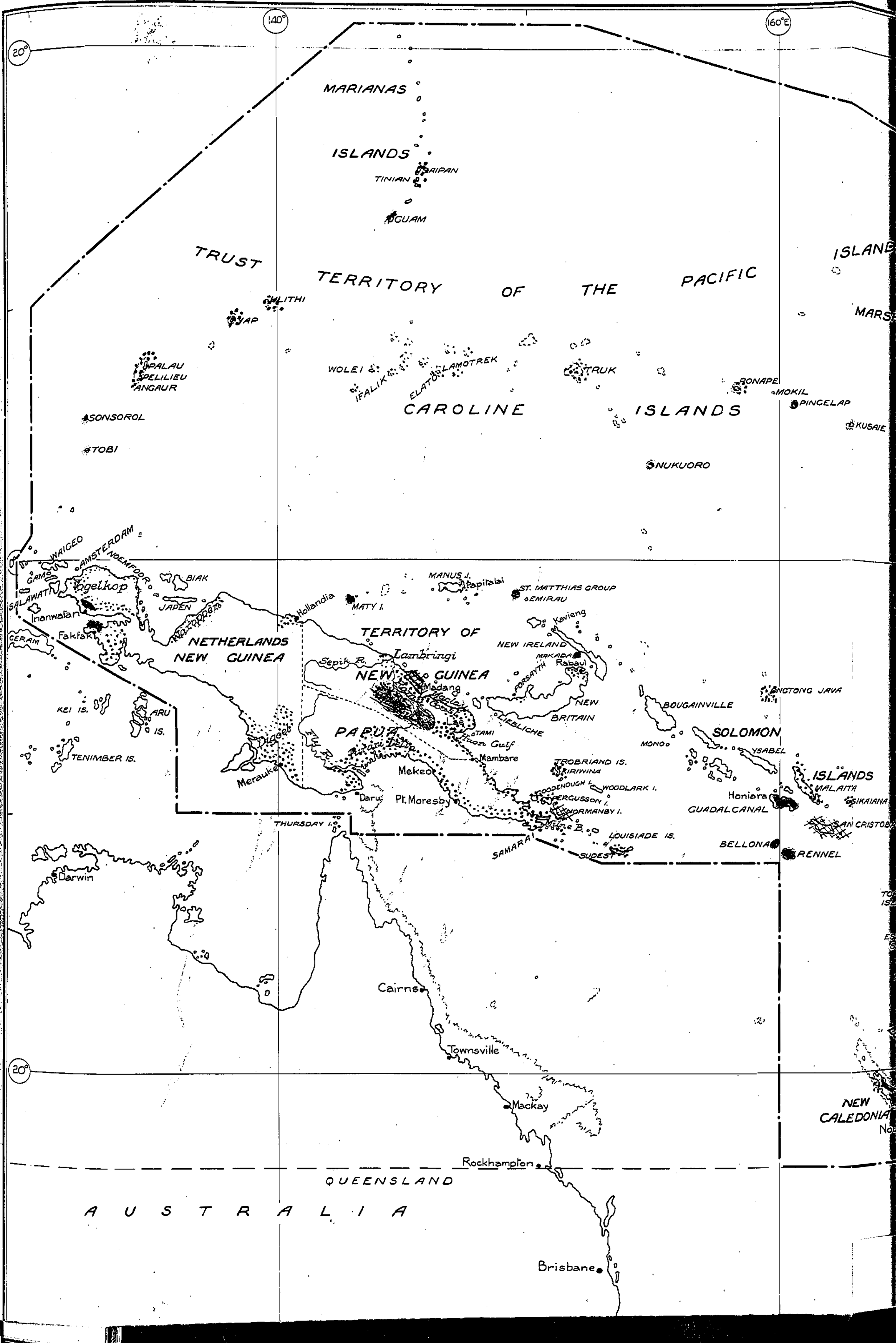
SUMMARY DATA REGARDING PREVALENCE OF ELEPHANTIASIS IN THE SOUTH PACIFIC REGION

Locality	No. of Persons Examined	Elephantiasis Rate %	Authority
1. NEW GUINEA			
(a) MAINLAND:			
Waropen district	-	Elephantiasis present	de Rook, 1938
Hollandia area	-	Elephantiasis present	de Rook, 1938
Madang coast	-	Elephantiasis common	de Rook, 1938
Markham area	-	Elephantiasis uncommon	Bearup & Lawrence, 1950
North Markham area	-	Several cases seen	Bern & Hansen, 1950
Maclay coast	-	Few cases	Fülleborn, 1912
Wahgi Valley & Upper Ramu	220	0.0	Heydon, 1940
Milne Bay	-	Elephantiasis uncommon	Hopla, 1946
Coastal belt of British New Guinea	-	Cases of elephantiasis in varying number	Breinl, 1915
Purari delta	-	Elephantiasis uncommon	Bearup & Lawrence, 1950
Lower Digoel & Wap	130(adults)	0.8	Elsbach, 1937 A
Upper Digoel	500	1.0	de Rook, 1930
Fak-Fak	284	11.7	Ting Soei Hoo, quoted by Brug & de Rook, 1933
Fak-Fak	300(adults)	11.3	de Rook, 1938
Vogel Kop, north coast	3,122	0.7	Kariadi, 1937
Vogel Kop, Berau district	-	"Prolific breeding place of elephantiasis"	de Rook, 1938

Locality	No. of Persons Examined	Elephantiasis Rate %	Authority
(b) ISLANDS:			
Papitalai (Manus Island)	-	Few cases	Fülleborn, 1912
Mussau Island (St. Matthias Group)	-	No cases seen	Fülleborn, 1912
Rahujana (New Britain)	-	Elephantiasis uncommon	Fülleborn, 1912
Rabaul	427 (indentured labourers from various districts)	0.7	Backhouse & Heydon, 1950
Makada	131(adults)	9.2	Backhouse & Heydon, 1950
Matty	89 (adult males)	11.2*	Backhouse & Heydon, 1950
* Scrotal affections			
Kiriwina	3,956(adults)	0.2	Ford, 1939 (unpublished)
Dobu & Normanby Islands	2,498(adults)	1.1	Ford, 1939 (unpublished)
Goodenough	2,515(adults)	0.8	Ford, 1939 (unpublished)
Fergusson	3,742(adults)	0.5	Ford, 1939 (unpublished)
Sudest	-	Elephantiasis present	de Rook, 1938
2. SOLOMON ISLANDS			
Solomon Islands	-	"Elephantiasis almost unknown"	Bahr, 1912
Guadalcanal	109	3.2	Byrd & St. Amant, 1950
Malaita	481	0.8	Byrd & St. Amant, 1950
San Cristobal	244	1.2	Byrd & St. Amant, 1950

Locality	No. of Persons Examined	Elephantiasis Rate %	Authority
Ontong Java	-	Few cases	Black, 1952
Sikaiana	-	Few cases	Black, 1952
Rennel	-	No cases reported	Black, 1952
Bellona	-	No cases reported	Black, 1952
Santa Cruz Islands	-	No data	
3. NEW HEBRIDES			
New Hebrides Islands	-	"Great morbidity"	Lambert, 1928
New Hebrides Islands	30,331	0.4	Tully, 1931 (unpublished)
Torres Island	-	Two cases reported	Byrd & St. Amant, 1950
Banks Group	-	One case reported	Byrd & St. Amant, 1950
Espiritu Santo	121	10.7	Buxton, 1928
Espiritu Santo	-	Two cases reported	Byrd & St. Amant, 1950
Pentecost	20	5.0	Buxton, 1928
Maewo	21	0.0	Buxton, 1928
Epi	22	4.5	Buxton, 1928
Malekula	-	One case reported	Byrd & St. Amant, 1950
Tanna	51	2.0	Buxton, 1928
Futuna	-	"Filariasis absent"	Buxton & Hopkins, 1927
4. NEW CALEDONIA			
New Caledonia	-	Elephantiasis frequent	de Rochas, 1862
New Caledonia	-	Prevalent	Seguin, 1891
Mou	57	1.8	Merlet, 1950
Mou	86	1.2	Iyengar, 1954

MAP 2 : SHOWING DISTRIBUTION AND INCIDENCE OF ELEPHANTIASIS


140°
160°E
20°
MARIANAS
ISLANDS
SAIPAN
TINIAN
GUAM
TRUST TERRITORY OF THE PACIFIC
ISLANDS
MARS
ULITHI
YAP
PALAU
PELILIEU
ANGAUR
SONSOROL
TOBI
WOLEI
IFALIK
ELATO
LAMOTREK
TRUK
PONAPE
MOKIL
PINGELAP
KUSAIE
CAROLINE ISLANDS
NUKUORO
WAIGEO
AMSTERDAM
NOEMFOOR
GAMS
SALAWATI
Vogelkop
Inanwatan
Fakfak
BIAK
JAPEN
Waropen
CERAM
KEI IS.
ARU IS.
TENIMBER IS.
NETHERLANDS NEW GUINEA
Hollandia
MATY I.
MANUS I.
Papitalai
ST. MATTHIAS GROUP
EMIRAU
Kavieng
TERRITORY OF NEW GUINEA
NEW IRELAND
MAKADA
Rabaul
Sepik R.
Lambringi
Madang
FORSAYTH
NEW BRITAIN
LIEBLICHE
TAMI
Huon Gulf
Mambare
PAPUA
Fly R.
Purari Delta
Mekeo
Digoel
Merauke
Daru
Pt. Moresby
TROBRIAND IS.
KIRIWINA
GOODENOUGH I.
WOODLARK I.
FERGUSSON I.
NORMANBY I.
Milne B.
LOUISIADE IS.
SAMARAI
SUDEST
ONGTONG JAVA
BOUGAINVILLE
MONO
SOLOMON ISLANDS
YSABEL
MALAITA
Honiara
GUADALCANAL
SIKAIANA
SAN CRISTOBAL
BELLONA
RENNEL
THURSDAY I.
Darwin
Cairns
Townsville
Mackay
Rockhampton
Brisbane
NEW CALEDONIA
QUEENSLAND
AUSTRALIA

THE SOUTH PACIFIC COMMISSION

Commission boundary: ——·——·——

Equatorial Scale in Miles:

0 100 200 400 600 800 1000

MAP 2. DISTRIBUTION AND INCIDENCE OF ELEPHANTIASIS.

References:

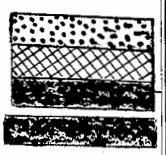
Areas with elephantiasis rate of one per cent or under .. ..

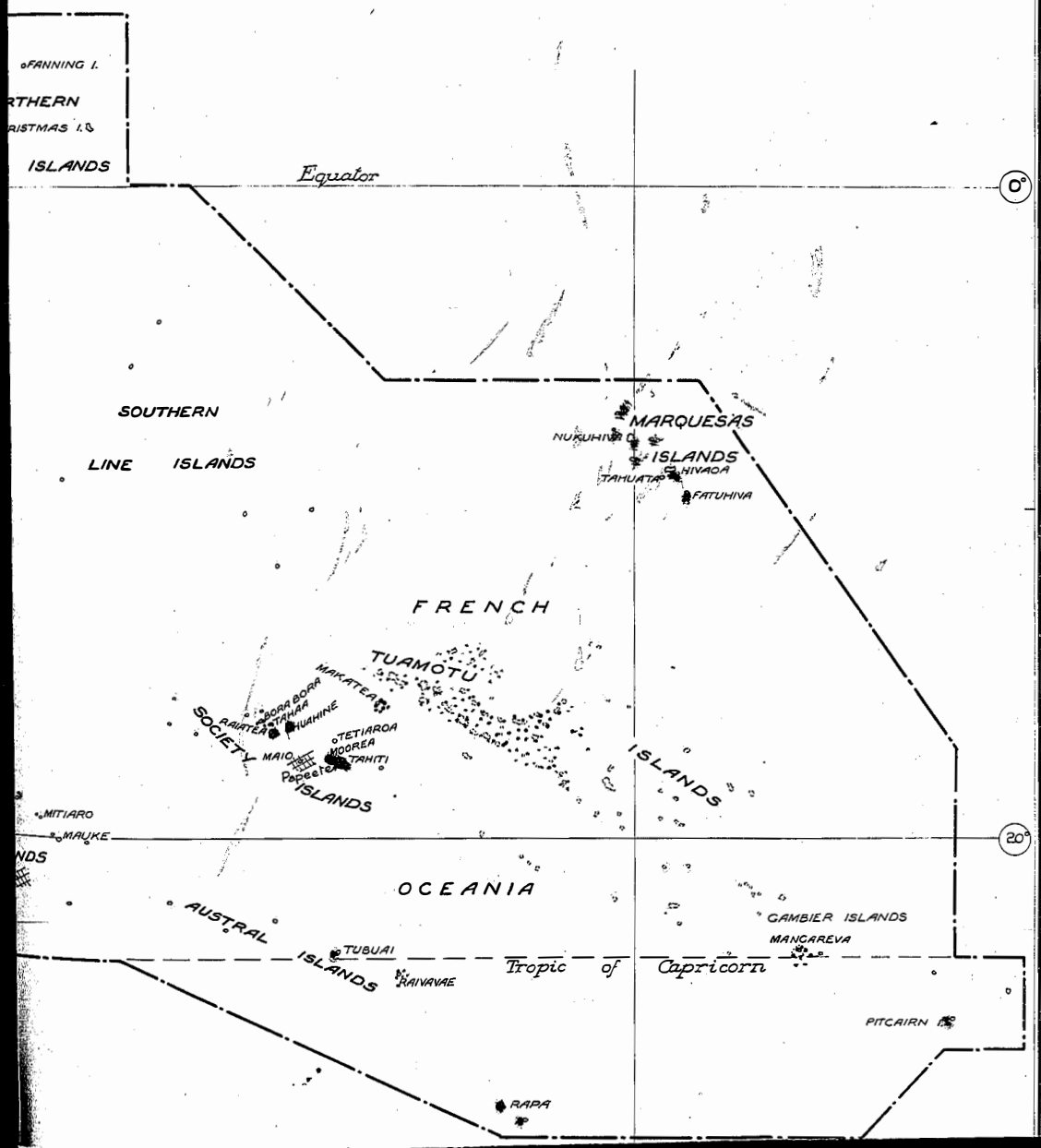
Areas with elephantiasis rate of 1 to 3 per cent .. ..

Areas with elephantiasis rate of over 3 per cent . .. .

Areas reported free from cases of elephantiasis .. ..

Areas with no available data .. ..





PART III

DISTRIBUTION OF THE PERIODIC AND THE NON-PERIODIC FORMS OF WUCHERERIA BANCROFTI IN THE SOUTH PACIFIC REGION

Two forms of Wuchereria bancrofti infection occur in the South Pacific region, (1) the nocturnal periodic form and (2) the non-periodic form. The microfilariae of the nocturnal periodic form are present in the peripheral circulation in fairly large numbers (depending on the intensity of the infection) from about 1800 hours to 0600 hours, with a peak incidence at about midnight. They are practically absent in peripheral blood at noon, except in cases of heavy infection when small numbers of microfilariae could be seen in blood taken at mid-day. In this type of infection, the microfilaria count in a unit quantity of peripheral blood taken at noon is generally, though not invariably, about one per cent of that taken at midnight. The nocturnal periodic form of W. bancrofti infection has a wide distribution throughout the tropical and sub-tropical areas of the world, including parts of Asia, Africa, America and Australia.

The microfilariae of the non-periodic form are morphologically indistinguishable from those of the periodic form. They occur in more or less equal numbers in the peripheral blood at all hours of the day and night. On the basis of several biological differences between the non-periodic form and the periodic form, the name of Wuchereria pacifica was proposed for the former by Manson-Bahr (Trop. Dis. Bull., 38 : 363-367, 1941). Pending the acceptance of this name by systematists, the writer here calls it by the generally accepted name, the non-periodic form of W. bancrofti. This form, unlike the periodic form, has a very limited distribution. From what is known at present, it is restricted in its distribution to the eastern section of the South Pacific region, and has not been recorded from any other part of the world.

Summary data on the findings of the periodic and the non-periodic forms of W. bancrofti in the different parts of the South Pacific region are furnished on pages 32 to 38. The findings are represented on Map 3. The different areas known to have filarial infection are shown under four categories: (1) definitely periodic, (2) probably periodic but lacking definite information, (3) definitely non-periodic and (4) probably non-periodic but lacking definite information. The probable line of demarcation of the geographical distribution of the two forms of W. bancrofti is indicated on this map. This line runs between the Gilbert Islands on the north and the Ellice Islands on the south; it then takes a southerly course between the New Hebrides and the Fiji Islands and then, curving westward, runs between the New Hebrides and the Loyalty Islands.

It was thought that W. bancrofti infection present in New Caledonia was the nocturnal periodic form. This view was based on the observations made on a single case by Leboeuf and Javelly (1911) and on two cases by Bahr (1912). Subsequent observations made by Knott (1946), Levine and Harper (1947), Merlet (1950), Kerrest (1951) and Iyengar (1954), have shown that the infection in New Caledonia is definitely the non-periodic form of W. bancrofti.

The whole of the Gilbert Islands is placed within the area of periodic filariasis on this map. Evidence as regards the type of infection present in the Gilberts is to some extent conflicting. Lambert (1928), Knott (1944) and Farner (1944), specifically state that the infection in the Gilberts is the nocturnal periodic form. Marshall (1945) stated that the infection found on the island of Tarawa was the periodic form, whereas on the adjacent island of Maiana, he felt doubtful about the type of infection, as the data were not sufficiently conclusive. Byrd and St. Amant (1950) observed that in the Gilberts the infection was mostly of the periodic form. Backhouse and Heydon (1950) stated that both the periodic and the non-periodic forms occurred in the Gilberts. Schlosser (1945), from observations made on 27 Gilbertese microfilaria carriers resident in Guadalcanal (Solomons), stated as follows: "Although a nocturnal periodicity is strongly indicated, this phenomenon appears to be less clearly defined than is the case noted for the larvae encountered among the Solomon Island natives." He observed that the total number of microfilariae in blood smears taken at 13.30 hours from the 27 Gilbertese microfilaria carriers he examined, formed 11.3 per cent of the number found in smears taken from the same persons at 19.30 hours. Manson-Bahr and Muggleton (1952), on their map showing the distribution of the periodic and non-periodic forms of the infection, have shown the northern group of the Gilberts as having the periodic form of W. bancrofti, while the southern group is shown as having the non-periodic form.

In view of constant migrations of human population occurring in these areas, it is often difficult to decide whether an infection found in an area is autochthonous or imported. This is likely to happen, especially in areas bordering on the line of demarcation.

On the basis of the available data, and pending further information, all the islands of the Gilberts are provisionally placed within the area of periodic filariasis. Taking into consideration the fact that the vector of the non-periodic form has not been reported to occur on the Gilberts, and also the very low incidence of elephantiasis in the Gilberts, it seems probable that endemic filarial infection on the Gilberts is of the periodic form of W. bancrofti. Byrd and St. Amant (1950) observed that microfilariae found in Gilbertese underwent normal development in Anopheles farauti and A. punctulatus. This is further confirmatory evidence in support of the view that the infection in the Gilberts is the periodic form of W. bancrofti.

Definite information on the type of filarial infection occurring on Rotuma Island is not available. Lambert (1928) mentioned that the filarial

infection on Rotuma was not non-periodic. He stated as follows: "In all these (islands) except Rotuma, the Gilbert Islands and the New Hebrides, the filariasis has been proved to be non-periodic." Manson-Bahr and Muggleton (1952) however, on their map, have shown Rotuma as having the non-periodic infection, and cite Lambert (1928) as the authority.

In view of its geographical position and its affinities with the Polynesian area, Rotuma is provisionally placed within the area of the non-periodic form of W. bancrofti, pending results of further investigation.

As Map 3 represents only endemic filariasis, the occurrence of periodic W. bancrofti infection in Ocean Islanders that have migrated to the island of Rambi near Vanua Levu (Fiji) is not shown on the map. The infections observed in these people do not represent autochthonous filarial infection; they were contracted while they were on Ocean Island (Manson-Bahr and Muggleton, 1952).

SUMMARY DATA ON THE PERIODICITY OF WUCHERERIA BANCROFTI INFECTIONS IN THE SOUTH PACIFIC REGION

Locality	Nocturnal periodic or Non-periodic	Authority
1. NEW GUINEA		
German New Guinea and Bismarck Archipelago	Uncertain	Fülleborn, 1911
German New Guinea and Bismarck Archipelago	Nocturnal periodic	Fülleborn, 1912
New Guinea, New Britain, New Ireland, Matty, St. Matthias, d'Entrecastreaux, Makada and Kiriwina	Nocturnal periodic	Rosen, 1953
Markham area	Nocturnal periodic	Bearup & Lawrence, 1950
Markham area (North)	Nocturnal periodic	Bern & Hansen, 1950
Milne Bay area	Nocturnal periodic	Hopla, 1946
Port Moresby to Mambare Port Moresby to Daru	Both periodic and non-periodic	Breinl, 1915
Purari Delta	Nocturnal periodic	Bearup & Lawrence, 1950
Boven Digoel	Nocturnal periodic	Elsbach, 1937 A
Boven Digoel	Nocturnal periodic	de Rook, 1930
Dutch New Guinea	Nocturnal periodic	de Rook, 1938
Vogelkop, Salawati, Waigeo, Gam, Amsterdam & Noemfoor	Nocturnal periodic	Kariadi, 1937
Matty, Makada and Rabaul	Nocturnal periodic	Backhouse & Heydon, 1950
Umirau	Nocturnal periodic	Levine & Harper, 1947
Kiriwina	Nocturnal periodic	Rappaport (unpublished) 1943
Kiriwina	Nocturnal periodic	Bearup & Lawrence, 1950
Goodenough	Nocturnal periodic	Ford (unpublished), 1938

Locality	Nocturnal periodic or Non-periodic	Authority
2. SOLOMON ISLANDS		
Solomon Islands	Nocturnal periodic	Bahr, 1912
Guadalcanal, Malaita and San Cristobal	Nocturnal periodic	Vincent, 1944
Guadalcanal, Malaita and San Cristobal	Nocturnal periodic	Schlosser, 1945
Florida, Savo, Mono, Guadalcanal, San Cristobal and Malaita	Nocturnal periodic	Rosen, 1953
3. NEW HEBRIDES		
New Hebrides	Nocturnal periodic	Lambert, 1928
New Hebrides	Nocturnal periodic	Buxton, 1928
New Hebrides	Nocturnal periodic	Byrd & St. Amant, 1950
Efate & Espiritu Santo	Nocturnal periodic	Levine & Harper, 1947
4. NEW CALEDONIA		
New Caledonia	Nocturnal periodic	Leboeuf & Javelly, 1911
New Caledonia	Nocturnal periodic	Bahr, 1912
New Caledonia	Non-periodic	Knott, 1946
New Caledonia	Non-periodic	Levine & Harper, 1947
New Caledonia	Non-periodic	Merlet, 1950
New Caledonia	Non-periodic	Kerrest, 1951
New Caledonia	Non-periodic	Iyengar, 1954
5. LOYALTY ISLANDS		
Loyalty Islands	Non-periodic	Levine & Harper, 1947

MAP 3 : SHOWING THE DISTRIBUTION OF THE TWO FORMS OF W. BANCROFTI INFECTION

THE SOUTH PACIFIC COMMISSION

Commission boundary: .—·—·—·—·—

Equatorial Scale in Miles:

0 100 200 400 600 800 1000

IBUTION OF THE NOCTURNAL PERIODIC AND THE NON-PERIODIC FORMS OF ERERIA BANCROFTI, SHOWING PROBABLE LINE OF GEOGRAPHICAL DEMARCATION.

eas with periodic W.bancrofti infection .. ..

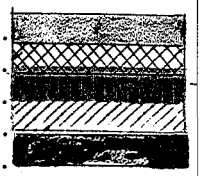
eas probably with periodic W.bancrofti infection .. ..

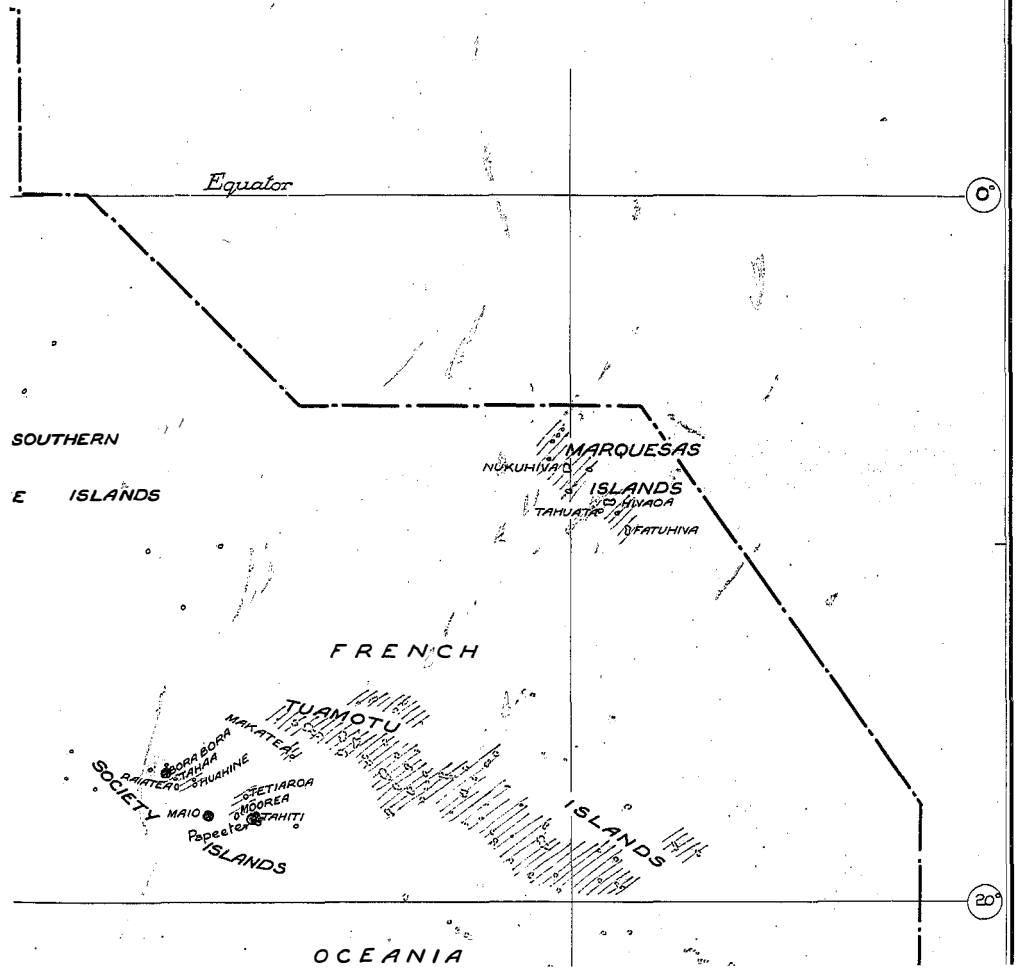
eas with non-periodic W.bancrofti infection .. ..

eas probably with non-periodic W.bancrofti infection .. ..

eas reported free from W.bancrofti infection .. ..

eas with no available data .. ..





PART IV

VECTORS OF FILARIAL INFECTION IN THE SOUTH PACIFIC

Summary data on the findings of natural and experimental infection in different species of mosquitoes in the region are furnished on pages 41 to 47.

The criteria on which a species could be adjudged a primary vector of the infection in an endemic area are the following: (1) the finding of natural infection with filaria larvae morphologically similar to those of Wuchereria bancrofti, (2) presence of infective stage larvae in a fair proportion of naturally infected specimens, (3) experimental susceptibility of the mosquito to the infection prevalent in the area, (4) a marked anthropophilism of the species, and (5) its numerical prevalence in the area. On the basis of these considerations, and with the information available in the summary data, different species are considered as vectors in the respective areas shown on Map 4. Confirmed primary vectors are indicated in red. For several areas with endemic W. bancrofti infection, no information is available as regards the local vectors there. For such areas, on the basis of the type of infection present, the local mosquito fauna and epidemiological evidence, certain species are considered as probable vectors; these are shown in blue on the map. In some areas the primary vector is supported by one or more species that serve as secondary vectors, playing a subsidiary role in the transmission of the infection. These are shown in green on Map 4.

In the coastal areas of the western part of the South Pacific region, namely, New Guinea (including the Bismarck Archipelago), Solomons and New Hebrides, the primary vector is Anopheles farauti, a species with a coastal, flat-land distribution. The distribution of endemic filarial infection in these areas corresponds closely to that of A. farauti. In the flat interior area around Tanah-merah in the upper reaches of the Digoel River, a different species comes into play. Elsbach (1937) has shown that in this area Anopheles bancrofti is the principal vector.

It seems possible that several species like Anopheles punctulatus, A. koliensis and Culex fatigans serve as secondary vectors in different parts of the western section of the South Pacific.

The primary vector in the Carolines appears to be Culex fatigans. Pipkin (1953) found this species naturally infected with filaria larvae in the Palau area. Judged from Pipkin's findings, Culex annulirostris is probably a secondary vector in the Carolines. For the Marshalls and the Marianas, no data are available; it seems likely that Culex fatigans is the main vector in the Marianas and the Marshalls.

For the Gilberts, we have the finding of Stemplen (1944) regarding the suitability of Culex fatigans as an experimental host to the infection

occurring there. Here again it is likely that Culex fatigans is the principal vector.

No data are available for Rotuma and we do not know the local vector of the infection which, as reported by Brunwin (1909) and Lambert (1928), is widespread there.

In the eastern section of the South Pacific region, the main vector is Aedes (Stegomyia) polynesiensis. Most of the previous records of examination of mosquitoes for filarial infection were made prior to the differentiation of Aedes polynesiensis from Aedes pseudoscutellaris by Marks (Ann. Trop. Med. Parasit., 45 : 137-140, 1951). These records were all under the name of Aedes pseudoscutellaris. They have been reviewed in the light of the respective distributions of the two species given by Marks (1951).

Natural infection in Aedes polynesiensis has been recorded from Ellice Islands, Samoa, Cook Islands and Society Islands. This species has also been found to be a very favourable intermediary host to the non-periodic form of W. bancrofti under experimental conditions. For the Tuamotus, Australs, Marquesas, and Tokelaus, we have no definite data; on epidemiological grounds, Aedes polynesiensis is considered the primary vector on all these islands.

In Fiji, natural infection in the mosquito has not so far been recorded. Bahr (1912) has shown that in Fiji Aedes pseudoscutellaris is a very favourable host for the non-periodic form of W. bancrofti under experimental conditions. Marks (1951) has shown that both Aedes polynesiensis and A. pseudoscutellaris (sensu lato) occur in Fiji. On epidemiological grounds it appears likely that both species transmit the infection in Fiji. We, however, await further information on this question.

In Tonga, non-periodic filarial infection is endemic, but we lack information on the local vector. Aedes polynesiensis has not been reported to occur in Tonga. The only species of the Aedes scutellaris group known to be present in Tonga is Aedes tongae. On epidemiological grounds, this species is considered to be the main vector in Tonga.

New Caledonia presents an entirely different picture from the rest of the South Pacific as regards its mosquito fauna. Anophelines are absent in New Caledonia; none of the species of the Aedes scutellaris group is present there. Non-periodic W. bancrofti is endemic in certain coastal areas of the northern part of New Caledonia. It has recently been shown (Iyengar 1954) that the infection is transmitted by Aedes (Ochlerotatus) vigilax, a species that breeds in the brackish water marshes along the coast.

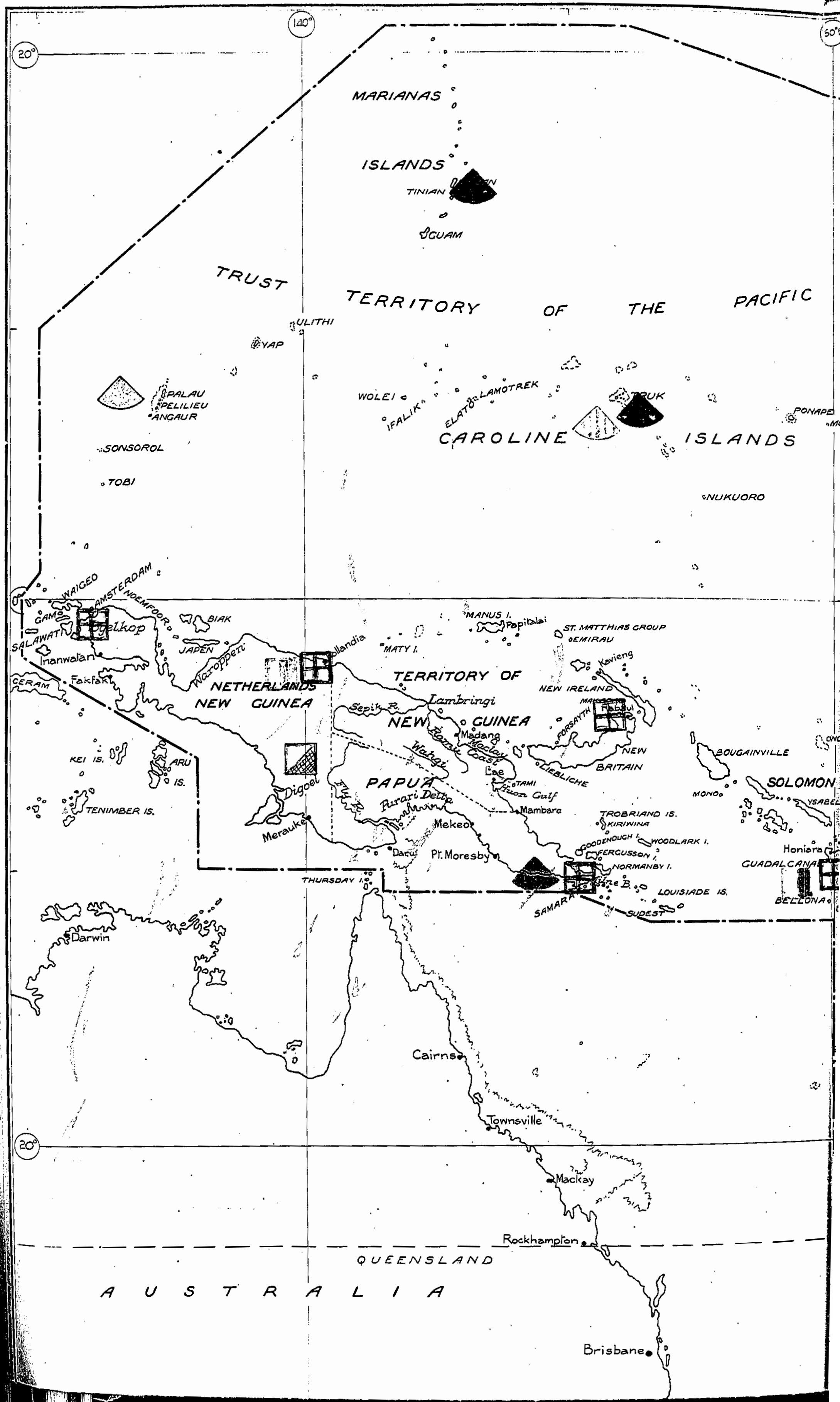
Locality	Species	Natural or Experimental	Number Examined	Infection Rate	Authority
				%	
Makada	Anopheles punctulatus	Natural	5	0.0	Backhouse & Heydon, 1950
Rabaul	Anopheles farauti	Experimental	43	70.0	Backhouse, 1934
"	Anopheles farauti	Experimental	-	20.0	Backhouse & Heydon, 1950
"	Anopheles punctulatus	Experimental	-	33.0	Backhouse & Heydon, 1950
"	Culex fatigans	Experimental	115	7.7	Backhouse & Heydon, 1950
"	Aedes kochi	Experimental		"Hospitable"	Backhouse & Heydon, 1950

2. SOLOMON ISLANDS

Guadalcanal	Anopheles farauti	Natural	-	52.0	Perry, 1946
"	Anopheles farauti	Natural	195	27.6	Schlosser, 1949
"	Anopheles farauti	Natural *	655	51.9	Byrd & St. Amant, 1950
(* Microfilariae in the stomach included)					
"	Anopheles farauti	Experimental *	24	16.6	Byrd & St. Amant, 1950
(* Gilbertese strain of W. bancrofti)					
"	Anopheles punctulatus	Natural	200	15.0	Schlosser, 1949
"	Anopheles punctulatus	Experimental	-	Positive	Schlosser, 1949
"	Anopheles punctulatus	Experimental *	239	7.1	Byrd & St. Amant, 1950
(* Gilbertese strain of W. bancrofti)					
"	Anopheles koliensis	Natural	-	Positive	Reiber, 1945 B
"	Anopheles koliensis	Experimental	-	Positive	Reiber, 1945 B
"	Mansonia (M) uniformis	Natural *	385	23.4	Byrd & St. Amant, 1950
(* Microfilariae in the stomach included)					

Locality	Species	Natural or Experimental	Number Examined	Infection Rate %	Authority
3. NEW HEBRIDES					
New Hebrides Islands	Anopheles farauti	Natural	1,239	13.7	Byrd & St. Amant, 1950
4. NEW CALEDONIA					
Ponérihouen	Aedes vigilax	Natural	141	5.0	Iyengar, 1954
"	Aedes vigilax	Experimental	14	57.1	Iyengar, 1954
5. LOYALTY ISLANDS					
NO DATA					
6. NORFOLK ISLAND					
NO DATA - REPORTED FREE FROM INFECTION					
7. MARIANAS					
NO DATA					
8. CAROLINES					
Palau District	Culex fatigans	Natural	285	4.9	Pipkin, 1953
Truk District	Culex fatigans	Experimental	55	7.2	Pipkin, 1953
"	Culex annulirostris	Natural	211 (One with infective form)	12.7	Pipkin, 1953
"	Culex annulirostris	Experimental	153	16.3	Pipkin, 1953
9. MARSHALL ISLANDS					
NO DATA					

MAP 4 : SHOWING THE PRINCIPAL AND SECONDARY VECTORS OF FILARIAL INFECTION IN DIFFERENT PARTS OF THE SOUTH PACIFIC REGION


140°
20°
MARIANAS
ISLANDS
TINIAN
GUAM
TRUST
TERRITORY
OF
THE
PACIFIC
ULITHI
YAP
PALAU
PELILIEU
ANGAUR
SONSOROL
TOBI
WOLEI
IFALIK
ELATO
LAMOTREK
TRUK
CAROLINE
ISLANDS
PONAPE
NUKUORO
WAIGEO
AMSTERDAM
NOEMFOOR
GAM
SALAWATI
Vogelkop
BIAK
JAPEN
Inanwatan
Fakfak
CERAM
Waropen
Hollandia
NETHERLANDS
NEW GUINEA
KEI IS.
ARU IS.
TENIMBER IS.
Digoel
Merauke
MANUS I.
Papitalai
MATY I.
ST. MATTHIAS GROUP
EMIRAU
Kavieng
TERRITORY OF
NEW IRELAND
Lambringi
Sepik R.
NEW GUINEA
Madang
Rabaul
FORSAYTH
NEW
BRITAIN
Maclay Coast
Ramu
Wahgi
Lae
LIEBLICHE
STAMI
Huon Gulf
Mambare
PAPUA
Fly R.
Purari Delta
Mekeo
Daru
Pt. Moresby
THURSDAY I.
SAMARAI
TROBRIAND IS.
KIRIWINA
GOODENOUGH I.
WOODLARK I.
FERGUSSON I.
NORMANBY I.
LOUISIADE IS.
SUDEST
BOUGAINVILLE
MONO
SOLOMON
YSABEL
Honiara
GUADALCANAL
BELLONA
Darwin
Cairns
Townsville
20°
Mackay
Rockhampton
QUEENSLAND
AUSTRALIA
Brisbane

140°

20°

THE SOUTH PACIFIC COMMISSION

Commission boundary: .—·—·—·—

Equatorial Scale in Miles:

0 100 200 400 600 800 1000

. DISTRIBUTION OF VECTORS OF WUCHERERIA BANCROFTI INFECTION.

ences:

Proved vectors of primary importance - marked in RED

Probable primary vectors (based on epidemiological evidence) - marked in BLUE

Potential secondary vectors - marked in GREEN

Anopheles farauti .. ..

Anopheles punctulatus .. ..

Anopheles bancrofti ..

Anopheles koliensis .. ..

Culex fatigans .. ..

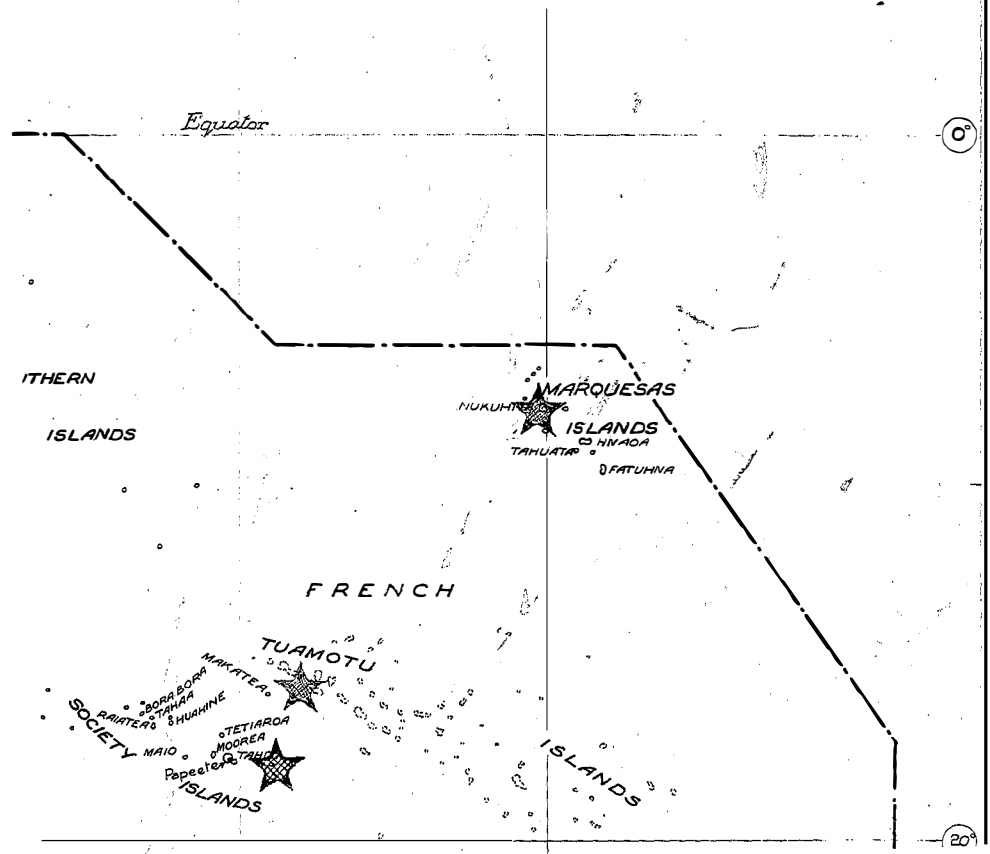
Culex Annulirostris .. ..

Aedes polynesiensis.. .. ..

Aedes pseudoscutellaris. ..

Aedes tongae .. ..

Aedes vigilax .. ..



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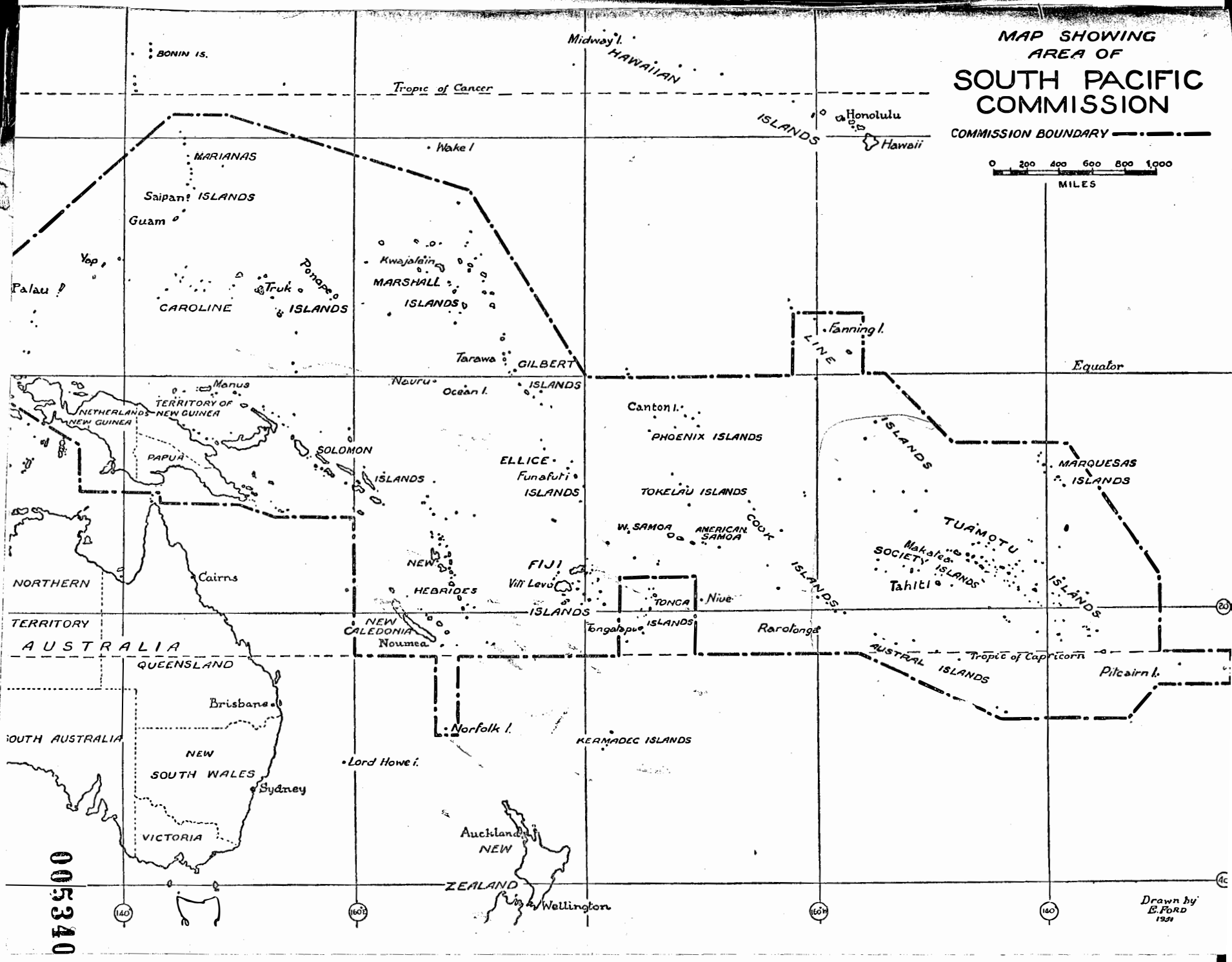
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TOKELAU ISLANDS
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Brisbane
Tropic of Capricorn
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Norfolk I.
KERMADEC ISLANDS
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