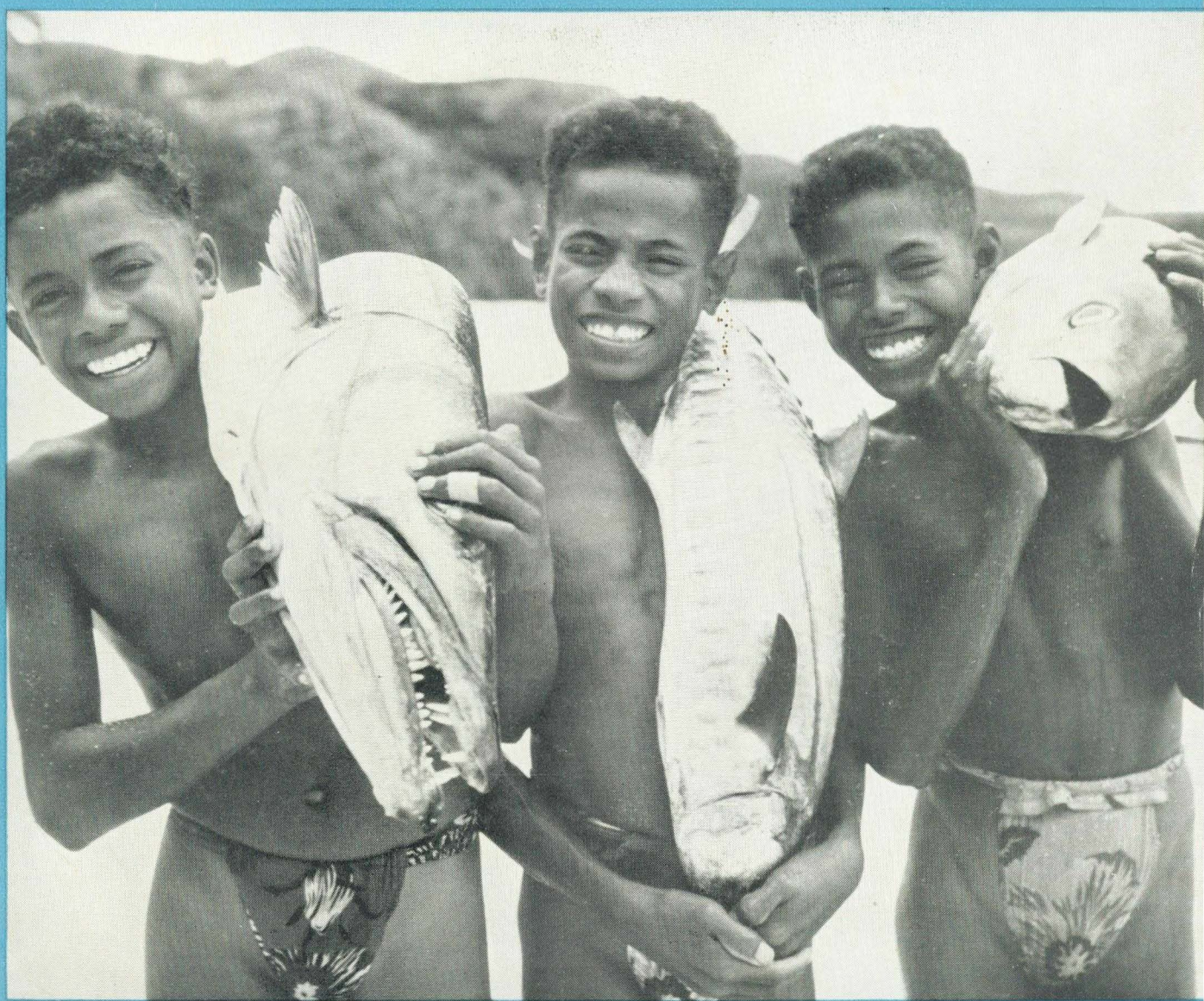
SPC SOUTH PACIFIC COMMISSION

quarterly Bulletin



OCTOBER, 1958

2/6 AUSTRALIAN
● 2/3 FIJIAN ●
30 CENTS UNITED STATES
1 NEW GUINEA GUILDER

2/- STG.

W. R. CARPENTER & CO. LTD.

HEAD OFFICE: 27 O'CONNELL STREET, SYDNEY, N.S.W.

ESTABLISHED 1914 - - - - - *CAPITAL* £2,500,000

Over 40 years of Pacific Island Development and Service

ASSOCIATE COMPANIES THROUGHOUT THE PACIFIC:

NEW GUINEA:	New Guinea Company Limited	*RABAUL, KOKOPO, LAE, MADANG, KAVIENG*
PAPUA:	Island Products Limited	*PORT MORESBY*
FIJI:	W. R. Carpenter & Co. (Fiji) Limited	*SUVA* and *LAUTOKA*
	Suva Motors Limited	*SUVA* and *LAUTOKA*
LONDON:	W. R. Carpenter & Co. (London) Ltd., 13 Rood Lane	*LONDON*, E.C. 3

SOUTHERN PACIFIC INSURANCE CO. LTD. Head Office, 60 Hunter St., Sydney.

BRANCHES AT: SUVA, RABAUL, MELBOURNE AND NEWCASTLE.

BUYERS AND EXPORTERS OF:

COPRA
COCOA
M.O.P. SHELL
TROCHUS SHELL
GREEN SNAIL SHELL
ETC.

COCONUT OIL MILLS:

ISLAND INDUSTRIES LTD.
SUVA, FIJI

COCONUT PRODUCTS LTD.
TOBOI, RABAUL
NEW GUINEA

MERCHANDISE STOCKS CONSISTING OF:

EVERYTHING REQUIRED
IN THE ISLANDS
AVAILABLE AT
ISLAND CENTRES

Inter Island Shipping Services to Plantations in New Guinea and Fiji

DISTRIBUTORS THROUGHOUT THE PACIFIC FOR:—

All types Motor Vehicles, Tractors
and General Merchandise

PACIFIC SHIPPING SERVICE FROM AUSTRALIA VIA NEW GUINEA AND FIJI TO PACIFIC COAST OF CANADA AND UNITED STATES

Subscription Form

SOUTH PACIFIC COMMISSION,
G.P.O. BOX 5254, SYDNEY, AUSTRALIA.

OCTOBER, 1958

I wish to subscribe to the *SPC Quarterly Bulletin* for:

ONE YEAR: Subscription 8/- stg., 10/- Aust., 9/- Fiji, $1.15 U.S., 4G. (N.G.), post free (surface mail)*

THREE YEARS: Subscription 20/- stg., 25/- Aust., 22/6 Fiji, $2.80 U.S., 10G. (N.G.), post free (surface mail)*

Cross out line not required

My remittance for.. .....is enclosed.

Please send me an account covering cost.

Cross out line not required

Name and address .....

(Please use BLOCK letters)

.....

.....

* Rates for postage by air mail will be supplied on request.

Place
Postage
Stamp
Here

The South Pacific Commission,

Box 5254, G.P.O.,

Sydney,

Australia.

The South Pacific Commission

The South Pacific Commission is an advisory and consultative body set up in 1947 by the six Governments responsible for the administration of island territories in the South Pacific region (Australia, France, the Netherlands, New Zealand, the United Kingdom and the United States of America).

The Commission's purpose is to advise the participating Governments on ways of improving the well-being of the people of the Pacific island territories. It is concerned with health, economic and social matters. Its headquarters are at Nouméa, New Caledonia.

The Commission consists of not more than twelve Commissioners, two from each Government. It normally holds one Session each year. There are two auxiliary bodies, the Research Council and the South Pacific Conference.

There is a Research Council meeting once a year. This may be either a meeting of the full Council, or of one or other of its three main sections, specializing in the fields of health, economic development and social development. Members of the Research Council are appointed by the Commission. They are selected for their special knowledge of the questions with which the Commission is concerned, and the problems of the territories in these fields. The chief function of the Research Council is to advise the Commission on what investigations are necessary. Arrangements to carry out those that are approved are the responsibility of the Secretary-General and other principal officers.

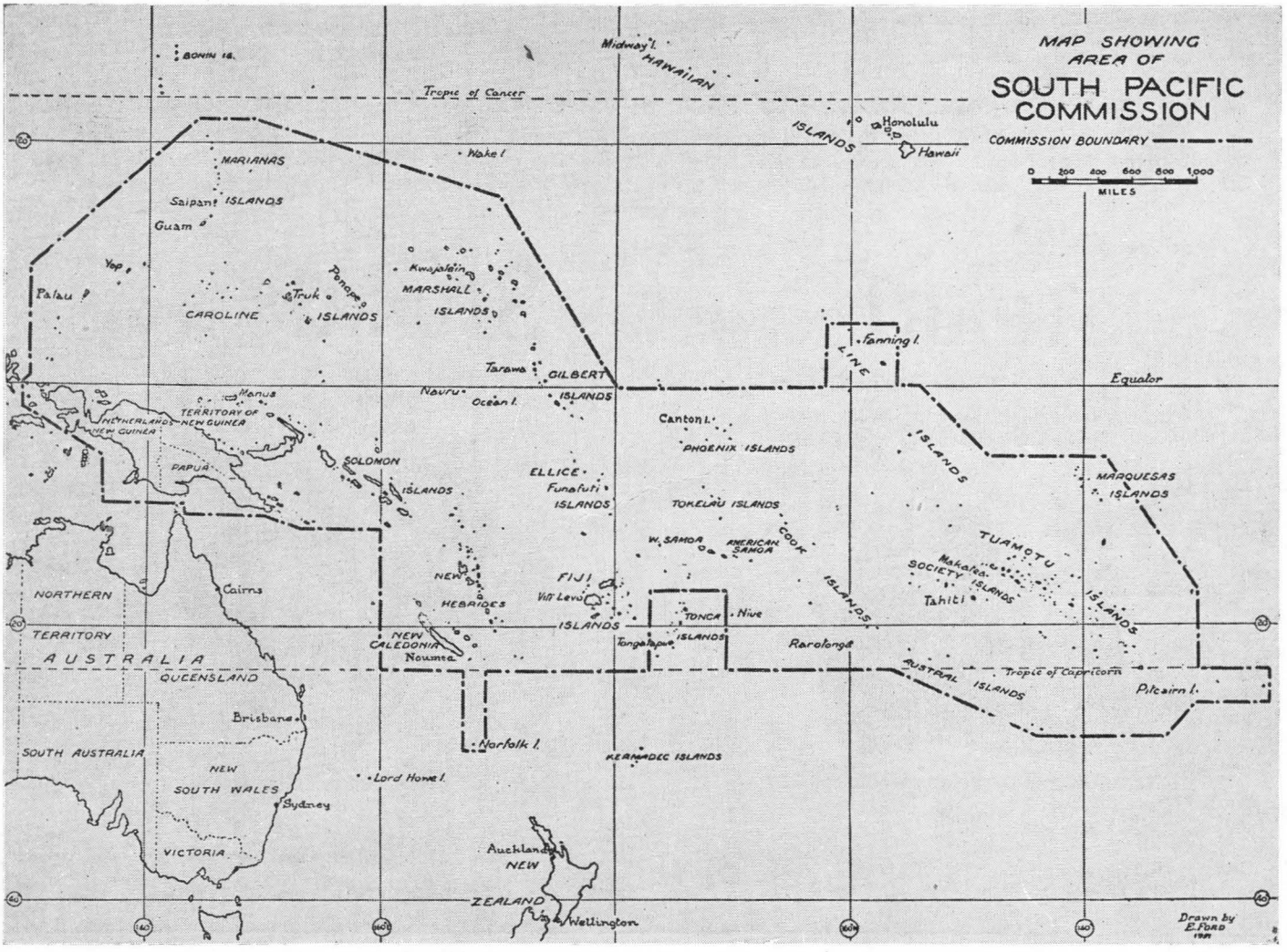
The South Pacific Conference, which meets at intervals not exceeding three years, consists of delegates from the local inhabitants of the territories, who may be accompanied by advisers. The first Conference was held in Fiji in April 1950, and was attended by delegates from fifteen territories and from the Kingdom of Tonga. The second Conference was held at Commission headquarters in April 1953. The third Conference was held in Fiji in April-May 1956.

The principal officers of the Commission are: Secretary-General, Mr. T. R. Smith; Executive Officer for Health, Dr. E. Massal; Executive Officer for Economic Development, Dr. A. H. J. Kroon: Executive Officer for Social Development, Dr. Richard Seddon. The powers and functions of the Deputy Chairman, Research Council, are exercised by the Secretary-General.

Further particulars of the Commission's activities may be obtained from the Secretary-General, Nouméa, New Caledonia.

FRONT COVER PHOTOGRAPH

Fijian boys happily display a trio of fish taken by trolling off the coast of Viti Levu, near Suva. The fish are (left to right): barracouda, Spanish mackerel, yellow fin tuna.



SPC QUARTERLY BULLETIN

VOL. 8. No. 4 OCTOBER, 1958

CONTENTS

THE SPC QUARTERLY BULLETIN, first published in January, 1951, features articles on selected activities in the Commission's three main fields of operation: economic development, health and social development. Articles are also contributed by specialists working in these and related fields, in the territories within the Commission area.

THE BULLETIN is given selective world distribution to people and institutions in widely differing fields sharing a common interest in the purposes and work of the Commission. It is published in two editions, English and French.

SUBSCRIPTIONS and orders for single copies should be directed to: South Pacific Commission, Box 5254, G.P.O., Sydney, Australia. Subscription rates are given in the Table below.

ALL OTHER ENQUIRIES relating to the SPC QUARTERLY BULLETIN should be directed to: The Editor, South Pacific Commission, Nouméa, New Caledonia.

THE ORIGINAL TEXT of all articles is in English unless stated otherwise.

THE COMMISSION does not accept responsibility for statements made in contributed articles.

SPC QUARTERLY BULLETIN: SUBSCRIPTION RATES

PRICE	STG.	AUST.	FIJI	U.S. $	NEW GUINEA GUILDERS
Single copy	2/–	2/6	2/3	0.30	1.00
One year	8/–	10/–	9/–	1.15	4.00
Three years	20/–	25/–	22/6	2.80	10.00

SOAP AND FOOD products of the Unilever companies are well-known throughout the South Pacific.

Copra, from this area, forms the basic material for a number of Unilever products. These products play an important part in improving hygiene and providing attractive, nourishing foods for the rapidly growing white and native populations of Papua, New Guinea, the Solomon Islands, New Caledonia, New Hebrides, Samoa, the Fijian Islands and Tahiti.

The complete Unilever range of food and soap products is available through Wholesale, Retail and Indent Houses in all areas.

Export Division,
J. KITCHEN & SONS PTY. LTD.,
representatives for the Unilever Organisation,
Lever Brothers Pty. Ltd., J. Kitchen & Sons Pty. Ltd.,
and World Brands Pty. Ltd.

JR.36.SPIM

A YEAR OF OPPORTUNITY FOR COPRA PRODUCERS

The Ministry of Food's contract expired at the end of 1957. This has opened the field to far more competition and it is the producers of the highest grade copra who will command the market — make sure of your full share!

Invest in a "Chula" Copra Dryer now! "Chula" Copra dryers are designed to operate in all climatic conditions and will produce a purer copra, free from mould or discolouration. Available in models designed to process from 1300 to 15,000 coconuts in 24 hours.

Are you growing Rubber ? Then you should know more about the "Huttenbach" Rubber Machinery. You will find "Huttenbach" an invaluable asset on your plantation.

For full particulars contact our agents or write direct to :-

TYNESIDE FOUNDRY & ENGINEERING CO. LTD.

Skinner burnRoad, NEWCASTLE UPON TYNE, ENGLAND.

Agents

PAPUA. The B.N.G. Trading Co. Ltd., Port Moresby.

NEW GUINEA: Burns Philp (New Guinea) Ltd. Port Moresby. Rabaul, Lae, Madang and Kavieng.

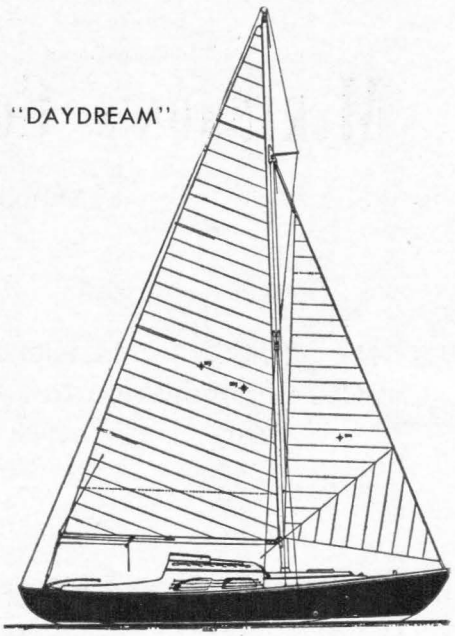
FIJI, SAMOA, TONGA. Morris Hedstrom Ltd., Suva, Fiji.

SOLOMON ISLANDS: Mendana Enterprises Pty. Ltd. P.O. Box 73, Honiara.

YACHT PLANS

FOR AMATEUR BUILDERS

"DAYDREAM"



"DAYDREAM", No. 536, a sloop suitable for harbour or ocean cruising. L.O.A., 27 feet 6 inches. L.W.L., 21 feet 6 inches. Beam, 8 feet. Draught, 4 feet 3 inches. Sail area, 325 square feet. Displacement, 5,200 lbs. Ballast, 1,000 lbs. Good cruising accommodation for three in full-length berths. Price, 189/-.

"GANNET", No. 530. A miniature yacht sloop rigged. L.O.A., 19 feet. L.W.L., 16 feet. Breadth, 6 feet 6 inches. Draught, keel only, 1 foot 9 inches; with centreboard down, 3 feet 6 inches. Displacement, 2,600 lbs. Ballast, 600 lbs. Sail area, 156 square feet. Camping berths for two. Construction of marine plywood built-up frames. 3½ h.p. motor. Price, 126/-.

"BLUEBIRD", No. 521, popular small sloop suitable for building yourself. L.O.A., 22 feet. L.W.L. 18 feet 4 inches. Beam, 7 feet 4 inches. Draught, 3 feet 10 inches. Sail area, 218 square feet. Displacement, 3,500 lbs. Ballast, 1,000 lbs. Large cockpit and 2-berth accommodation in cabin. Price, 147/-.

"CORMORANT", No. 529. Shoal draught, hard chine sloop constructed of plywood on built-up frames. L.O.A., 24 feet. L.W.L., 19 feet 9 inches. Breadth, 7 feet 8½ inches. Draught, keel only, 2 feet 3 inches; with centre-board down, 4 feet 1 inch. Displacement, 4,150 lbs. Ballast, 1,250 lbs. Three berths. Sail area, 242 sq. ft. Engine, 3½ to 5 h.p. Price, 147/-.

PLANS MAY BE PURCHASED BY MAIL ORDER

Send for Price List

PAYMENTS:

Within Australia, add 1/6 for wrapping and postage by ordinary mail, and send the total by money order, cheque or postal note. Outside Australia, please send only Banker's Draft or International Money Order.

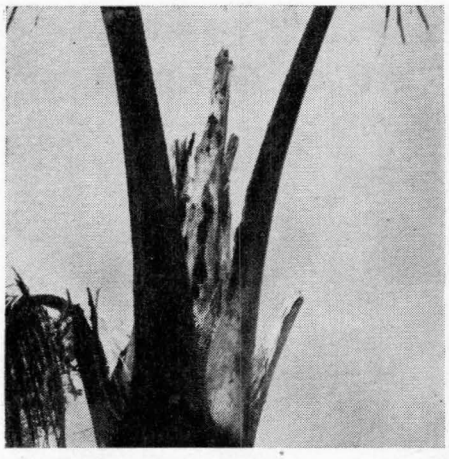
BOAT PLANS PTY. LTD.

841 GEORGE STREET, RAILWAY SQUARE
(Next to Marcus Clark's)
SYDNEY

BA 2467 Box 3923, G.P.O.

READ "BUILD-A-BOAT" HANDBOOK FOR AMATEURS

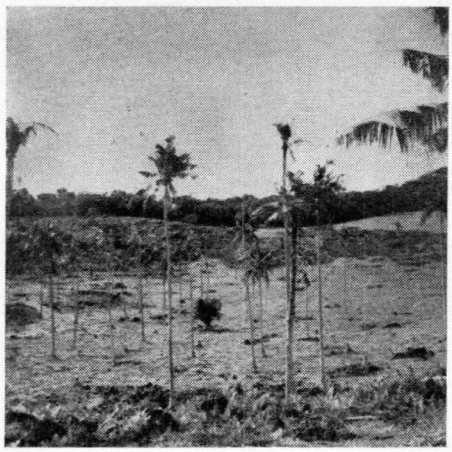
Price 8/6, plus 1/6 wrapping and postage



THE RHINOCEROS BEETLE IN WESTERN SAMOA

Top left: Coconut palm killed by Oryctes. Centre: Dr. Paul Surany and Dr. R. A. Cumber investigating a typical breeding site of Oryctes. Right: Rhinoceros beetle larvae collected by workers on a badly-infested plantation.

Left: Plantation devastated by Oryctes. Left, below: If left uncleared, felled jungle provides ideal breeding sites for the beetle.



Rhinoceros Beetle Control In The South Pacific

During the past fifty years the copra industry, main income-earner in the Pacific, has suffered incalculable losses due to the rhinoceros beetle. Accidentally introduced into Western Samoa in 1909, this pest has since spread to other islands. Last reported infestation is in Viti Levu in the Fijian Group, where since 1953 over a quarter of a million pounds has been spent on control measures. Below is a brief account of the history of the beetle in the Pacific and of the various campaigns and research projects developed in an attempt to control it.

By CHARLES P. HOYT*

FOLLOWING its introduction into the South Pacific in 1909 the coconut rhinoceros beetle, *Oryctes rhinoceros* (Linn.) has proved a serious pest of the coconut palm. This large beetle is of one of the forty-odd species which compose the genus *Oryctes*. This genus, together with eighty other similar genera, some of which are also serious pests of coconuts as well as of other cultivated tropical crops, make up the sub-family Dynastidae, a major division of the family of beetles, the Scarabaeidae.

The majority of the species of *Oryctes* occur in Madagascar and Africa. However, *Oryctes rhinoceros* seems to be confined to India, Ceylon and South East Asia.

Possibly in a shipment of potted rubber plants from this region the beetle was introduced into Samoa in 1909. From there it has spread to other islands in the South Pacific. It was found in Wallis Island in 1931, the Vava'u group (Tonga) in 1951 and on the island of Viti Levu (Fiji) in 1953.

From elsewhere in South East Asia the beetle reached the Palau Islands, New Britain and New Ireland during the war years of 1942-1945. The beetle is present in several localities in Netherlands New Guinea, both on adjacent islands and on the mainland, although when these introductions took place is not known.

In keeping with the habits of many other members of the sub-family, *Oryctes rhinoceros* is a pest only in the adult stage. The large adult beetles fly into the crown of a coconut or other favoured palm and chew a tunnel into the embryonic tissues. The beetle feeds on this tissue, and after a day or so leaves the crown and seeks shelter in a rotten log, compost pile or similar debris. Here mating takes place and the eggs are laid.

The resulting larvae feed on the rotting vegetable matter and complete their development in about three months. Pupation takes place in the compost and the adults emerge after a period of about twenty-four days. Evidently several feedings are necessary for the adults to reach full reproductive capacity.

Observations made in Western Samoa indicate a life span for an adult beetle

* Technical Officer, Pests and Diseases, South Pacific Commission.

Principal building and entomological department of the Madagascar Institute of Scientific Research, located at Tananarive. Last January the Institute began a Commission-sponsored investigation into factors affecting the lives of the various native rhinoceros beetles found in Madagascar, in an attempt to discover parasites and predators that will be useful in the Pacific.

to be about four months (Cumber, 1957).

Beetle Damage In The Pacific

Throughout its entire range there are many records of serious outbreaks and extensive damage by the beetle to coconut palms. Probably the most serious in recent times was that on the islands of Peleliu and Angaur (Palau Islands) where hundreds of war-killed palms provided ideal breeding grounds for the beetle, and the resulting population rose to such a level that nearly all of the bearing palms on the islands were killed. The beetles were able to sustain themselves by using pandanus as an alternative host and so complete the destruction of the coconuts unchecked (Gressit, 1953).

Following the introduction of *Oryctes rhinoceros* to the Gazelle Peninsula of New Britain, the beetle, together with one of the native dynastid rhinoceros beetles (*Scapanes grossepunctatus*) has accounted for the death of a very high percentage of newly-planted palms. In this area the young palms appear to be favoured over the mature palms, though at times these also may be badly damaged. Perhaps the presence of the red palm weevil, *Rhynchophorus*, which has a habit of breeding in the tunnels made by *Oryctes* in the crowns of the palms, has contributed substantially to the extreme destructiveness experienced in this region.

In contrast to the situation found in Samoa, damage done by the beetle in New Britain declines sharply with increase in altitude, the badly-damaged palms being restricted to the coastal belt, while those growing several hundred feet up on the mountain slopes show little or no damage.

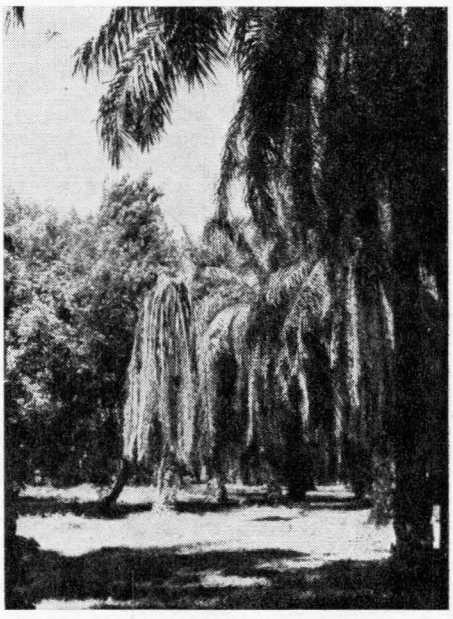
In other areas of New Guinea also, the dynastid beetles, *Scapanes australis* and *S. grossepunctatus* at times assume serious proportions and do extensive damage to new plantings of coconuts. In addition, the elephant beetle, *Xylotrupes lorquini* (another dynastid), has been found, in the Solomon Islands as well as in New Guinea, to damage bearing palms by hollowing out the spadices with the resulting complete loss of production of nuts.

Since the beetle became established in Samoa it has maintained a high but stable population, and few devastating outbreaks have occurred. Recently, clean-up campaigns conducted in Western Samoa have again showed that beetle populations can be reduced by these somewhat laborious methods.

Fiji, by means of an extremely thorough and also expensive campaign consisting of clean-up measures, treatment of coconut palm crowns with insecticides, ordinances and appeals to civic groups, has one of the lowest populations of *Oryctes*. The main effort in Fiji has been to prevent the beetle from spreading to the outer islands from Viti Levu. To date this has been successful (O'Connor, 1953, 1957).

Control By Eliminating Breeding Material

The most satisfactory method, from the standpoint of reducing the damage done by these beetles, no matter what the cost, has been by the elimination of all types of breeding material. Decaying coconut logs, stumps, sawdust piles, compost pits and rubbish heaps as well as decaying wood of all kinds are disposed of by burning, or by being thrown into the sea or rivers. If these breeding sites are properly eradicated, the populations of beetles in the area immediately begin to decline. The tendency, however, has



Left: Young coconut palm nearly killed by Oryctes, Keravat, New Britain. This palm is part of an experimental planting of selected coconuts at the Lowlands Experimental Station. Over half have been killed by Oryctes. Right: Oil palm on the Station (background, left) killed by Oryctes attack. These palms are fairly resistant to the beetle and are seriously damaged only when subjected to continuous attack by large numbers of the pest.

been to clean up the obvious breeding places and to neglect those in the more inaccessible areas.

Examples of this type of control are many, the most spectacular being the eradication of *Oryctes rhinoceros* from the small (six square miles) Keppel Island after six years of intensive effort. Similar campaigns carried out in the Palaus, Fiji, and more recently in Western Samoa have all been successful from the standpoint of limiting damage, although the areas involved are far too great to expect eradication of the pest.

In addition to the elimination of breeding sites, numerous supplementary control measures have been tried and suggested.

It has been shown that certain cover crops and inter-planted shade trees serve as shields against the adult beetles. Also, closely-spaced palms seem much less susceptible to intensive attack than the wider-spaced trees of many plantations (Cumber, 1957).

Pit And Log Traps

Trapping the beetles has always received considerable attention. The first traps were made by filling shallow pits with all manner of vegetation and allowing it to decompose (Jepson, 1912). These pits were difficult to search and the insecticides and fumigants available at the time were expensive or otherwise unsuitable for large-scale use.

Leefmans (1920) remarks that hand searching of compost piles will probably be cheaper than the use of chemical fumigants or insecticides. While this may have been true for Indonesia, it has not been found so for the Pacific area. In addition, there was also considerable danger that traps of this nature might be overlooked or forgotten and thereby become important breeding sites for the very insect that they were supposed to control.

Pit traps were abandoned until recently when the development of insecticides, such as benzine hexachloride, made their revival possible in the Fiji campaign. However, these pit traps poisoned with insecticide, while not becoming breeding sites, were disappointing in the number of beetles attracted (O'Connor, 1953).

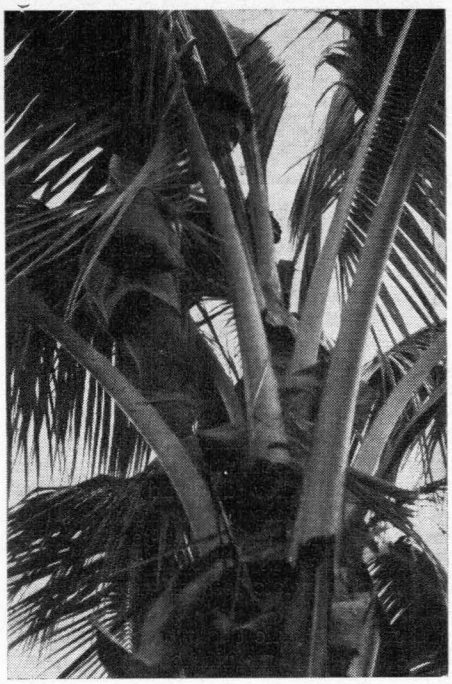
Log traps made of eight or more six-foot lengths of coconut logs split lengthwise and laid flat side down on the ground are still in use in Samoa on some plantations. These traps are placed around the margins of the plantations to try to reduce the numbers of beetles coming in from adjacent areas. The traps are searched regularly by teams of men who capture and destroy the adult beetles which gather beneath the split logs.

Both pit and log traps are of value when used in conjunction with an intensive clean-up campaign of the breeding sites. However, neither of them produces good results if they are being operated in competition with natural breeding places.

Control By Insecticides

Breeding materials, such as large sawdust piles, have been successfully controlled by the use of insecticides in Fiji, Western Samoa and elsewhere. Aside from the use of chemicals to kill beetle larvae in these places, recent experimentation with DDT, BHC and Dieldrin has shown that under certain conditions these insecticides will kill adult beetles when they visit the crowns of the palms.

In Fiji, BHC in the form of a wettable powder of 50% content containing 12% gamma isomer is mixed in the ratio of 1 part insecticide to nine parts sawdust and the mixture is packed into the bases of the young fronds. Cage experiments using this mixture indicated that 100% mortality was obtained in about 12 hours



In the beetle-infested area of Viti Levu, a Fijian treats a palm crown with a mixture of B.H.C. insecticide and sawdust, applied through a funnel.

(O'Connor, 1953). Recent experiments carried out in Western Samoa using the same mixture as Fiji have given promising results.

However, regardless of the results, this method is slow and laborious and therefore costly. Each palm must be climbed and hand treated at intervals of about three months. The campaign carried out in Fiji where great numbers of palms were so treated (300,000 per year) costs in the neighbourhood of £55,000 per year (O'Connor, 1957). It could be that this type of control would be practical for the treatment of young palms (which could be treated without having to be climbed), but even this would depend entirely on the local situation.

Biological Control

The discovering of natural enemies of *Oryctes rhinoceros* and related dynastid beetles has been of interest to all concerned for nearly as long a period as have the ravages of these pests. The successful introduction of *Scolia oryctophaga* from Madagascar to Mauritius in 1917, and its control of *Oryctes tarandus* in the sugar-cane fields there, showed clearly that at least some species of this genus were subject to biological control methods.

Perhaps the relatively slow and somewhat erratic progress in the search for biological control agents has been due to the abundance of cheap labour in the coconut growing areas, enabling the plantations to be kept free of all beetle breeding sites, as well as the loss of interest in copra production, due to low prices coupled with the feeling on the part of planters and government agriculturalists that each particular area contained some unknown natural factor which kept the beetle population down.

Unfortunately, this last idea has been disproved with disastrous results, for, following the last war, conditions in the coconut growing industry have changed, and labour in many places is unavailable with the result that the plantations have become littered with stumps, logs and dead trees, and the beetle populations have risen alarmingly.

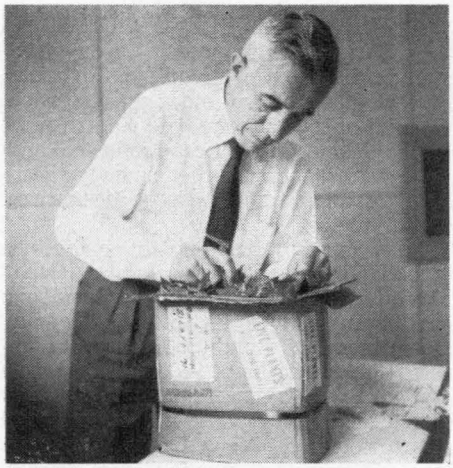
The recent spread of the rhinoceros beetle in the Pacific islands has raised another problem. Coconut palms in many of the islands are not grown as a plantation crop, but are allowed to grow in a haphazard manner and the crop used as needed for food, building materials and only secondarily for copra, which is sold whenever the need is felt for money. Sanitary measures in the coconut groves are almost impossible to maintain, and these places serve as a potential source for beetles.

Following the clearing of new lands, or catastrophes such as wars or hurricanes, large amounts of dead wood and other vegetable trash are liable to become suddenly available to the beetles, with the result such as that experienced in the Palaus of nearly a complete loss of the palms. The problem then is not solvable in terms of plantation control alone. Even effective insecticides do not offer much hope if outbreaks should occur in isolated islands, as these control methods would never be used until the outbreak was well under way, and by that time much of the damage would have been done.

SPC Beetle Control Programme

Following the introduction of the coconut rhinoceros beetle into Fiji in 1953, the South Pacific Commission initiated a programme to study the various possible means of control of this pest. Initially this programme consisted of investigations of the habits of the pest in Western Samoa and a search for

(Continued on page 45)



SPC Plant Introduction Service Steadily Expands

Left: Dr. Alex Kroon, who is in charge of the Commission's economic development programme, examines a consignment of fifty-five coffee seedlings from Puerto Rico on their arrival in Noumea. They had been flown from the West Indies via the United States, where they had been kept in quarantine for several weeks at the Department of Agriculture's plant industry station at Beltsville, Maryland. Right: The Commission's plant introduction officer, Dr. Jacques Barrau, prepares a consignment of seeds for despatch to territories.

Since October of last year the Commission's plant introduction service has, in response to requests from territories, distributed among them planting material of 112 species and varieties of economic plants. How this new service operates is explained below . . .

By JACQUES BARRAU*

IN the *Quarterly Bulletin* for January last, the importance of plant introduction and exploration was discussed in relation to the economic development of the South Pacific region.

Since this article was written the South Pacific Commission's activities in that field entered a new phase. While the reorganization of Naduruloulou Plant Introduction and Quarantine Station has been progressing, considerable quantities of seeds and plant material have been introduced and distributed in the islands through the Commission's plant introduction service. A survey of the economic flora of the South Pacific Islands, by species and varieties, has been undertaken, special attention being paid to breadfruit. Lastly, a fair amount of plant material of economic value has been collected in the area.

It could be of interest to review these activities and to draw some practical conclusions to be applied for future development in that field.

* Plant Introduction Officer, South Pacific Commission.

Plant Material Introduced And Distributed

Since October 1957 planting material of 112 species and varieties of economic plants has been distributed through the SPC Plant Introduction Service (this does not include the material from Naduruloulou Plant Introduction and Quarantine Station distributed during 1958).

The territories benefiting from this distribution were the Solomon Islands, New Hebrides, Fiji, French Polynesia, Netherlands New Guinea, New Caledonia, Niue Island, Papua and New Guinea, and Western Samoa.

The material distributed included 11 species of bamboos, 10 varieties of *Coffea arabica*, 12 varieties of *Coffea canephora* or "Robusta" coffee, 5 other species of coffee (*Coffea abeokutae, C. bengalensis, C. eugenioides, C. liberica* and *C. steno-*

Above: The Arabica coffee collection at Naduruloulou plant introduction station, Fiji. Right: The new extension of the black pepper collection.

A cocoa plot at Keravat Lowlands Agricultural Experiment Station in New Britain. The trees are close on three years old, and are just coming into bearing.

phylla), 19 varieties of maize, rice and sorghum, 6 varieties of castor bean, 2 varieties of sunflower, 37 species and varieties of legumes useful as food plants or cover crops, etc.

In addition, arrangements have been made for the introduction of coffee varieties (*Arabica* and *Robusta*) in the Solomon Islands, Fiji and Netherlands New Guinea; cacao varieties in Netherlands New Guinea ("Lafi 7") and the Solomon Islands ("Amelonado"), both varieties being found in the Commission's area; Polynesian seedless breadfruit in the Solomon Islands; and fruit trees in the Solomon Islands (Avocado varieties) and Netherlands New Guinea (various species and varieties of citrus).

All this material was introduced into the various territories following requests, which are increasing steadily.

Survey Of Economic Flora

A survey by species and varieties of economic plants grown in the South Pacific area has been undertaken. So far the following territories have been covered: Solomon Islands, Netherlands New Guinea, New Caledonia and the Loyalty Islands, Papua and New Guinea, Fiji and French Polynesia.

When all territories within the Commission's area have been visited, a catalogue of economic plants found in these islands will be prepared. This will greatly facilitate inter-territorial exchanges of plant material.

In the scope of this survey, and in accordance with decisions made by the Commission, special attention has been paid to breadfruit and its varieties. The variation of breadfruit has been studied mainly in order to find a reliable means of describing the numerous varieties of this food plant. This classification study also acknowledges the fact that, under the general name of breadfruit, there is a possibility that several different species may be found; which would be a factor of importance for the improvement of this crop.

A further special study of breadfruit varieties, mostly on factors affecting their fruiting time, has also been undertaken. It has already been verified that fruiting times vary not only with ecological conditions, i.e. climate and soil, but also with variety.

Breadfruit is certainly one of the most typical and popular food plants in many territories within the South Pacific Commission's area. Nevertheless, knowledge of this plant is far from complete, and many commonly-accepted ideas about it have yet to be verified.

Literature on the subject is limited, except for the taxonomical study made by Trécul, published in 1847, the two papers on breadfruit varieties (one by Wilder for Tahiti, and one by Sasuke for Ponape) and the information on breadfruit that can be found in some floras of the Pacific Islands such as Seeman's *Flora Vittensis*.

It seems that a monograph dealing with this plant could fill an important gap, and one will therefore be prepared at the end of the present survey.

Plant Exploration And Collection

As a substantial quantity of plant material has been obtained from overseas sources, seeds or other propagation material of several economic plants found in the Islands have been collected and sent overseas, either on an exchange basis or to assist in research work of interest to our region.

For instance, seedlings of mangrove species (*Bruguiera eriopetala* and *Rhizophora mucronata*) from New Caledonia have been sent to Professor Chapman, Department of Botany, Auckland University, New Zealand; seeds of *Duboisia myoporoides*, a medicinal plant from New Caledonia, to the U.S. Department of Agriculture, New Crops Research Branch, and the "Section des Plantes Aromatiques et Médicinales, Office de la Recherche Scientifique et Technique d'Outre-Mer" at Paris, France; and seeds found in Fiji of two varieties of *Cyamopsis psoroaloides* (guar bean) to the Plant Introduction Section, Division of Plant Industry, C.S.I.R.O., Canberra.

This was done in addition to the collection and distribution overseas of other plant material already mentioned in the July *Quarterly Bulletin* (wild and cultivated bananas, a wild relative of the tobacco, and taro, *Colocasia esculenta*, seeds).

In order to check the botanical identification of some economic plants, a fairly large number of plant specimens was also collected. In this connection, special attention was paid to less-known economic plants of the area, such as nut trees of the genus *Barringtonia* and *Finschia*.

Close contacts have been maintained with leading overseas agencies working in the field of economic botany, South Pacific botany or plant introduction, e.g. the U.S. Department of Agriculture, New Crops Research Branch; Kew Royal Botanic Gardens in England; the "Section des Recherches Agronomiques" of the French "Office de la Recherche Scientifique et Technique Outre-Mer," the herbarium of the Bernice P. Bishop Museum, in Hawaii, etc.

Lessons From This Year's Experience

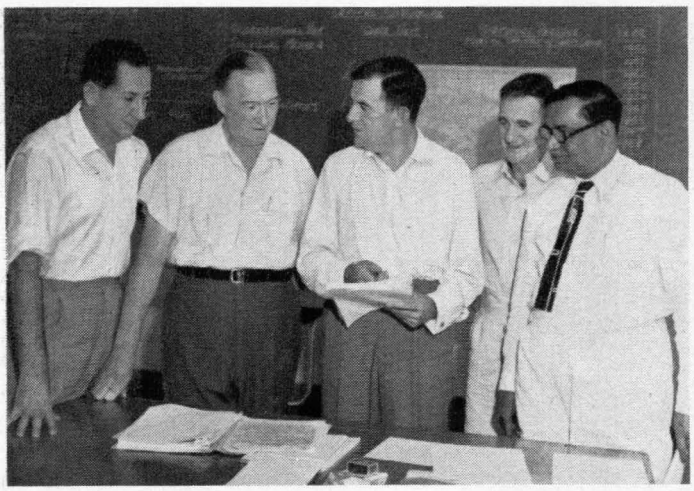
The SPC Plant Introduction Service has been established for almost a year, and it now seems possible to draw some practical conclusions from its activities.

First of all, it is obvious that the importance of this service as a regional agency is increasing. Even well-equipped territories are now requesting our assistance to obtain plant material they need.

Requests received from the islands cover a wider range of economic plants than those to which priority had been given. For instance, cereals such as maize, rice and sorghum are in frequent demand, as well as cover crop legumes.

Although the requests received show clearly the practical usefulness of the

(Continued on page 33)



An informal discussion during the meeting. Left to right: Mr. C. G. Joannides (SPC co-operatives officer), Mr. Kelsey B. Gardner (United States observer), Dr. Richard Seddon (SPC executive officer for social development), Mr. I. Cartledge (observer for Australia), Mr. J. C. Ryan (FAO observer). Dr. Seddon was Chairman of the meeting.

The assembly hall of the Co-operative Educational Centre at Konedobu, near Port Moresby, where the meeting was held. The Centre was established to train students for positions with native co-operative societies throughout Papua and New Guinea.

SPC Meeting On Pacific Co-operatives

That co-operatives in the Pacific will benefit greatly from the discussions and exchange of views that took place at the Commission's technical meeting on co-operatives held in Port Moresby last July was the unanimous opinion of those who attended.

By RICHARD SEDDON*

THE Commission's technical meeting on co-operatives opened as planned at the Co-operatives Education Centre, Port Moresby, on July 21. In a brief opening statement the Commission's Executive Officer for Social Development, who had been appointed chairman of the meeting, explained how it formed an integral part of the Commission's work programme and commented on the growing importance of co-operatives in the economic and social advancement of the South Pacific peoples.

The meeting was then addressed by His Honour the Administrator of Papua and New Guinea, Brigadier D. M. Cleland, who after welcoming participants and observers to the territory, went on to pose some questions which he considered merited attention by the meeting. His Honour said:

"This meeting is a most important one. During its proceedings you will be making an examination of some of the problems of economic development of the peoples of the South Pacific and, in the course of that examination, you will be assessing the significance of the co-operative movement within that development.

"You believe, as we do, that co-operatives are important agencies for the promotion of social progress. On the other hand, I think that your meeting should endeavour to find ways and means whereby the co-operative movement of each territory in the Commission area can become a better agency of self-help by the people themselves, and how it can make the task of government easier.

"You should also determine, as far as you can, what are the limitations of the movement, on the understanding that co-operatives are not the only means of promoting and assisting economic activity."

Ample evidence that these questions were not neglected in the ensuing discussions, which occupied the full two weeks of the meeting, is provided in the report which the meeting adopted for transmission to the Commission. The discussions leading up to the final report were at all times free and frank, and every part of the agenda which had been approved for the meeting was given thorough consideration.

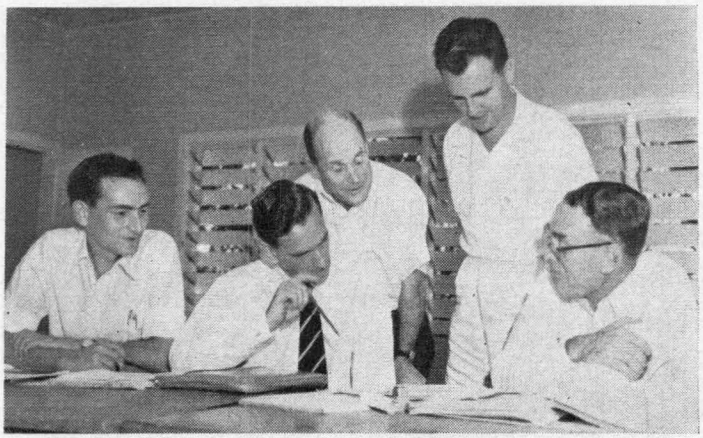
A prime objective of the meeting was to provide an opportunity for officers of territorial administrations, and for specialist co-operative officers, to discuss their problems and to exchange views and experience. It was quite obvious during the whole period of the meeting that those attending welcomed this opportunity and put it to very good use.

With participants present from the Solomon Islands, the Cook Islands, Netherlands New Guinea, Papua and New Guinea, Western Samoa and the South Pacific Commission, it was possible to bring a wide range of territorial experience to bear on the many problems raised, while the official observers for the Governments of Australia and the United States of America and for the United Nations Food and Agriculture Organisation materially assisted the deliberations of the meeting through their first-hand experience of co-operative developments in many other parts of the world.

The outstanding feature of the various discussions was their thoroughly practical nature. At no stage were actual conditions within the territories lost sight of, and the report that has been presented to the Commission reflects this approach. The trend of the discussions largely followed the agenda approved for the meeting, but one or two other matters whose importance had perhaps not been fully appreciated were also given thorough consideration. Notable among these were the questions of capital formation in co-operatives, and the relation of credit and marketing.

In considering the place and practical value of co-operative organization in relation to the advancement of the peoples of the area, the meeting made it clear that the successful use of co-operatives is directly dependent on an understanding of their possibilities. The con-

* Executive Officer for Social Development, South Pacific Commission.



Left to right: Mr. D. S. Murray (Cook Islands), Mr. M. B. Hamilton (Solomon Islands), Mr. R. H. Boyan (Western Samoa), Dr. P. J. van Dooren and Mr. J. van Bodegom (both of Netherlands New Guinea).

Left to right: Mr. C. G. Joannides (SPC co-operatives officer), Mr. H. H. Jackman (observer for Papua and New Guinea), Mr. J. C. Ryan (FAO observer), Mr. M. R. Rarua (Secretary of Federation of Native Associations Limited, Papua and New Guinea).

trolling circumstances in a specific situation must be such that a co-operative society can attain the aims and purposes of its members.

Nonetheless, the formation and effective operation of co-operatives may present many difficulties, such as the obtaining of effective managerial employees, the securing of adequate capital, the adoption of proper operating practices and the development of sound planning. To assist in meeting these and other problems a significant measure of government support and skilled supervision are necessary.

Social Aspects Of Co-operation

The meeting also emphasized the far-reaching social aspects of co-operation. A highly-technical economic system is rapidly coming to areas whose people until recently had not even used money in its present form. Sudden changes may well have unpredictable effects. The co-operative approach, better than any other, can help individuals and their communities to enter and establish themselves in the modern world of money and trade.

Co-operatives, by involving their own members in management problems, create experience for many people, thus giving better opportunities to develop talent and skills which might otherwise not have been reached. The operations of co-operatives bring a constant challenge to members further to improve their economic position through self-help organization, bring ethical ideals to business undertakings, and give a practical illustration of basic democratic principles.

The experience of the participants in the meeting has been that the benefits and advantages of co-operatives are beyond dispute and, although it recognized that there may be circumstances where co-operatives are unlikely to be of significant help, the meeting was firmly of the opinion that the extensive use of co-operatives, when practicable, would be to the benefit of both the people and the administrations concerned in promoting economic and social advancement. Although the actual line of development must depend on the particular circumstances and needs of individual territories, the meeting has stressed the importance of a thorough consideration of such forms of co-operative activity as thrift and credit, production and marketing, transport, and the obtaining of household and farming supplies.

The meeting indicated that a vigorous co-operative development must be self-reliant and not dependent indefinitely on governmental assistance and support. It pointed out that groups interested in forming co-operatives, and co-operatives themselves, should assume to the fullest extent possible their own financial and other incidental responsibilities. Policy should provide for any initial external assistance to be taken over by the co-

(Continued on page 57)

TECHNICAL MEETING ON CO-OPERATIVES: Participants and Observers

Participants

Mr. J. van BODEGOM, District Commissioner, Manokwari, Netherlands New Guinea.

Mr. R. H. BOYAN, Registrar of Co-operative Societies, Western Samoa.

Mr. W. E. BRISKEY, Chief Inspector of Co-operatives, Department of Native Affairs, Port Moresby, Territory of Papua and New Guinea.

Mr. D. G. CUDMORE, District Commissioner, Central Solomons, British Solomon Islands Protectorate.

Dr. P. J. van DOOREN, Co-operatives Officer, Department of General Economic Affairs, Hollandia, Netherlands New Guinea.

Mr. M. B. HAMILTON, Co-operative Societies Officer, Honiara, British Solomon Islands Protectorate.

Mr. C. G. JOANNIDES, Co-operatives Officer, South Pacific Commission, Noumea, New Caledonia.

Mr. G. MORRIS, Registrar of Co-operative Societies, Department of Native Affairs, Port Moresby, Territory of Papua and New Guinea.

Mr. D. S. MURRAY, Department of Social Development, Rarotonga, Cook Islands.

Mr. M. R. RARUA, Secretary, Federation of Native Associations Limited, Port Moresby, Territory of Papua and New Guinea.

Dr. Richard SEDDON, Executive Officer for Social Development, South Pacific Commission, Noumea, New Caledonia.

Observers

Mr. I. CARTLEDGE, Officer-in-Charge, Commerce Branch, Department of Territories, Canberra, A.C.T., Australia (observer for the Government of Australia).

Mr. Kelsey B. GARDNER, Director, Management Services Division, Farmer Co-operative Service, United States Department of Agriculture, Washington, D.C., U.S.A. (observer for the Government of the United States).

Mr. H. H. JACKMAN, Assistant Registrar (New Guinea), Co-operatives Section, Rabaul, Territory of Papua and New Guinea (observer for the Administration of the Territory of Papua and New Guinea).

Mr. J. C. RYAN, Chief Officer, Agricultural Credit Department, Reserve Bank of India, Bombay, India (observer for the United Nations Food and Agriculture Organization).

Trochus Research In New Caledonia

In the early post-war years the trochus industry in New Caledonia flourished. The beds, closed during the war, were rich, and prices for shell were high. By the mid-1950's, however, evidence had appeared of serious over-fishing, even threatening extinction of the species. The French Institute of Oceania was asked to carry out a scientific survey and to propose regulations that would ensure a continuing and plentiful supply of shell. How this was done is related below . . .

By MICHEL ANGOT*

New Caledonians diving for trochus immediately outside the main reef, on which the rollers in the background are breaking.

MAN uses many kinds of mother-of-pearl shells, but among them the trochus (*Trochus niloticus,* Linné.) ranks first in importance. Because of the thickness and strength of its shell it is particularly sought after in the mother-of-pearl industry, main product of which is buttons used by shirt makers and fashion designers.

In New Caledonia, collecting trochus quickly proved a profitable occupation. Various problems developed, however, which in recent years fishermen and government have combined to solve.

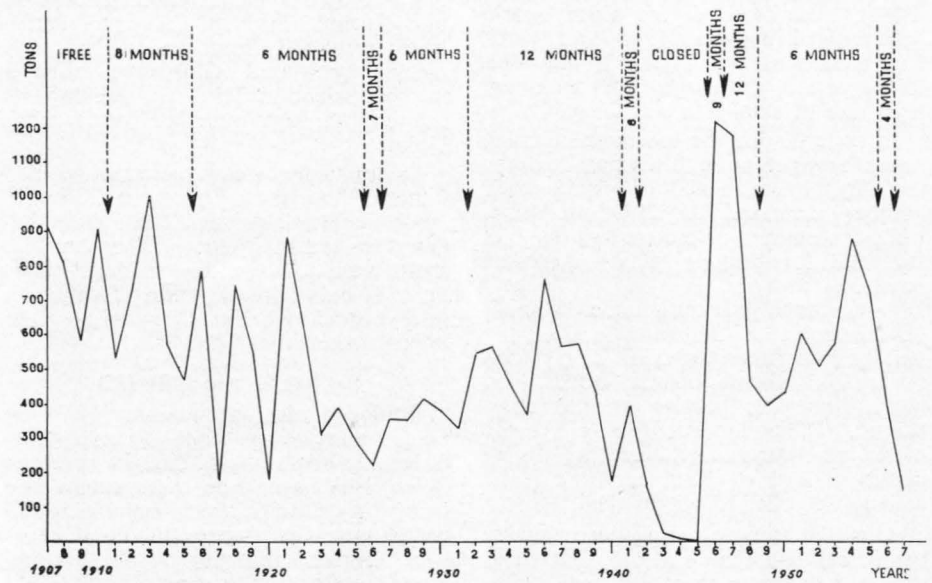
Scientific Research Entrusted To IFO

The scientific research involved was entrusted to the Marine Section of the *Institut Francais d'Océanie* in Nouméa. Work was carried out under the successive direction of two biologists, Mr. R. Gail* and Mr. M. Angot, and with the continued assistance of Mr. J. Patterson. A large number of observations was made and their interpretation has enabled us to solve most of the problems hitherto unanswered.

But, first of all, how had these problems arisen? In fact, they appeared gradually as trochus fishing became more difficult and less rewarding. At its very beginning in New Caledonia, around 1907, it was a remarkably simple operation. All one had to do was to walk along the reef at low tide and pick up the shells crowding the surface. This could be done by hand or, in particularly good spots, even with a shovel.

Such intensive gathering soon reduced the number of easily available trochus. They were no longer to be found on reefs uncovered at low water but went into hiding in the myriad crannies of the submerged reef. The method of fishing, perforce, had to change and thus was developed trochus diving, which is still a common practice. The diver—male or female—wears underwater goggles, swims along the reef and dives whenever a shell is seen.

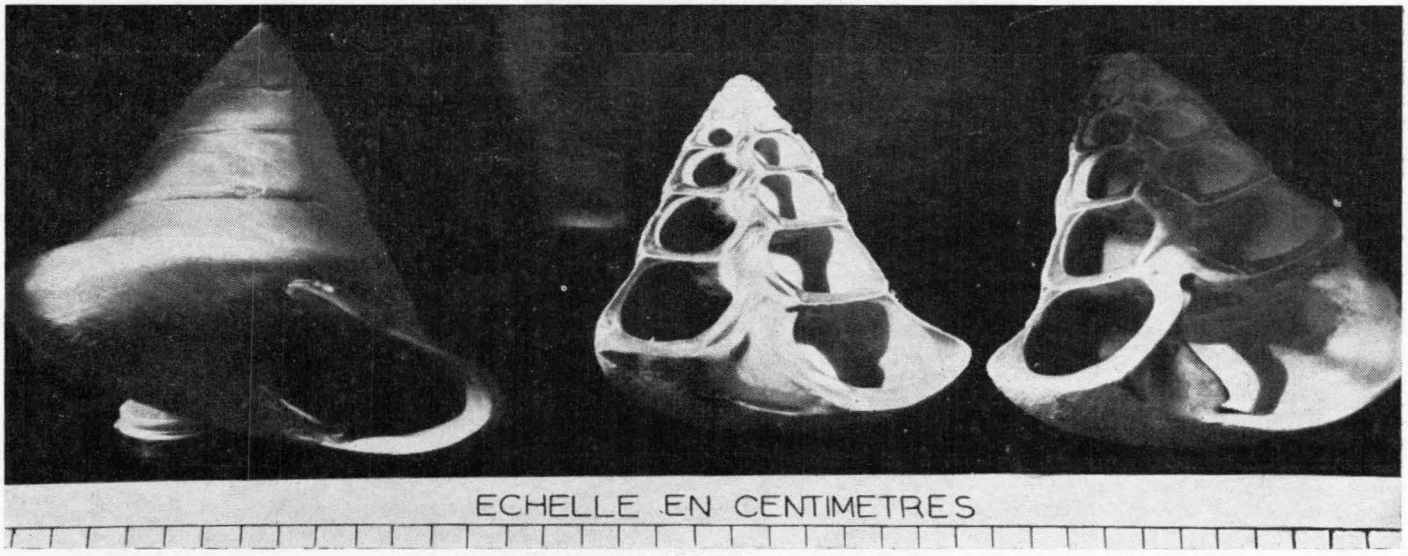
When the new method was first used there was no need to go very deep, but soon divers were forced to go down further and further for good catches. Today the Caledonian diver frequently



Tonnages (in metric tons) of trochus fished during the last fifty years in New Caledonia. Above the graph, between the arrows, the number of months per year during which trochus fishing was open is indicated for each period. Since 1911 the minimum legal size has always been 8 cm., except in 1935, when it was raised to 9 cm., and in 1957 when new legislation brought it up to 10 cm.

* Marine biologist, French Institute of Oceania, Nouméa.

* Mr. Gail lost his life on 10 January 1957 when diving near the New Caledonian reef in connection with his trochus research.



Because of the thickness and quality of its shell the trochus ranks first among mother-of-pearl species sought for commercial use.

goes down to 6 metres and often to 10 (sometimes even 14, but this is exceptional).

Steady Decline In Pre-War Yields

Trochus fishing has, therefore, become increasingly difficult, a fact well illustrated in the accompanying graph showing the weight of trochus collected annually in New Caledonia. Limiting ourselves to the pre-World War II period, we notice considerable fluctuations in tonnage, with an overall trend towards decline. As early as 1930, Risbec stressed the "steady decline in average yield". This is surprising, since, even then, trochus fishing was controlled; one of the main rules being that no shell under 8 cm. in diameter might be captured. (Another rule laid down that trochus fishing was to be open only for a given number of months each year, but this could not be enforced as it has never been possible to patrol all the reefs of New Caledonia.)

So, in spite of these regulations, trochus were unable to reproduce at a rate sufficient to keep up with shell taken, and, consequently, production steadily decreased.

During the war trochus fishing stopped. From 1943 to 1945 the animals lived and reproduced freely, and were again to be found in reef areas from which they had previously disappeared. Their colonies again formed one of the main components of animal life on the coral reefs.

Soon after the war the world market for mother-of-pearl revived. At first it was feared that there might be a slump in the prices paid to producers, chiefly because of the introduction of plastics in the button industry. But the genuine mother-of-pearl button retained its prestige, and prices rocketed. In 1948 a ton of shell was worth 28,000 Pacific francs; in 1955 the price went up to 53,000 and in 1956 it reached 63,636 Pacific francs.

The obvious result of such a strong demand was a corresponding increase in trochus fishing, as, quite naturally, divers were intent on making the most of this excellent opportunity.

Trochus Plentiful Following War Years

In 1946, 1221 tons of shell were taken and in 1947, 1178 tons. Trochus was so plentiful that fishermen were in high spirits and looked to the future with confidence. But optimism declined when, in 1948, the catch amounted to only 465 tons!

Facts to be faced: the abundance of shell due to non-interference during war years was no more. In two years only, fishing had depleted the extra stocks accumulated between 1943 and 1945, and conditions were back to the pre-1943 period, although the minimum legal size of shell was still 8 cm.

In spite of this the incentive of rising prices brought more fishermen into the industry. From 1,400 in 1954 their number increased to 2,004 in 1955, while the number of cutters and dinghies equipped for trochus fishing increased from 394 to 479.

At the same time the number of shells on the inside of the reef was declining steadly, and fishermen increasingly took the risk of diving on the ocean side, away from the shelter of the coral barrier. Thus trochus fishing became more and more hazardous, especially as depths of 8, 9 or 10 metres had to be reached in order to obtain shell.

Also, the trochus caught were mostly large ones and therefore old, and parasites had had time to attack their shells, which were thus pierced unevenly by tiny holes. This fact is responsible for the commercial grading of shells. The larger ones are so often damaged by parasites that they fetch a lower price than the smaller.

The percentage of shells over 12 cm. fished in New Caledonia had remained in the vicinity of 5% until 1954, but it increased to slightly under 10% in 1954, then to 20% in 1955 and reached 30% in 1956.

Serious Production Decline

Producers now became seriously worried. The total catch for 1956 was only 402 tons, and, worse still, the percentage of inferior shells was increasing at an alarming rate. Why was this? And how could this state of affairs be remedied? Finding an answer to these questions was a matter of urgency.

The problem, primarily a commercial one but with a social aspect because so many people in New Caledonia derive their livelihood from the trochus, was tackled by Mr. R. Gail, who raised it to the scientific level by seeking its solution through research on trochus biology.

Undoubtedly, areas where trochus had hitherto flourished had been seriously depleted. However, one could have believed, as did many local fishermen, that shells were still abundant in deep water, out of man's reach, thus forming a reserve stock capable of replenishing the upper beds.

Further Research By IFO

Equipped with an aqua-lung Mr. Gail made many deep dives around New Caledonia from the Kuaré Pass to the Belep Islands on the west coast, and from Cape Chambéron to Balabio Island on the east. Everywhere his observations were identical. Trochus do not live below a depth of 15 metres. The few odd ones that were spotted at this depth were all old specimens with shells ranging between 12 and 15 cm. in diameter (the latter size is about the maximum

ever reached by the species in New Caledonian waters).

As skilled skin-divers can reach a depth of approximately 15 metres it was now proved that the entire trochus population is accessible to divers; there is no natural reserve, and no breeding trochus is beyond a possible capture.

Let us now consider the picture of trochus production at the close of the 1956 season.

The commercial aspect of the situation was not serious. Inflated prices were maintaining an artificial prosperity because, although tonnage was small, earnings were still considerable. Nevertheless, there was a risk of depreciation of New Caledonian trochus on the world market because of the high percentage of shells measuring 12 cm. and over. Though not desperate, the outlook was certainly bleak.

Need For Drastic Action

Biologically, according to the data available, the very survival of the species was doubtful. Not only had the shells within easy reach practically disappeared but even the more remote ones were becoming scarce, in spite of the fact that their commercial value was less than that of smaller shells. The species was in danger of extinction through intensive fishing, and rules and regulations were therefore absolutely necessary to preserve the species as well as to safeguard local trade. It was for the good of the fishermen themselves that drastic measures had to be taken at once.

First consideration was given to measures which would enable the trochus to breed, multiply and grow. It would, of course, have been easy to prohibit fishing altogether for a period of four years and then start it off again on a new basis: the war years had proved that the species was strong enough to recover. But this procedure would have had dire consequences for the fishermen, as some derived their entire livelihood from trochus diving. Another method had to be found, probably more protracted but achieving the same results.

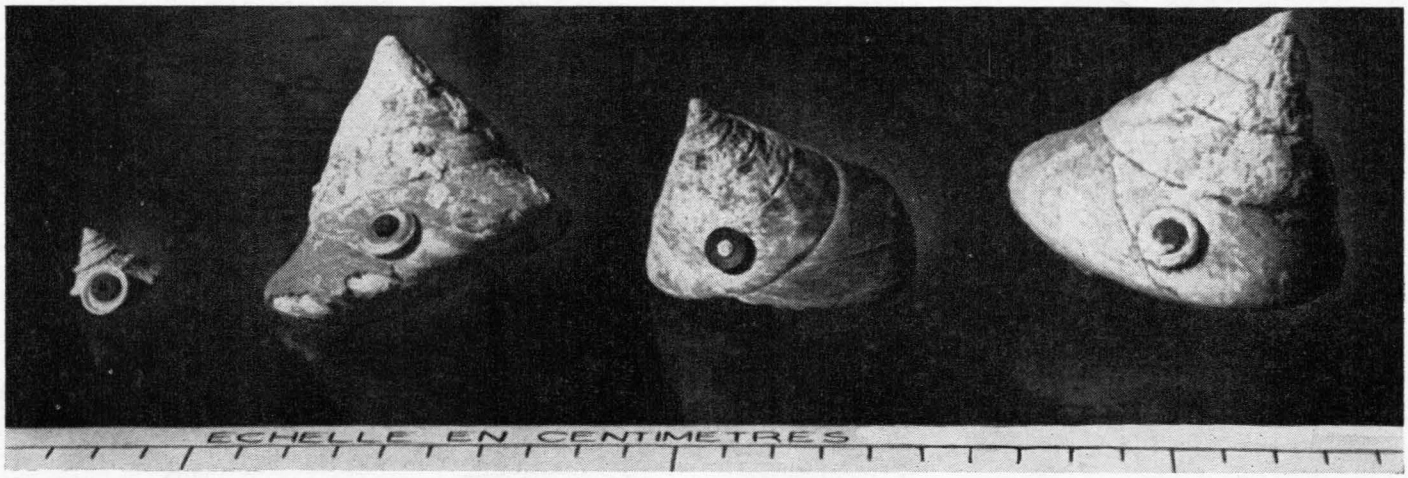
Holes being drilled in the living shells. When tagging is completed the animals will be immediately replaced whence they were caught.

The method, now officially enforced in New Caledonia, is based on the biological knowledge on *Trochus niloticus* acquired by Mr. Gail.

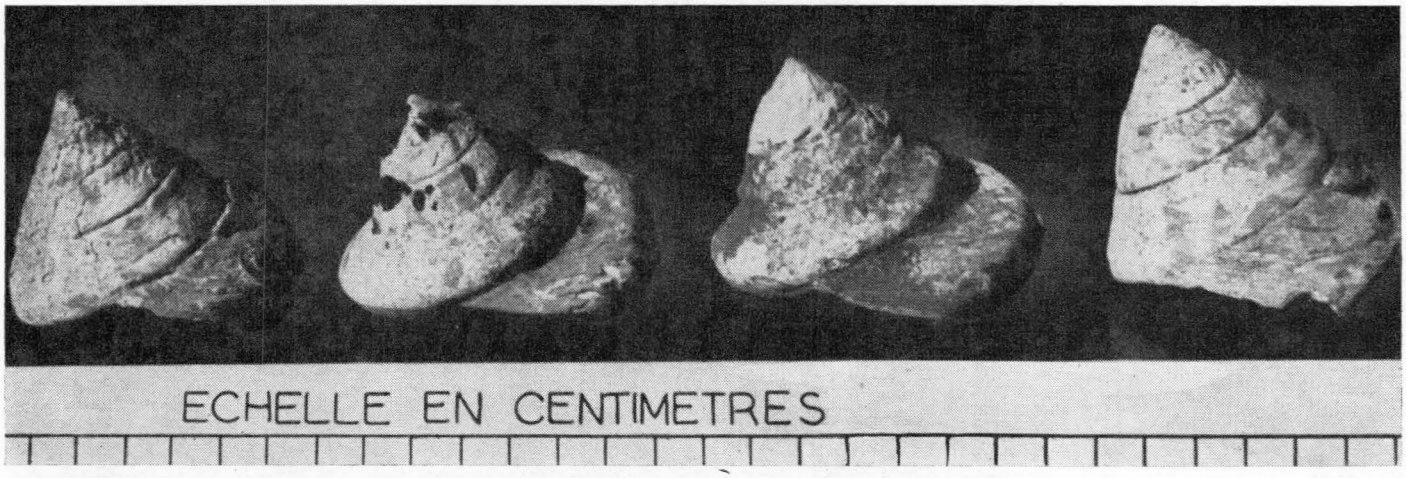
He found that the trochus starts spawning when it reaches approximately 7 cm. in diameter. At that stage it increases in size by 1.5 cm. a year. The rate of growth was ascertained by marking shells and following their development.

First a given trochus is measured. Then a hole is bored in the shell near the opening and a rivet inserted and clamped over a small coloured disc, a different colour being used for each size. The animal is then released and at intervals, recaptured and measured; thus the rate of growth can be determined very accurately by comparing the original size with that at the last date of measuring.

A trochus of 7 cm. therefore increases by 1.5 cm. a year. Unfortunately, fishing was so intensive around 1956 that, in fact, the animal hardly had the chance to live for a year after reaching 7 cm. because as soon as it measured 8 cm., approximately eight months after the beginning of its breeding life, it was captured. Therefore, under the rules and regulations in force in 1956, a trochus



Four tagged shells. The third from the left has increased by one complete whorl since the marking date.



The two middle shells are "stunted" trochus. On either side is a normal trochus identical in diameter with its stunted neighbour.

could breed actively for only 8 months, or perhaps a year at the most. Moreover, the animal is then at the very beginning of its productive period when its breeding capacity is small—very much lower than it would become if man did not interfere.

One could compare a 7 cm. trochus to an 8-year-old coconut tree just coming to fruition. During the next 4 or 5 years yields are small; the tree bears fully only between 15 and 30-40 years of age. Similarly, the reproductive capacity of a trochus is small during the first year of its breeding life—the equivalent of the first 4 or 5 years of the coconut's fruitfulness—but after this it releases great quantities of spawn, the trochus of the future. Unfortunately, under the 1956 regulations a trochus was not allowed even a year in which to breed.

New Regulations For Trochus Conservation

Because of this serious flaw in a law which was meant to protect the species, but, in fact, did little but slow down the rate of its extinction, Mr. Gail made the following suggestions, which have since been adopted by the Government and are now enforced in New Caledonia.

To begin with, trochus fishing was forbidden altogether for one year, from 1 September 1956. The minimum legal size was then raised to 10 cm., measured at the maximum diameter of the shell. In this way, when the trochus has reached 7 cm. (and better still 8 cm.) it can breed until it measures 10 cm., the period during which it spawns most profusely.

It was further decided that there would be no closed season for trochus fishing. A closed season serves its purpose only if it can be properly enforced, and this has always been a delusion in New Caledonia because of the vast expanse of reefs and the paucity of means of control.

Such is the legislation which was passed towards the end of 1956. It came into force on 1 September 1957, when fishing was declared open permanently. At that time shells over 10 cm. in diameter were scarce, and only 144 tons were fished during the last four months of the year. However, the 1958 catch, especially that of the last six months, should definitely show an improvement in the trochus production of New Caledonia.

In a few years' time there will be more 10 cm. shells than there were 8 cm. ones around 1950. The larger shell is heavier, and, consequently, of greater value. The advantages of the present legislation will then become obvious to the fishermen.

Occurrence Of Stunted Trochus

In the case of normal-sized trochus which are generally found on most New Caledonian reefs, these advantages are obvious to all. There are, however, two cases in which this may not be so; in the Balabio Island area north of New Caledonia; and Touaourou in the south. In both localities the trochus is stunted. The shells hardly ever exceed 8 cm. and therefore are no longer saleable.

The *Institut Francais d'Océanie* decided to investigate the matter, and a large research station was established at Touaourou in November 1956. The local fishermen were most helpful, and agreed not to disturb the shells under regular observation. Work has progressed over a period of eighteen months, and we are now in a position accurately to define the problem of stunted trochus.

Risbec has already proved that a stunted trochus belongs to the same species (*Trochus niloticus*) as a normal one. The term "stunted" merely describes the fact that such shells grow more slowly than normal ones. A stunted 7 cm. shell increases by 0.5 cm. a year instead of 1.5 cm., but it is not correct to state that it will never exceed 8 cm. In fact it continues to grow, but slowly, which explains why in 1956 fishermen could find only a small number of 8 cm. shells. These, in turn, will take longer to become 9 cm. trochus, and it is quite possible that all will not reach the 10 cm. mark if the time required to do so exceeds the life span of the species.

Yet another consequence of this slow growth is that the stunted shells were able to reproduce during longer periods than others before being caught, while the minimum legal size was 8 cm. Therefore, shells were much more plentiful in the stunted trochus areas than elsewhere.

Experimental Transplantings Successful

The next problem was to find out if stunted trochus remain so permanently. We collected shells and transferred them very carefully to areas where trochus grow normally. Each animal was placed apex upwards in its new habitat.

After an acclimatization period of 4 to 5 months the so-called stunted trochus started to grow quite normally. Most of them have now reached the 10 cm. mark.

Work at Touaourou is now ended, but the experience has been fruitful. The local fishermen who helped us and saw the results of our experiments are planning to carry on transplanting shells on their own.

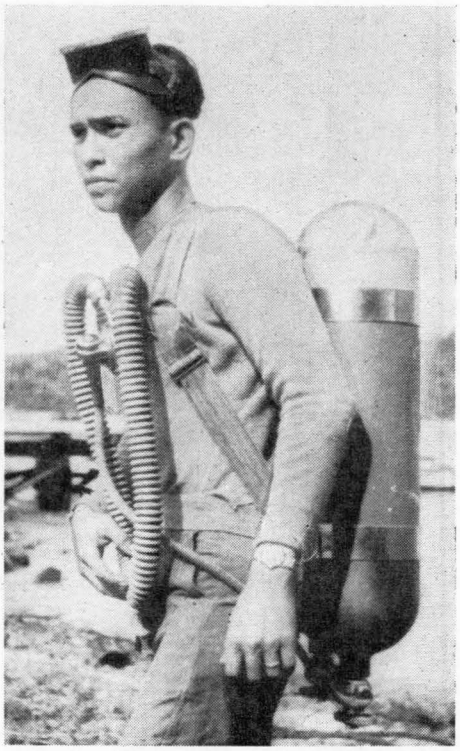
Natural Shell Reserves

It could almost be said that stunted trochus areas serve as natural shell reserves. The animals remain small and therefore protected against fishing until they are transplanted to suitable spots where they can grow normally to 10 cm. or more.

It has been found that areas where trochus growth is impeded are characterized by low salt content in the water, i.e. near the mouths of rivers or, broadly speaking, on the axis of currents carrying fresh water onto a reef. Trochus do not develop well in even slightly brackish water; their ideal habitat being an ocean reef bathed by the pure salt water of the open sea. This is naturally

(Continued on page 33)

Left: Mr. van Pel discusses the sun-drying of fish with Thomas Weasu, who attended the SPC-FAO fisheries training course at Commission headquarters in 1956. He is now in charge of a fisheries project at Insobabi Island, Netherlands New Guinea.



Right: Assistant Fisheries Officer Gerard Ipsen of the same territory, who also attended the fisheries course, is shown here wearing the aqualung he uses for shell investigations in depths of up to thirty fathoms.

Fisheries Development In The South Pacific

In July 1954 the South Pacific Commission appointed a fisheries officer to carry out the recommendations of the Fisheries Conference held at Commission headquarters in May 1952, his main task being to stimulate development of fisheries in the region. Below he reviews progress made to date.

By H. van PEL

IT was in July 1954 that the South Pacific Commission, by appointing a fisheries officer, began to play an active role in the development of fisheries in the South Pacific region.

Since then fourteen major territorial surveys have been carried out through which local administrations have been given advice on their fisheries problems. A corresponding number of reports contain accounts of the present status of fisheries in each territory as well as appropriate recommendations, many of which have already been applied.

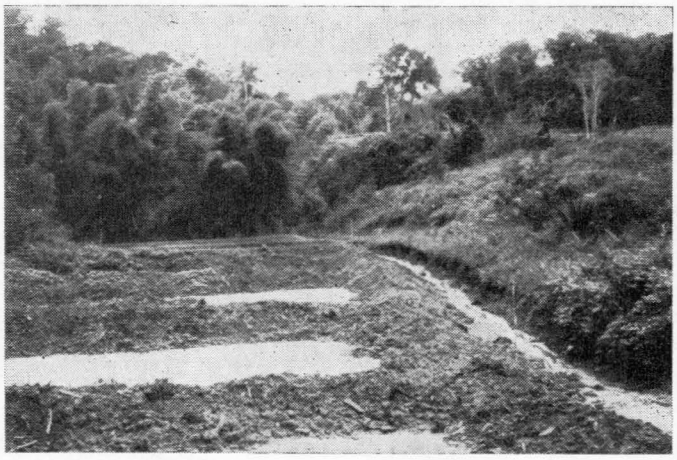
Variety Of Subjects

The various subjects treated include transplantation of shellfish, fish culture, stocking natural waters, fish preservation, organization of sea and inland fisheries, protection of natural resources, fishing gear and craft, and salt production.

In the course of each survey, information is given in the field, while sometimes demonstrations are held for administration officers and fishermen. In a few instances, projects have been started on the spot.

Information is also provided by articles in the *Quarterly Bulletin*. It is very gratifying to see the response and great interest evidenced by letters received from government officials and private individuals, and by visits to Commission headquarters. Enquiries from territories having a Fisheries Department are referred to that authority. The remainder, which are still numerous, are dealt with by correspondence.

The co-operation received from scientific organizations within and outside the Commission's area enables us to relay valuable information. Their constant assistance by far exceeds the little help we are able to give in exchange.



Experimental freshwater fish ponds under construction in Col d'Amieu by the Forestry Department of New Caledonia. They will shortly be stocked with fry from the Commission's ponds at Port Laguerre.

In the Van Camp fish cannery at Pago Pago, American Samoa. Japanese longliners keep the factory supplied with tuna.

SPC-FAO Fisheries Training Course

The highlight of the period under review was the Fisheries Training Course organized under the joint sponsorship of the South Pacific Commission and the Food and Agricultural Organisation of the United Nations.

A total of twenty-five trainees representing fourteen territories attended the Course for a period of three months. The classes covered a wide range of subjects, both theoretical and practical. They were conducted by instructors assigned by FAO or selected locally from the *Institut Francais d'Océanie,* the South Pacific Commission, and the Administration. Outings were organized in order to allow the trainees to observe and practice new techniques explained during the Course.[1]

Successful results are already apparent in a number of islands, where trainees have been assigned to various positions in the fisheries field.

Practical Fisheries Handbooks

A series of booklets was recently started. The first was *Fish Preservation Simplified,* which describes simple methods for preserving surplus catches of fish over short or long periods. It is practically sold out.

It will be followed shortly by two others; one dealing with the construction and care of tilapia ponds; the other giving advice on the care of fishing nets. These pocket-size publications are designed to convey ideas for the improvement of the fishing industry. The text is simple, clear, and well illustrated.

Fish Farming Investigations

Investigations on fish cultivation and pond hygiene continue, both at our two small ponds in New Caledonia and numerous others in various territories.

With students who attended the SPC-FAO fisheries training course in December 1956, Mr. van Pel (fourth from right) discusses local fishery techniques with M. Garcia (third from right), skipper of the motor fishing boat "La Paloma".

(An article briefly reviewing our work in this field appears elsewhere in this issue.)

Fisheries Project Programme

Our programme in the fisheries project is divided into three main categories, (i) surveys and recommendations, (ii) education, and (iii) assistance for implementation of recommendations.

SURVEYS AND RECOMMENDATIONS: Surveys have already been carried out in most territories, and recommendations made accordingly. This work represents the first step towards improvement and development.

EDUCATION: The second category, education, falls into two sections:

(a) The training of junior officers who, upon their return to their respective territories, can implement, under supervision, the various recommendations made by local fisheries authorities or by visiting experts. This was the aim of the Fisheries Training Course mentioned above.

(b) More specific and practical demonstrations to help local fishermen in mastering new techniques.

ASSISTANCE FOR IMPLEMENTATION OF RECOMMENDATIONS: This third category involves assistance that is necessarily long-term. Current projects (i.e. stocking of natural waters, shell transplantation, introduction of new species, etc.) are under way and have produced some satisfactory results, but will need to be pursued in the future.

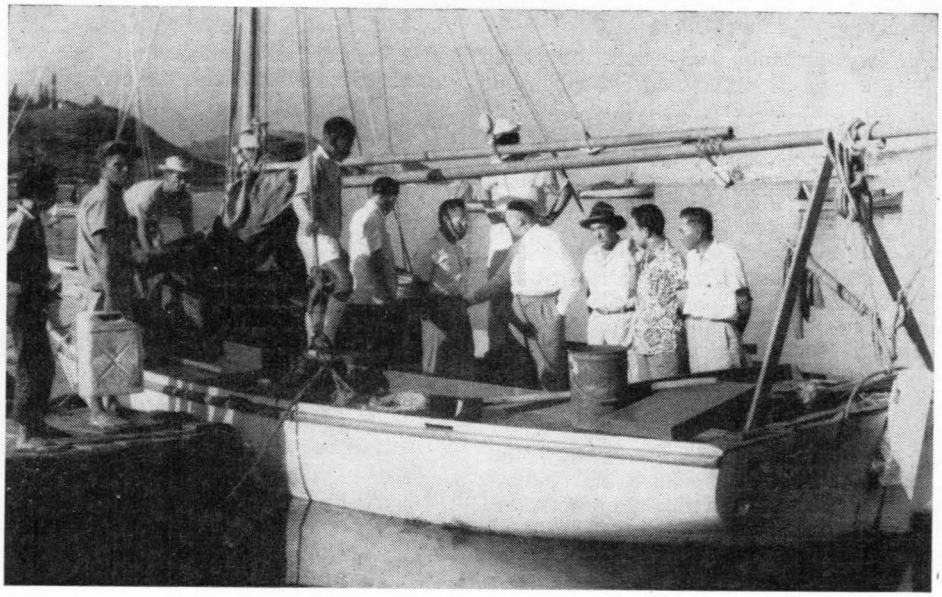
It is only through the co-operation of the governments concerned that our common aim will be reached; to develop fish production. To illustrate the point, small motor fishing boats could be used to advantage in a number of places, while coastal fish traps might be introduced to some suitable areas with great profit.

There are already examples of such development in fisheries in the South Pacific Commission's area—in New Caledonia and French Polynesia for instance —where in the main towns of Noumea and Papeete, respectively, fish is available in sufficient quantities. Small motor fishing boats are responsible for most of the catches.

However, small motor fishing boats require money, and that is a commodity most of the people in the South Pacific directly interested in fisheries usually do not possess in large amounts. It is hoped that islands can raise funds for these boats, collectively, or that another solution can be found.

---

[1] An official report on the Course was published by FAO, Rome, under the title *Report on the South Pacific Fisheries Training Course at Nouméa, New Caledonia* (FAO Report No. 753).



Leprosy Control In Netherlands New Guinea

Around 1 per cent. of Papuans living in the controlled areas of Netherlands New Guinea suffer from leprosy. The campaign in progress to control the disease is based on the segregation of patients, not in a single central leprosarium but in a number built in the main areas where the disease is endemic. In this way families of sufferers can visit them regularly, and their return to the community is made much easier. In the campaign, sulphone treatment is giving consistently encouraging results.

By D. L. LEIKER*

This village for leprosy patients is located seven miles from the oil centre of Sorong. The patients maintain a vegetable garden and carry out as much other work in the village as possible.

IN the late 1940's attention was drawn to the high prevalence of leprosy in the Wandamen Bay area on the north coast of Netherlands New Guinea, and in 1950 two government nurses were appointed to take care of fifty patients isolated in a leprosarium there.

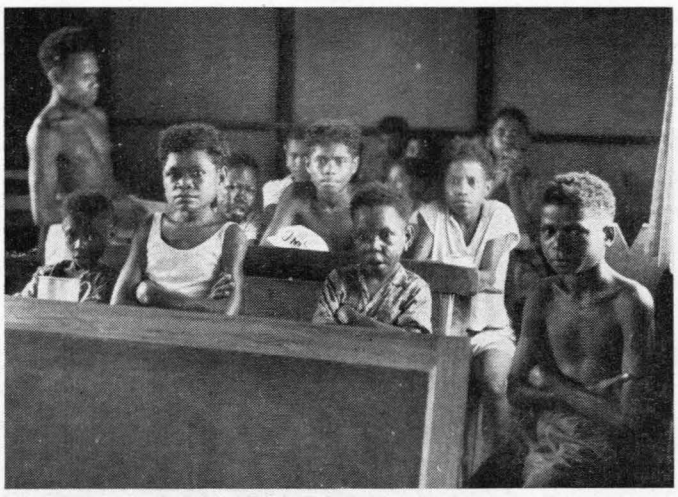
It had been found that leprosy was widely spread in New Guinea, and in 1952 Dr. Norman R. Sloan, leprologist with the South Pacific Commission, was invited to conduct preliminary investigations in several parts of the territory in company with the government physician, who would be responsible for the development of leprosy control. As a result of this survey, the extent of the leprosy problem was clearly defined.

During the following years the situation in many parts of the country was studied in more detail. It was evident that, although some foci of leprosy dated back to the last century, in most areas it was a "new" disease which had spread mainly in the present century.

It was possible to follow roughly the way it had spread from village to village, from area to area. Considerable differences were found. In some regions the spread of leprosy was slow in comparison with others, where it had developed into a serious epidemic within some ten years. In one area the patients were segregated, while in another the disease had been recognized but the patients continued to live in the community. In recently-infected areas it had not been recognized.

The surveys undertaken showed that leprosy was extending in nearly all the areas already known to be infected, and into new ones as well. The opening up of the country and its pacification, the

* Head of the Division of Leprosy Control, Department of Public Health, Netherlands New Guinea.



In this school both teacher and pupils are patients.

Here as everywhere else in New Guinea there is great interest in sewing lessons.

In New Guinea there is a great demand for the model proas that this patient is making.

migration of peoples into towns, the low sanitation level and many kinds of living habits were all promoting the further spread of the disease.

Registration of patients was instituted. There are now some 3,000, or approximately 1% of the population living in the controlled areas.

Facilities For Segregation Essential

In the conduct of a control campaign the first important problem is the necessity for providing facilities for the segregation of patients.

Until recently, the isolation of the infectious patient was the only measure taken to prevent the spreading of the disease. But forced segregation has not been successful everywhere, because many patients evade it by hiding, and in this way maintain the infection. It was thought that in New Guinea forced isolation was foredoomed to failure, for here it is easy to escape examination and hide in the sparsely-populated jungle.

Then the discovery and use of the effective sulphone therapy raised the question as to whether isolation was, in fact, necessary.

In comparison with other infectious diseases leprosy is not very infectious, and isolation increases the unreasonable fear among many people of contracting the disease. But the study of the spread of leprosy in New Guinea showed that, in general, Papuans possess a lower resistance to the disease than many other people. This was particularly evident among the recently-infected groups.

Moreover, it could not be expected that the Papuans themselves would take measures to protect their surroundings from infection.

The fact that leprosy was spreading inland among primitive mountain people, widely scattered, always wandering, and therefore difficult to reach, resulted in an attempt being made to control leprosy in the coastal areas as early as possible, in order to prevent its spread inland.

An effective sulphone treatment was impossible to conduct at the outposts. It seemed then necessary to convince the patients of the need to accept, of their own free will, admission to leprosaria. Only 25% of the registered patients appeared to be infectious, and their admission in the available leprosaria was possible.

Leprosarium A Model Village

In order to find out whether the Papuans would freely accept isolation, a special project was developed in the Wandamen Bay area. The local leprosarium was extended to include a small hospital, school, church and shop. Much attention was paid to treatment and recreation. The patients were given the opportunity of following their own living habits as much as possible.

The leprosarium became a model village, with the advantages of better medical care and education in many aspects of life.

Leprosy, which had been introduced in the Wandamen Bay area some fifty years earlier, was well known to the Papuans. During visits to the villages, use was made of some examples from their own surroundings for the instruction of the people. The number of patients seeking isolation increased, and, as soon as the favourable results of the sulphone therapy became apparent and the first patients were discharged, there was no more hiding from examination.

All the infectious patients found during surveys were soon willing to enter the leprosarium. Many others with only limited lesions are voluntary and regularly reporting to the out-patient clinic, though for many of them this means half a day's travel.

Another important fact is that there is little social stigma attached to leprosy. Discharged patients are accepted in the community without resistance. Leprosy has become a common disease and nobody is ashamed of it. It can be cured.

More Leprosaria Being Built

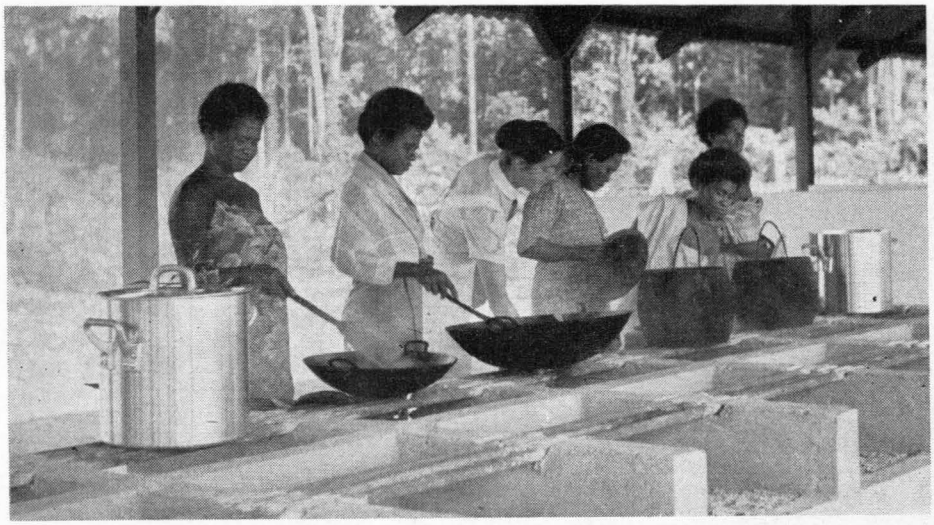
The success of the Wandamen Bay scheme led to the building of another leprosarium in West New Guinea, where the leprosy index was high. Within a short time most of the infectious patients had accepted isolation. Recently the first ten patients have been discharged, and progressively the fear of those who are still hesitating is being overcome.

A third leprosarium is under construction on Japen Island. A fourth will be built in Kaimana to replace the less favourably situated one in Fakfak, while a fifth is planned in Merauke.

Every area where leprosy is endemic will then possess its own leprosarium. This scattering is inevitable. A central leprosarium, though well organized, would not be as attractive to patients as one built in their own surroundings.

In this way patients can keep in touch with their families and relatives who, with the exception of the children, are allowed to visit them. The return to the

Patients engaged in mat making and basket work.



Patients working in the light and airy kitchen.

community is made more easy, while everybody is aware of conditions in the leprosarium.

Encouraging Results

The results of this work show great hope for the control of leprosy in the whole coastal area. An attempt is now being made to examine, each year, the total population in all infected areas, in order to find the new patients in the early stages of the disease.

Though the people are not aware that patients even in an advanced stage of the disease can be cured, in some areas they are now convinced that the disease can be cured faster if treated at an early stage, and that the severe mutilations which have given the disease its bad reputation can, in many cases, be prevented.

The basis for a sound leprosy control has been laid. Yet other important problems still remain. New Guinea is a large country, with widely-scattered population groups often difficult to reach.

Papuans Being Trained In Leprosy Control

Until recently, the leprosy control work has been carried out almost entirely by European personnel. Papuans are now being trained in diagnosis, treatment and education of the people, and more frequent visits to rural areas will result.

In the leprosaria, patients are trained in nursing and laboratory work, and some will be kept working when cured.

The sulphones are powerful weapons in the eradication of leprosy, but treatment requires several years of careful attention.

In the central part of New Guinea there are still population groups exposed to leprosy infection who are not yet used to modern methods of treatment, and they follow with interest the investigations into the preventive value of the BCG vaccine in leprosy control.

During 1957 the people in one endemic area were vaccinated. This year BCG is being used in a second area.

SPC Plant Introduction Service

(Continued from page 22)

SPC Plant Introduction Service, it must be kept in mind that its purpose is not to act as a seeds and plants concern, but to be a means of crop improvement.

As such, its activities have to be included in a general programme which must be constantly reviewed, to keep up-to-date with territorial research and development schemes. For instance, special attention is given to species and varieties which are of practical and immediate use to the economic development of the islands and the betterment of the crop concerned. Thus, a number of "Arabica" and "Robusta" coffee varieties have been introduced, for these two species are the only ones with commercial possibilities. Furthermore, an increasing number of South Pacific territories, in their efforts for cash crop diversification, are now including coffee in their agricultural development programmes.

As far as cacao is concerned, no introductions from overseas will be made through the Commission for the time being, firstly because the risks of introducing serious diseases or pests of this important crop are too great, while secondly, a wide range of excellent material is already available in the South Pacific region.

The outstanding results achieved in the field of cacao selection on the "Trinitarios," introduced long ago at Keravat Station, New Britain, show clearly that new introductions are not absolutely necessary. However, even in such a case, the SPC Plant Introduction Service has its importance in assisting inter-territorial exchange of plant material and, eventually, in locating in old plantations, material which could be worth propagating or including in collections established for selection purposes.

The coconut offers another example of this definite trend towards crop improvement. Research on the coconut is increasing in many territories such as Papua and New Guinea, French Polynesia and the Solomon Islands, selection and breeding of improved coconuts being a main objective.

Here again, introduction from overseas sources involves too many risks from a quarantine point of view, except perhaps for pollen, which could be imported for cross-breeding purposes. Instead, our main task is to survey the South Pacific varieties of this palm and use the material available in the area for the improvement of this basic cash crop. Our assistance in that field has already been requested by the Solomon Islands and French Polynesia.

An Enormous Task Ahead

These few examples show that selection work is now playing an important part in agricultural research schemes in the South Pacific region.

Until recently, we had to consider plant introduction mostly as a means of introducing already improved varieties. Now our programmes must include material for use by plant breeders. This will have to be obtained either by introduction from sources outside the South Pacific, or by exploration and collection.

An enormous task remains to be done to improve South Pacific crops, and the present agricultural research in our region is developing in this direction. The indications are that the Commission's plant exploration, collection and introduction activities will play an important part in this essential work.

Trochus Research In New Caledonia

(Continued from page 28)

the most suitable location for transplanting. Great care must be taken in handling the shells to give them every possible chance of survival during the settling down period.

Once these principles are accepted by the Balabio and Touaourou fishermen (in the case of the latter, they are almost unanimously converted to the idea) the inhabitants of these areas will consider themselves the most fortunate among trochus fishermen.

Nature maintains for them a practically inexhaustible supply of shells; it is up to them to make the best of such favourable circumstances. With a little care and common sense their catches should always be plentiful.

REFERENCE

Selected Annotated Bibliography of Trochus, by R. Gail and L. Devambez. SPC Technical Paper No. 111, Nouméa, 1958.

This interesting cocoa exhibit was presented by the Lowlands Experiment Station, Keravat, at the Kokopu Agricultural Society's annual show held last June.

The Cocoa Industry In New Britain

The problems and possibilities of the young and thriving cocoa industry in New Britain were studied during a recent visit to the island by the author of this article, a leading authority on cocoa cultivation in the Pacific. He records his impressions in the article below.

By D. R. A. EDEN

FOLLOWING demands by Australian manufacturers for cocoa beans with a good chocolate flavour, but without their customary acidity or bitterness, the Department of Agriculture has experimented with a broken ferment system of processing, which has produced cocoa beans to the desired specifications.

At the Kokopo Agricultural Society's Annual Show in June last, the Department presented an interesting and carefully-prepared exhibit. In the cocoa section they featured chocolate manufactured entirely from local cocoa beans processed by the broken ferment system. The public were given samples to taste and the consensus of opinion was that it had a good chocolate flavour, mild, and without a trace of bitterness. Other samples of chocolate from beans processed by ordinary methods were bitter by comparison.

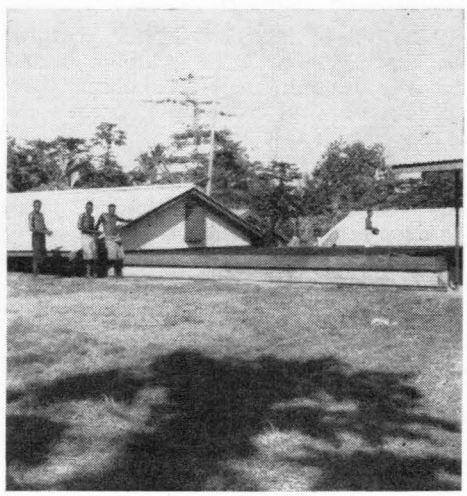
The new system includes a break in the fermenting process, when the beans are subjected to a period of cold-air drying before their return to the fermenting boxes, and finally a very slow hot-air drying of the fully-fermented beans. Basically there are four principal stages:

1. A normal fermentation of the beans for 24 hours.
2. A resting period of interrupted fermentation for 24 hours.
3. A resumed fermentation in boxes for 3½ days, making a total of 4½ days' fermentation in all.
4. A slow drying in a McKinnon rotary hot-air drier for approximately 65 hours.

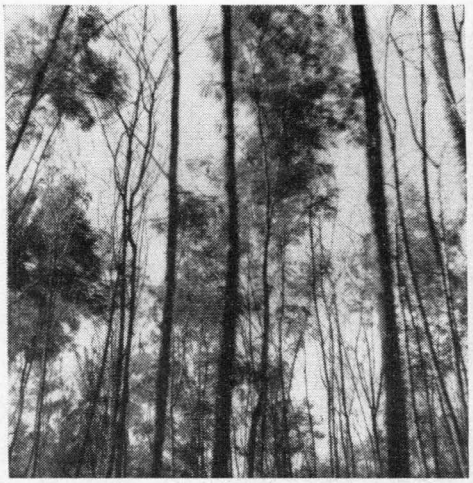
During the resting period, when the beans are spread out upon a wooden floor, (5 lbs. of cocoa beans to 1 sq. foot) they lose a percentage of their moisture content, principally from the external mucilage. When they are returned to the fermenting boxes this loss of moisture gives the microphytes less water to heat, and in consequence the temperature in the fermenting mass rises rapidly, and is maintained at around 50 degrees C. At this ideal heat the germination of the beans is halted, and fermentation proceeds perfectly to its conclusion, 3½ days later.

R. V. Wadsworth, Chief Chemist, Messrs. Cadbury Brothers Limited, after conducting experiments in the fermentation of small quantities of cocoa beans, and writing on that subject in *Nature* for August 28 1954, stated, *inter alia*:

> "At least three factors play a part in the development of chocolate flavour. The first is . . . when beans are maintained at a temperature of 50 degrees C. for several days without a prior period at a germinating temperature, no chocolate flavour is developed. The second factor is that beans must be maintained at a temperature of 50 degrees C. for several days after the initial germination period. . . . The third factor is the (necessary) removal of carbon dioxide



Two views of the new forced-draught A.S.P. hot-air drier located near Rabaul, which processes native-grown cocoa beans. The plant is run by the growers under Administration supervision.


Above: An example of over-shaded cocoa. The tree has literally reached for the sunlight and has ramified too high. When mature, inconvenient height will complicate harvesting. Centre: An example of shade reduction on Raulawat Plantation near Rabaul. Dead trunks of Leucaena killed by the use of hormone solution. The cocoa responded well when the heavy shade was reduced. Right: A beautiful three-year-old cocoa tree, with healthy, tall, heavily-bearing cocoa trees in the background. The latter are survivals of a pre-war plantation in Papua and New Guinea. Coconut palms supply the only overhead shade.

from the air around the fermenting beans. . . ."

Presumably, then, the first 24 hours given to the beans in the fermenting boxes before the ferment is broken is a sufficient period at a germinating temperature, because chocolate flavour is certainly developed in the new process.

Wadsworth's second factor is complied with in the broken ferment processing by the beans being maintained at 50 degrees C. for 3½ days after their return to the fermenting boxes. His third factor, the necessary removal of carbon dioxide from around the fermenting beans, is routine procedure in any fermentary. The beans are turned daily—or every second day—by shovelling them from one fermenting box to another. This disposes of any accumulation of carbon dioxide around the fermenting beans.

I understand that a number of Company-owned plantations are considering the use of the broken ferment system, and I was given an opportunity for seeing it in operation on an extensive private estate in the Kokopo district. The system there was fairly elaborate, because three different types of hot-air driers were used in sequence to turn out the cocoa beans to buyer specifications.

I was shown the beans being spread upon the wooden floor of a large open building. This was the second stage, or resting period, during the break in fermentation. I was told that if there is a heavy wind blowing outside, the beans are inclined to dry too rapidly. In this case they are heaped in small ridges, which regulates the drying. If there is no wind and the cocoa is thought to be drying too slowly, fans stir the air above the cocoa beans and attendants spread them as thinly as possible.

This cold drying stage is apparently a little difficult, and some amount of experience is necessary before an operator becomes competent to judge whether the beans are progressing favourably or not.

In the drying sequence the cocoa is processed to a stage on a Martin dehydrator when the beans are surface-dried but still spongy inside. Removed from the Martin, the cocoa is thoroughly damped down. Drying is resumed in a McKinnon rotary at fairly high temperatures for 24 hours. Final slow drying is accomplished on an A.S.P. platform drier at more moderate temperatures.

The finished products from the Department's plant and from the private estate were similar. They were both very good indeed. For all practical purposes they can be described as one. With a polished surface, the beans were full and unbroken. The samples cut showed that the cocoa was well and evenly fermented, the cotyledons being a cinnamon brown with a good loose texture. In taste the nibs were mild, of good chocolate flavour and without bitterness or acidity. The tests were firm and the product could be expected to transport well without risk of broken beans and nibbing.

Notwithstanding the quality which this system seems to guarantee, it is doubtful whether it will be universally accepted by planters. The equipment involved is expensive, and the handling costs fairly high by comparison with older methods. The old routine of from five to seven days' fermentation and up to two days' drying on a hot-air dehydrator still sells cocoa in the open market at quite attractive prices.

In the peak harvest a heavy crop demands that the cocoa be passed through the drier as rapidly as possible. A process which takes longer than 48 hours on an artificial drier could cause a bottleneck in the processing routine. After all, the original reason for procuring hot-air and mechanical driers was to handle a large tonnage in the shortest possible time. The routine suggested by the Department—of slow drying for over sixty hours in a McKinnon—may prove an expensive process.

Extra drying equipment could be erected to handle heavy seasonal cropping, but the expenditure of many thousands of pounds will not be lightly undertaken when the additional equipment may be used for only two or three months in the year.

Where, however, producer-to-manufacturer agreements may be negotiated, either for the total annual crop or for specified tonnages, the planter—by the inducement of an attractive premium—may consider the extra expense fully warranted. Selling at a fixed price is always an inducement in a fluctuating market.

There is no doubt that the broken ferment system produces top-quality cocoa beans, but for the smallholder the capital outlay involved in expensive plant may be beyond his means.

Co-operative processing plants under Administrative supervision could help in districts where farms are not too scattered. Native fermentaries and driers are already established in New Britain, and are working well under Government direction. The new A.S.P. forced-draught platform cocoa drier, which was erected for drying native cocoa near Rabaul, is run entirely by village people, though under the supervision of an officer of the Department of Agriculture.

In the meantime, many of the cocoa planters in the district with young plantations are using simple equipment, and, while the quality of their products varies considerably, the prices they obtain are very encouraging.

On a visit to Raulawat plantation I was shown some cocoa produced there, which had been seven days in the fermentary and just over four days on a platform drier, using sun heat only. The cocoa had certainly been produced

Above: Healthy lines of rising two-year-old cocoa grown under the shade of old coconut palms. The cover crop in the foreground is a mixture of Centrosema and Pueraria. Right: Re-planted five-year-old coconut seedlings under sixty-year-old palms. Cocoa has been inter-planted between the rows of coconuts. Photograph taken on a plantation in the Gazelle Peninsula, Rabaul District, Papua and New Guinea.

under ideal weather conditions, but was equal to any I had seen in the territory. My enthusiasm for that particular batch prompted the management to enter a sample in the Kokopo Show. It won first prize there for "Processed Cocoa Beans".

Unfortunately adverse weather conditions affect not only sun-drying, but fermentation also. During long spells of wet weather, damp atmospheric conditions and low temperatures combine to produce the dreaded "cold ferment". In these conditions the helpful microphytes are supplanted largely by putrefractive bacteria, and fermentation cannot proceed. Under these circumstances the quality of the cocoa is practically ruined before it emerges from the fermenting boxes.

The raising of the bean temperature in the fermenting boxes by the use of the broken ferment system will prevent a cold ferment forming, and the planter who uses it will become independent of weather conditions, providing, of course, he possesses a mechanical drier to complete the processing.

The artificial heating of the fermenting boxes by the use of steam-heated coils would have an effect similar to the broken ferment routine. In this case, as Wadsworth has proved, the beans would have to be given a prior period at a germinating temperature before the steam heat was turned on.

Breaking a ferment is a new and striking development of an old idea described by Dr. A. Schulte im Hofe in 1908.[1] He described a similar process for the improvement of flavour and the elimination of acid aroma in cocoa beans.

In the experiments he conducted, he returned partly-fermented and partly-dried cocoa beans to fermenting boxes artificially heated with steam coils to between 40 and 45 degrees C. The beans were retained in the boxes until the best degree of oxidation had been obtained. The latter factor was determined, apparently, by constant tasting. Even his critics admitted that he obtained an improved chocolate flavour without acidity.

Shade A Common Problem

In tours around the island I had opportunities for observing the progress made in many of the younger plantations which I had seen nearly two years previously. Most of the planters with whom I conversed had one problem uppermost in their minds—that of shade.

Urquhart has said—"There are few aspects of cocoa planting which have come in for so much discussion as the respective merits of shading plantations and leaving them unshaded".[2]

Leafless twig and die-back diseases can be the result of under-shading; lack of crop and heavy attacks of fungus disease can be a penalty for over-shading.

O. J. Voelcker, in a paper prepared for the 1953 London Cocoa Conference stated — "In evaluating the relative methods of different techniques in establishing and growing cocoa, the main criterion is, of course, bean yield per acre. . . . Nevertheless, another criterion — less precise, but entirely practical—can be used: the general health and vigour of the tree as judged by eye".

Unfortunately very few of the cocoa plantations in New Britain are old enough to have records of bean yield per acre or per tree. Consequently these crop records are not available to make comparisons between shaded, partly shaded or unshaded areas. Judgment by eye must, therefore, be the criterion for the present.

Generally speaking, the young cocoa plantations on New Britain are well above average for vigour of growth and forwardness of development. There is very little disease and everywhere the cocoa is well foliated with healthy, deep green leaves.

Although I was there in June—a dry month—most of the plantations were harvesting quite a heavy crop: but here and there one could not fail to notice mature cocoa, shaded by tall *Leucaena glauca,* with scarcely a pod to be seen over quite large areas. It seemed to be that wherever the shade was heaviest, the crop was lightest. There was nothing wrong with the growth of the cocoa trees, but under heavy shade some of them carried neither flowers, cherelles nor pods.

It is normal for cocoa to have resting periods from bearing, but it is not normal for acres of trees to be bare of any form of crop, when other neighbouring plantations with lighter shade are being harvested. Because there was no other apparent reason for lack of crop, the overshading by the use of too much *Leucaena* was judged the cause.

On native plantations with their invariable assortment of all kinds of overhead shade, the tall trees were spaced at random, and quite a substantial amount of sunlight managed to penetrate to the cocoa. Wherever this was so the trees were healthy and carried good crops.

I have seen cocoa trees both on New Britain and Buka—survivals of pre-war plantings—growing where there was no shade at all. Such trees all carried pods. Nevertheless some of these trees showed evidence of die-back disease and there was reason to suppose that they would have done better under some shade. Apparently the nearer the equator a plantation lies, the greater becomes the need for shade.

Introductions of cocoa into Malaya between 1949 and 1953—mostly Trinitario seed—led to many experiments in the techniques of establishment and growing. Upon the question of overhead shade Voelcker, in his paper already referred to, states—"It is abundantly clear that shade of some sort is essential; trials of establishing cocoa in the open have resulted in very poor growth . . . . even on soils of good fertility".

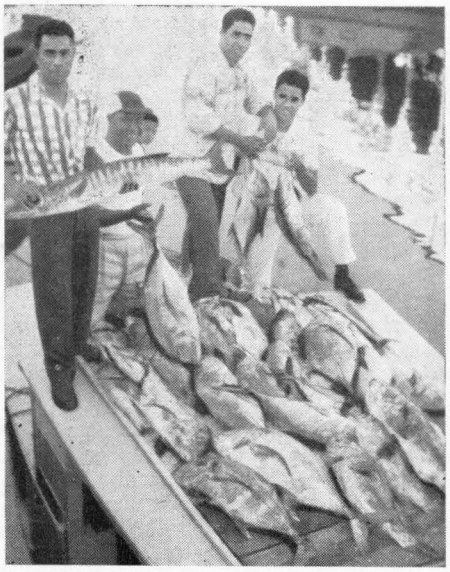
Malaya lies between the latitudes of two and ten degrees above the line, while New Guinea lies relatively within the same degrees of latitude below the line. Climate is similar, and so the shade requirements of cocoa in the two territories should not be widely different.

Cocoa in New Britain and Buka, inter-planted between lines of coconuts and shaded only by the tall palms, has

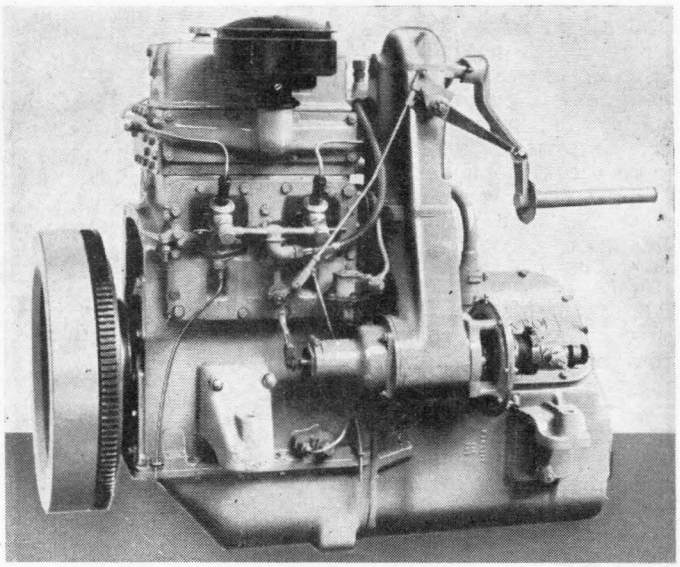
(Continued on page 57)

1 Dr. A. Schulte im Hofe in *The Fermentation Of Cocoa* by H. Hamel Smith. John Bale, Sons, and Danielsson Ltd.

2 *Cocoa* by D. H. Urquhart. Longmans, Green and Co.



This Fijian, shown here with his sons after a successful day's fishing, is one of the few professional fishermen in Suva who operate a launch.



Right: The fresh water cooled Thornycroft RJD2, new diesel version of an old Pacific favourite, the petrol - paraffin "Handybilly". Designed to fit the engine bearers of its predecessor, the RJD2 has an increased power of 12½/16 b.h.p. at 1500/1800 r.p.m.

Marine Engines For Pacific Fishermen (I)

Types of marine engine on the market suitable for the average islands fishing boat, and their inherent advantages and drawbacks, are discussed in this article by an Australian naval architect.

By ARTHUR N. SWINFIELD

OFTEN, when the problem of choosing an engine for a boat is being discussed, all sorts of arguments are brought up to support one make and type against another, and very often prejudice rather than experience decides the issue. However, if one reasons logically when making a selection, a final choice becomes much simpler.

Petrol Or Diesel?

First and foremost comes the question, shall it be a petrol or diesel engine?

THE PETROL MARINE ENGINE has held pride of place in many marine applications, and still does. For ordinary pleasure or intermittent use it is difficult to compare a good petrol marine engine with a diesel marine engine—mainly because of the cost factor.

It should be noted that reference is made to a marine engine. A properly-designed and faithfully-produced marine engine has many features that place it in a different category from an automobile engine.

In this instance we refer to a water-cooled marine petrol engine. In such an engine one would expect to find a heavier cylinder block and head as well as generally sturdier construction in most moving parts. The exhaust manifold would be water-jacketed and every care taken to ensure the least amount of corrosion from the effect of salt water (both inside the engine and out). Ordinary aluminium alloys would be noticeable by their absence, and every effort would be made to have all important "outside" equipment such as starter, generator, etc., easily accessible and readily removable for servicing.

The engine sump would be of non-corrosive material and shaped in such a way that the lubricating oil could be retained for subsequent distribution throughout the motor.

Last, but by no means least, the clutch and reverse gear box would be of pure marine design, with the addition perhaps of reduction gearing to reduce the propeller shaft revolutions to the most favourable speed, or r.p.m.

A marine engine performs at very constant and heavy duty. In most instances it runs either at idling speed or "flat out", with a load equivalent to an all-day uphill climb in the average car.

An ordinary car engine produces a road speed of approximately 70 m.p.h. from about 50 h.p. But in a boat, this same engine would perhaps be required to operate all day at a maximum horsepower of around 85 h.p., and then with the boat at cruising speed.

Because of this it is most important that the engine be selected to suit the boat and the propeller.

A slow, heavy-duty fishing vessel or trading vessel requires a large diameter, slow-turning propeller. There are two ways of achieving these conditions. One is to select a marine engine with large bore and stroke which will turn over at slow speeds (such an engine being referred to as a slow, heavy-duty motor). Needless to say, this engine would operate at something like the desired propeller revolutions and would therefore not be fitted with reduction gears. On the other hand, one could select a comparatively high-speed motor and then use a suitable reduction gear to utilize the large propeller diameter with slow revolutions.

Both methods have certain advantages and disadvantages.

The first method would of necessity use a comparatively heavyweight engine. with greater overall "physical" dimensions. Such an engine could perhaps reduce cargo or fish-room capacity.

The second method uses a motor smaller in overall dimensions, with a direct saving in weight and cargo capacity. However, the slower-turning motor would perhaps wear much longer, due to its slow rate of operation, and it would not be burdened with the use of reducing gears and their inevitable wear.

For purposes of rough calculation, one can allow 100 r.p.m. on the propeller shaft for every knot of estimated speed. If this coincides with your engine speed, direct drive can readily be used.

One very important point to remember

is that lightweight high-speed launches call for a high-speed propeller shaft, with a small diameter propeller. Larger heavyweight vessels require a slow-turning propeller, with comparatively large diameter. For this reason it is useless to fit a high-speed petrol engine with direct drive to a heavyweight vessel; reduction gears must be used to achieve efficient propulsion.

Diesel Advantages

THE DIESEL MARINE ENGINE holds pride of place for most commercial installations. Its advantages are manifold. Apart altogether from its efficiency as a unit, the reduced fire risk is of enormous importance.

With a petrol motor that is properly installed and maintained, fears of fire and explosion are at a minimum—but the risk is always there. However, with a diesel motor this risk is very greatly reduced, and the vessel can be operated with much more confidence in any weather.

In the modern diesel, both four- and two-stroke systems are used. The former uses a power stroke every two revolutions of the crankshaft—with the air-pumping stroke in between. The latter produces power with *every* revolution, and in any case uses an attached "blower" to both suck out (or scavenge) the exhaust gases and push in the new gas for combustion. Two-stroke engines therefore have the same smoothness as four-stroke engines, and use half the number of cylinders.

The actual combustion of the fuel for a petrol motor is brought about by means of an electric spark, which calls for batteries, generator, coils, spark plugs, etc., whereas the combustion for a diesel motor is achieved without the use of such equipment.

Electrical Ignition A Weak Link

The electrical ignition system of almost every marine engine has been something of a weak link, for there are so many things that can go wrong, particularly under tropical conditions. The main source of trouble is condensation (due to poor ventilation in the engine room or engine case) and the inevitable presence of salt water from the bilge or "over the side". Salt water and condensation simply do not mix with electrical systems, and once ordinary wet weather occurs the chances of trouble-free starting and running become even worse.

This should not occur in a well laid out and properly maintained engine room, but one must face the fact that such rarely exist in the South Pacific, and that tropical conditions generally are against any electrical system, ashore or afloat.

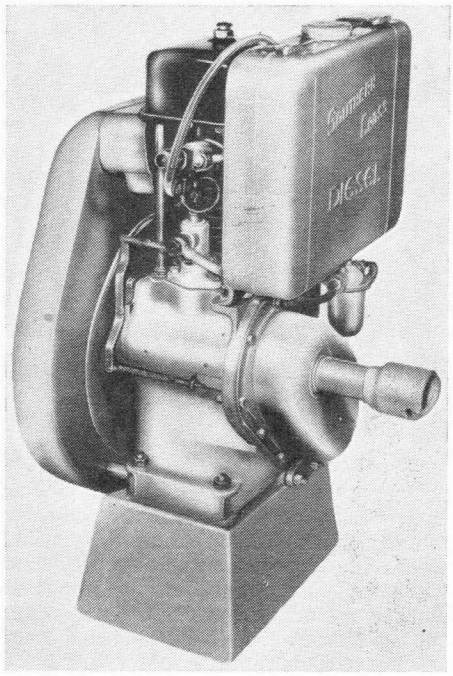
On the other hand, the diesel engine obtains its combustion heat from the very high compression of the air in the cylinders and the introduction of a very fine spray of fuel oil at the exact instant. This mixture ignites and burns without the use of an electrical system, and so one of the "snags" in an ordinary marine installation is non-existent in a diesel.

Nevertheless the diesel engine must be fed with absolutely clean fuel, free from impurities, water and sludge. Such impurities will block the fuel nozzles, and should this occur the engine will begin to miss and ultimately will cease to function. (The provision of spare injectors is a wise precaution, for one may readily replace the faulty unit with a clean nozzle and service the dirty nozzle at leisure.)

Three Main Forms Of Marine Diesel

The diesel motor is produced in many forms, but for marine purposes one may consider either:

(i) a salt water-cooled unit;



An excellent example of a small air-cooled diesel marine engine is this Southern Cross single-cylinder model, developing 4 h.p. at 1500 r.p.m.

(ii) a fresh water-cooled unit (either built in or "keel cooled"); or

(iii) an air-cooled unit.

Type (*i*) has pride of place in heavy applications, where the engine turns over at comparatively slow speeds and where the construction generally is robust, with large water jackets — not sold on a weight-for-horsepower basis.

Type (*ii*) is very popular as it applies to most small, high, or medium-speed engines. But why use fresh water? The reason is that while salt water is a good cooling medium in a relatively cold climate, when an engine is used in tropical salt water it encounters much tougher conditions. Not only is the water warmer, but it is loaded with lime and salt (sometimes sand) which tend to build up in an overheated manifold or silencer, causing a restricted flow of cooling water in the water jackets. And so the "vicious circle" continues, to the ultimate destruction of the engine.

However, if the salt water in the water jackets, etc., is replaced by fresh (contained in a closed system) this danger is overcome, as we merely use the salt water to cool the fresh water, regulating the temperature of the latter as required with a suitable "bypass" valve.

This fresh water can be cooled by either an internal or external salt water system. The former is usually built into the engine system or is carried as an auxiliary unit; something in the nature of a steam condensing unit. The external system is merely an arrangement of copper pipes fitted close to the junction of the keel and garboard plank, and suitably protected from damage by reef or driftwood. The latter system has much to be said in its favour, being inexpensive to manufacture and simple to install. Both systems require the services of a small circulating pump and header tank.

Type (*iii*), a comparatively newcomer to the marine field, has had marked success since its introduction. Needless to say it does not use fresh or salt water as a coolant, depending entirely on a good supply of air to and from the engine itself. On small units this is a simple matter, as the radiated heat is not great and in an open boat can be easily led to the atmosphere. However, engines of higher horsepowers require duct work to carry the heat away from the engine through the engine room, etc., and thence to the atmosphere.

The main advantages of the air-cooled diesel are: No use of pumps or "drivers" for pumps; no sea cocks or need of holes through the hull; no water pipe work; clogged water jackets do not occur, as water jackets not required.

The main disadvantages are: The necessary duct work is sometimes difficult to install unless allowed for in a new design; engine room is usually hotter than when a water-cooled engine is used; noise can be greater than with a water-cooled unit.

One outstanding possibility (from the naval architect's viewpoint) is that of "forced" ventilation, which when an air-cooled diesel engine is to be installed, can readily be incorporated in a vessel in the early stages of design. The cold air can be drawn from almost anywhere in the vessel and carried over the hot cylinders, and thence exhausted through the duct work to the atmosphere. (The incidence of dry rot would incidentally be greatly reduced.)

(To be continued)

Miss Malcolm at Ajamaroe (Netherlands New Guinea) with two Papuan mothers. Note size of infants and amounts of breast milk expressed after twelve hours of not suckling. Right: Two Waropen children, eighteen months old, one with severe rickets. Even in their sun-soaked villages, children are not protected against this deficiency disease.

Nutrition And The Papuan Child

In 1956 a survey of child nutrition in New Guinea was completed by two members of the Commission's health staff, Dr. H. A. P. C. Oomen, physician-nutritionist, and Miss Sheila Malcolm, dietitian-nutritionist. With the title NUTRITION AND THE PAPUAN CHILD, *their joint report was published last April as No. 118 in the Commission's Technical Paper series. It is reviewed below. . . .*

By EMILE MASSAL*

"BEHIND the present study", writes Dr. Oomen, "was the idea that a better knowledge of the nutritional situation of the child would seem an essential element in understanding the basic problems of diets, health, development and subsistence. The Papuan child of today is the parent of the society of tomorrow, a society much different to the present one, a society facing many problems resulting from and related to changes in cultural and subsistence patterns".

This broad and human approach to the nutritional problems of the Papuan child led the authors to visit several areas in New Guinea and to study a large amount of literature in order to cover the different conditions and to produce and understand comparative findings.

The survey included eight rural areas, on the coast and inland, of low and high altitude. The selection depended on many factors: geography, food patterns, living conditions, travel facilities and co-operation of personnel from government agencies, missions and villages. "This study mostly moved along those fringes of civilization where schools were already moulding the minds of the young people, but where adults kept much of the ancestral patterns of life. The archaic conceptions, customs and beliefs have still a profound, but often masked, bearing on dietary habits and child care".

The nutritional state of the Papuan child was considered as the resultant of his food intake modified by his environment, by the socio-economic conditions and the disease pattern prevailing in each area, and also by the quality of maternal care.

All this compelled the authors to treat the separate areas covered as largely independent of each other. General information on resources, housing, ways of life, cooking facilities and the influence of disease are given separately for each area visited.

The common foods, the average adult diet, the condition of the Papuan mother, the breast feeding problems, the child's diet and condition are dealt with for all regions collectively.

The report ends with two chapters on "Perspectives of Nutrition in New Guinea" and "Prospects of Improvement".

* * *

It is exceedingly difficult to make general statements about the dietary and nutritional situations in New Guinea, and not easy to summarize the report under review. Only the main points will be considered here.

From the standpoint of adult diet, two ecological patterns are considered critical generally and highly vulnerable. The first are the low areas where sago is sometimes the staple food to an extreme degree and is only very lightly supplemented from the sea and freshwater animal food sources available. The second are the sweet potato areas of the high mountain valleys which, though moderately developed agriculturally, usually have no food protein sources of high quality.

The diets of pregnant and lactating women indicate the poor intakes on which child-bearing and breast-feeding are still possible, but such conditions are viewed with grave concern. Irregularity of intakes was observed everywhere.

"Breast-feeding is apparently a very efficient process among Papuan women, considering both the initial growth of the infant and the limited protein in the mother's diet", write the authors. Feeding frequency is high in the first few months, but afterwards decreases rapidly. In the beginning the method of feeding

* Executive Officer for Health, South Pacific Commission.

Breakfast of taro at Ajamaroe. Right: Miss Malcolm weighing foods at Waropen as part of a food survey made there.

may be called "on demand" but later on is better characterized as "opportunity feeding". Breast feeding is very prolonged, but definite differences exist in the regions and everywhere a number of customs and beliefs interfere with its aspects.

Food introduction in the child's diet may be very irregular. In nutritionally poor regions first foods are monotonous and unbalanced, whereas the pattern is more acceptable in the more favoured areas. Food intake is often extremely irregular caused by lack of a fixed routine for meals and by an irregular food supply. In a few places where available, tinned milk or other tinned products were used in a very unsatisfactory way.

The child's condition was thoroughly studied. The incomplete evidence available suggests that birth weight is influenced by malaria, nutrition and race. Weight increase is generally satisfactory during the first three to six months, and usually not less than Caucasian averages. Weight increase differences are most subject to faulty nutrition, whereas differences in height increase between the regions suggest racial influences.

Under-nutrition and malnutrition are present in all regions visited, though to a different degree and in a different pattern. They are due to neglect, ignorance or poor food supplies. Among the type of malignant malnutrition, marasmus seemed more common in the sago areas and kwashiorkor in the sweet potato areas. Both malaria and unbalanced diet have effects on the liver size.

Perspectives Of Nutrition

Despite low figures as compared with western dietary standards, the nutritional situation in some regions seemed to be satisfactory. Approximate *per capita* intake of 1,500 calories and 25 to 30 grams of protein per day were recorded in two villages with apparent sufficient resources, while evidence of malnutrition was absent. Similar values have been recorded earlier under identical conditions. Therefore the acceptance of above values as indicative of the immediate standards which should be pursued for Papuans is advocated. But further investigations are necessary to elucidate the influence of climate, physical activity, body surface, irregular intakes and prevailing diseases.

The favourable influence of even small quantities of animal protein was noted. Further studies seem desirable.

Prospects Of Improvement

"The nutritional condition of the child ultimately proved to depend mostly on the health, expertness and industry of the mothers; on the availability of satisfactory resources and on guidance of the community by a wise and active village chief", the authors observe.

"Native subsistence economy, though presenting various imperfections, has the virtue of being very realistic, and offers some other advantages as well. Money and a foreign economy mostly favours the men and usually overlook the possibility of improvement of existing situations. Efforts to improve nutritional conditions should specially consider the most vulnerable links of the society, that is the mother and the rapidly-growing child, and start at the level of the present subsistence economy".

The introduction and use of pulses is advocated. Animal food can be procured best by improving fisheries, including shellfish and crustaceans, and by introducing fish cultivation. The use of liquid milk should not be encouraged where hygiene is still primitive.

Early adequate training in nutrition of Papuan village nurses is very urgent. Supervising nurses and doctors should be prepared for their functions by a supplementary training course in tropical nutrition to correct the gaps in conventional overseas training.

Definite nutrition programmes should be prepared, based on realistic requirements and realistic assessment of resources. The interests in nutrition should be a joint effort of the health services, agriculture, fisheries, animal husbandry, education and administration.

EDITOR'S NOTE: The photographs accompanying this review are several of the many illustrating the report.

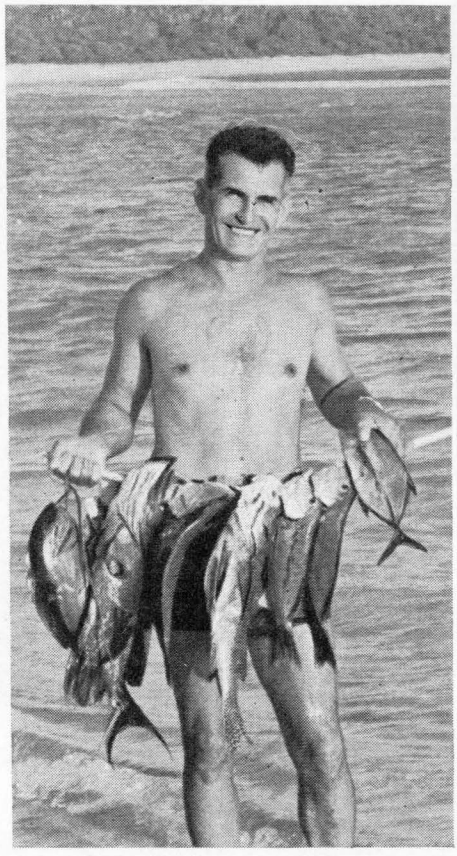
South Pacific Commission Meets In Noumea

Proposals for setting up schools to train Pacific islanders in boat-building and literature production are being considered at the eighteenth session of the South Pacific Commission, which opened at its headquarters in Noumea on Friday, September 26. The meeting is expected to last about eighteen days.

Also being studied is Commission progress made in the past year in a number of fields, notably fisheries, plant introduction, control of plant and animal pests and diseases (especially the rhinoceros beetle), health education of the public, nutrition and diet, mosquito-borne diseases and islands co-operatives. Plans will also be approved for the Commission's work for 1959.

Representatives are attending the meeting from the six member nations of the Commission, Australia, France, the Netherlands, New Zealand, the United Kingdom, and the United States of America. The chairman is the Senior Commissioner for the United Kingdom, Sir John Gutch, K.C.M.G., O.B.E.

[A report on decisions of the session will appear in the *Quarterly Bulletin* for January 1958—Editor.]



These are fish commonly caught in most parts of the Pacific. They include species of bream, snapper, cod, crevally, and barracouda. Right: The author, with an excellent catch of table fish taken by speargun.

Amateur Fishing In The Pacific Islands

To the Pacific islander, fishing traditionally plays a dual role; it is at once a pastime and a useful way of getting food. In this article, modern tackle and ways of fishing suited to the islands are reviewed by a leading Fiji angler. . . .

By ROB WRIGHT*

PROFESSOR J. L. B. Smith in his comprehensive book *Sea Fishes of South Africa* writes: "Human nature is always attracted to the unknown, and there is little joy to the true angler in fishing where he knows he can catch something of known size, for it ceases to be a sport and does not thrill. There is nothing like that about fishing in our seas. The angler never really knows whether he will sit with untouched bait, just feed small bait-snatchers, catch 'pan-fish', or the big one of his dreams, or whether blistered hands and broken tackle will end the thrill of a rush from some unknown monster. The angler is in many ways a fortunate man, for, though it is not generally realised, angling is virtually the only method whereby men in numbers may legitimately satisfy the primitive urge to secure meat by direct action."

This theory should be as good as any. It certainly applies to the Pacific. To catch fish of a reasonable size does give a grand thrill, but there is probably a more practical explanation for today's amateur angler. He catches fish for his table, and his activities with tackle are part of a snowballing rebellion against the ever-increasing high market prices for fish and fish products.

In the last ten or twelve years, angling or fishing—call it what you will—has gained more adherents the world over than any other form of sport adopted by mankind. And it is easy to see why this recreation is so popular. It may be followed by almost anyone—almost anywhere. Millions find in fishing the refreshment and escape from the pressure of everyday life; the true fisherman finds a stimulus in pitting himself against his opponent—the fish. The occasional angler finds reward in a good fish meal.

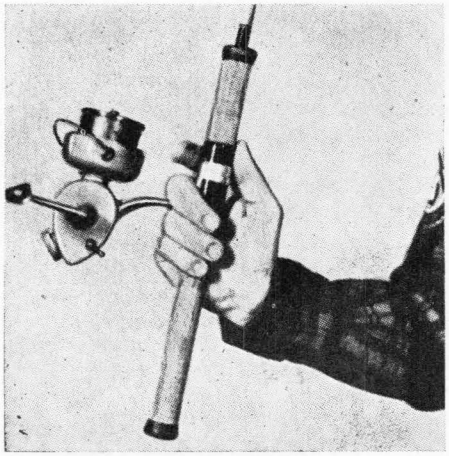
In the islands of the South Pacific, fishing has played a dual role for a long time. In an environment lacking in many of the amenities of larger countries, fishing has been both a pastime and a source of food. Indeed, in many of the islands and atolls closer to the equator, fish are taken as part of daily subsistence.

Basic Equipment For Fishing

Up to a decade or so ago the basic tackle requirements for fishing comprised a cord line, a piece of wire, and hooks. For the more adventuresome and active menfolk—a spear and a pair of small goggles.

Today, only a few years after the advent of nylon, comparatively few fishermen use cord line; while the man with the spear either uses a type of underwater catapult or a similar device which is mechanically powered. In addition there are simple, inexpensive

* Mr. Wright, who is the official photographer attached to the Public Relations Office in Fiji, also conducts a popular Saturday feature for amateur fishermen in the *Fiji Times* entitled HOOK, LINE AND SINKER.



Ready for casting a lure. Correct way of holding a rod with spinning reel.

reels, and rods of fibreglass — all of which may fit into the budget of the average angler.

By far the most popular method of fishing is, and has been, hand-lining. The first consideration is the line. Nylon has proved to be outstanding in this field; it has great power and elasticity, and is available in all sizes and breaking strains—from two pounds to eight or nine hundred pounds, and it can be bought in any desired length, and in almost any colour.

Selecting Lines And Hooks

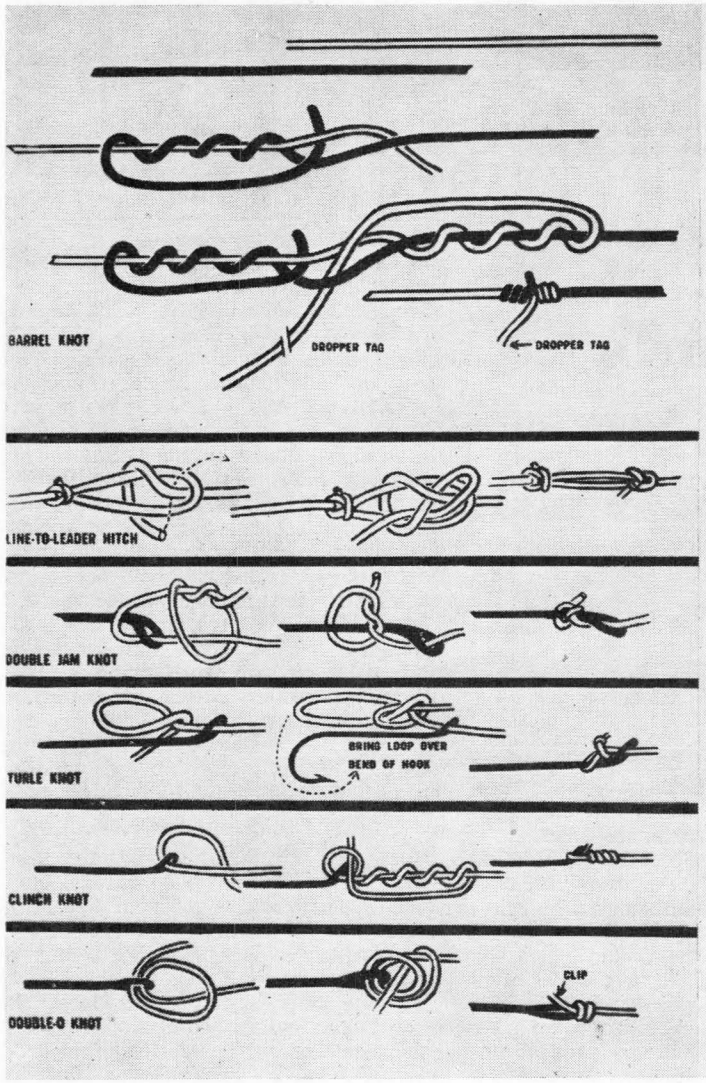
When selecting a line the main considerations are the location for fishing and the probable size of fish to be caught. It is obvious that if the intention is to fish shallow water from the shore or beach, or from a jetty, there is no use in buying a heavy line. On the other hand there is little point in procuring light line to fish reef passages, or deep rough water.

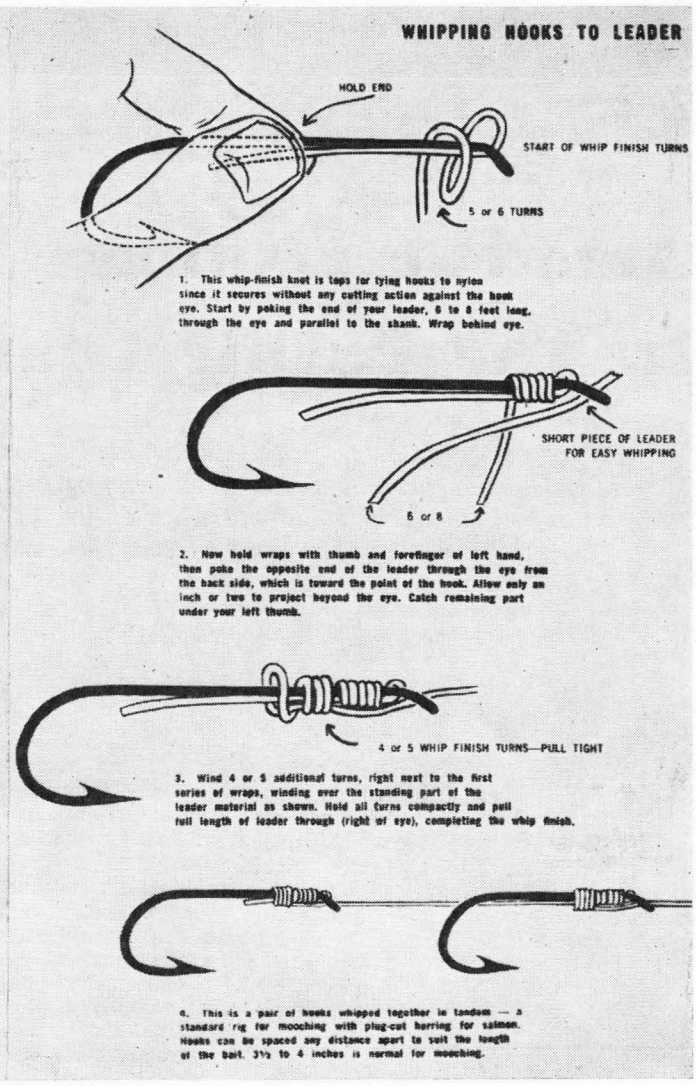
In Fiji, the average line used for lagoon, bay, or reef passage, would range between 60-100 pounds breaking strain, with a length of not less than 200 yards. This line would be suitable for catching Spanish mackerel, rock-cod and grouper, jack crevally, red emperor, tuna, bonito, wrasse, and barracouda, and many other species which may attain the sizes and weights up to the breaking strain of the line.

The fisherman therefore must buy line to fit the occasion and the place.

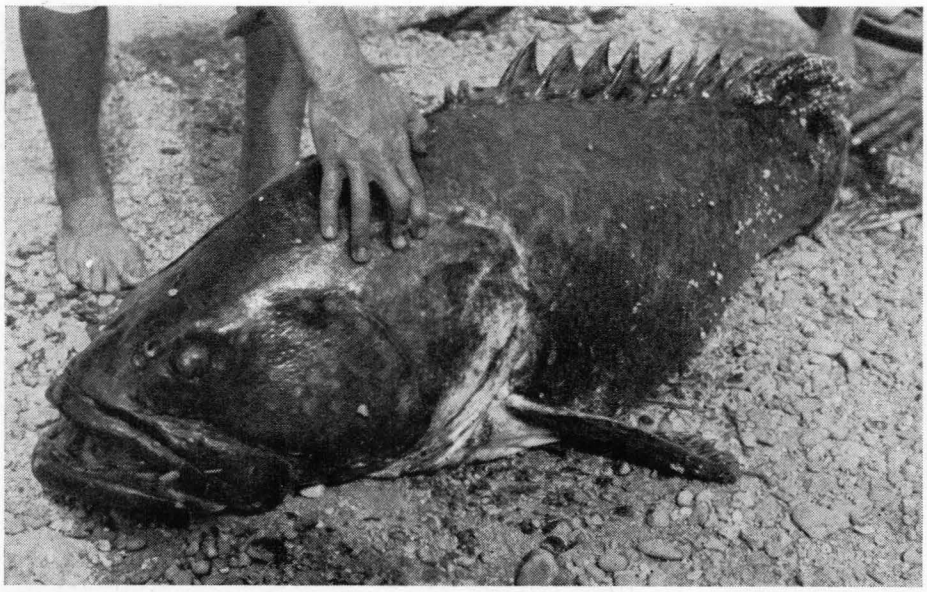
Hooks are the second most important part of an angler's equipment. To the newcomer, hook sizes are at first confusing. If we commence in the middle of the scale with size 1—which may perhaps be recommended for sea bream —then the smaller sizes will go 2, 3, 4, etc., while the larger sizes will have a stroke and an "O" after the size. For example, if the size smaller than one is 2, then the larger size would be 1/0, 2/0, etc.

In addition, there are various types of hooks, such as the Kirby, French Sneck, Suicide, King, etc. An average





Above: A selection of knots for use with nylon lines. The top sketch shows how to join two lines together with a barrel knot, which can also be used for attaching extra hooks, or a sinker. The other knots are used for attaching lines to hooks. Right: This diagram shows how to whip hooks to a nylon leader.



A 120-pound grouper caught on a handline near Suva.

hook for a 60-70 lb. line would be a 6/0 in either a Kirby or Suicide. Some fishermen prefer a special long shank, which is about an inch longer.

Knots For Nylon Lines

Knots in nylon line differ considerably from knots in other types of lines. An inefficient knot in nylon may pull out or may weaken the line to a point where it breaks before the full strain is taken. It is therefore recommended that fishermen should study diagrams and put in some practice in tying knots before actually fishing.

For fishing in the tropics where barracouda, wrasse, and other sharp-toothed fish are encountered, a wire trace is highly desirable. This may vary in length from six inches to three feet.

With regard to location, in Fiji, fishing in the vicinity of reef passages is by far the most popular. Also, as fish feed mostly at night, nocturnal angling has been found to yield far better results than during daylight hours. An hour before slack water, and two or three hours with the rising tide, is perhaps the best time.

Most favoured depth is anywhere between thirty to sixty fathoms, so naturally a lead sinker is required. It is a matter of personal taste whether the fisherman attaches his hook(s) below or above the sinker, though the latter method is preferable when fishing over a coral bottom, as the hook is less apt to be snagged.

Bait To Use

Bait can be anything from sardines to mullet, mackerel or small barracouda. A Coleman or similar high-powered light is invariably used in the launch or boat, and is positioned so that its rays shine all around. The theory is that this attracts bait fish, which in turn bring predators.

Many of the seasoned fishermen in local waters take small scoop nets with them. When bait fish are attracted to the light, these are scooped up, placed alive on a small hook with light line, and lowered for mackerel. The mackerel in turn are placed alive, either on triple-gang hooks or a brace of singles with a heavy line, and this invariably is a certain lure for surface-feeding fish such as Spanish mackerel, jack crevally, barracouda, and tuna.

Many of the local fishermen also have the habit of using three lines at the one time; a light line for mackerel, a heavy line for bottom fishing for fish such as red emperor, grouper, salmon cod, wrasse, etc., and a third heavy line for surface-feeding fish.

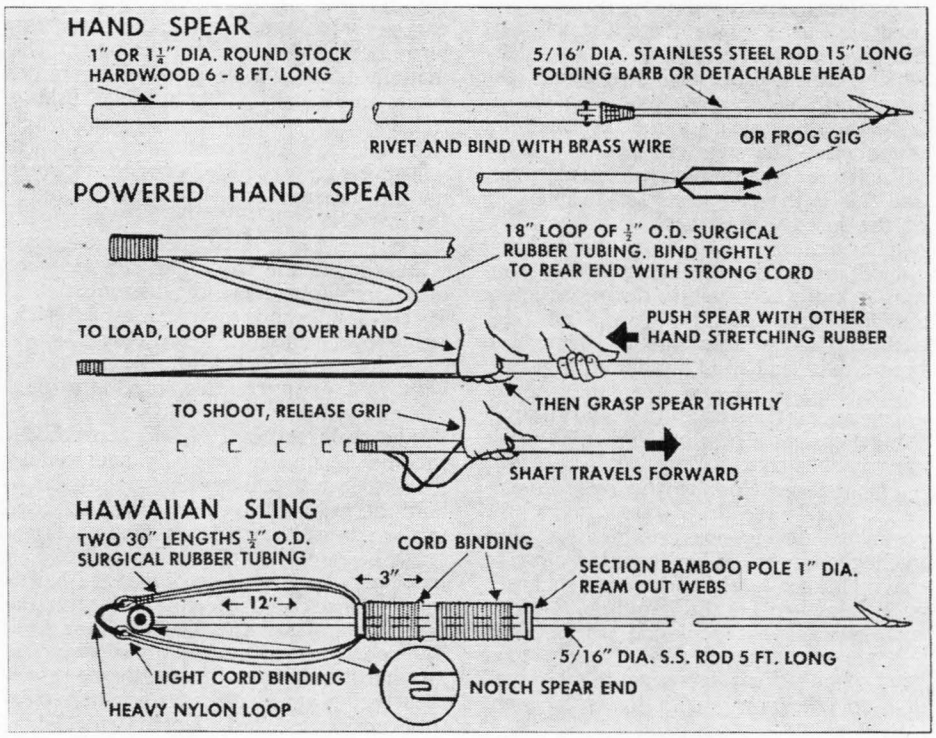
Hand-lining does produce good results, and it is the cheapest form of fishing.

Gear For Trolling

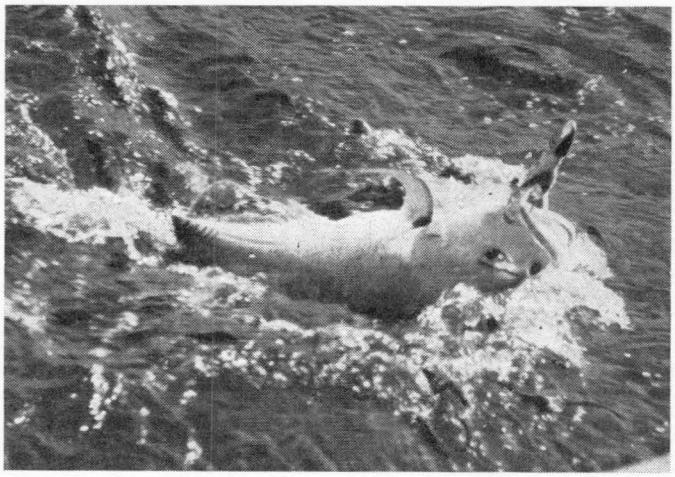
With many miles of reefs, bays, and lagoons in the islands, trolling is another form of fishing which finds favour, particularly with anglers who are not patient enough for still fishing. Here again, hand-lines may be resorted to, or else a trolling rod and reel are used.

For the latter, a medium-action rod in either cane or fibreglass and about six to seven feet in length is ideal. A modern multiplying reel with star drag and a capacity of 400-500 yards of 30-pound line should be used in conjunction with this rod. To complete this outfit, a rod butt-rest of leather or fabric is essential. This is used to rest the butt of the rod while the fish is being played. For heavier fishing, special gear should be used.

Terminal gear—that is, trace, swivel, and lure—is an important part in trolling. A good brand of stainless steel trace wire is very necessary. The length may vary with individual requirements, but about five feet is the average. To one end of this is attached a swivel, and the other end is made fast to the lure. As the first six feet of line takes the brunt of the fight, and may come into contact with the fish itself, it is recommended that this be doubled for this length. As with still-fishing, knots play an important part



These sketches show how various weapons for underwater use can be made at home. Many commercially-manufactured spearguns are also available.



A jack crevally being pulled aboard a launch after having fallen victim to a feather jig.

if nylon is being used, so care should be exercised.

If such small fish as mullet, small barracouda, or school mackerel are available, they are admirable trolling baits. Slice down from the top of the fish and remove the backbone from behind the gills to the tail. Insert the hook(s)—they may be used in tandem—then close and sew up the cut. If the bait fish is large, a strip taken from the belly or from a fillet is useful. Make sure the bait does not spin when placed in the water, and troll at a slow speed of between three-five knots.

There are innumerable artificial lures, spinners, spoons, and jigs to choose from. The three most popular in Fiji waters are the Gibbs, Glendon-Stewart, and the feather jig. In bright weather the feather is best, while on dull days a spinner or spoon produces results.

An inexpensive and very efficient lure used in Fiji is made from the stem of the *viavia* (local name), a large lily which grows profusely throughout the Group. It has long yellow-green leaves, and the botanical name is *Crinium Asiaticum*. The stem consists of a series of delicate cream-coloured membranes, and this is the part used for the making of the lure.

The stem is severed above the root and cut off just below the leaves. After running a knife very lightly down the stem, the first layer can be peeled off very easily. This is then cut to shape and bound to a lead head similar to that of a feather jig. It should have the general appearance of a squid. It is an unfailing fish-getter, but a new one has to be made after each strike.

Open water close to the reef, in passages, and in the deep water around the perimeter of lagoons and bays is ideal trolling country. When running close to the reef keep a tight drag on the reel, or a firm grip on the handline. It is in such places that rock-cod and similar fish are encountered and, if given their head, if only for a few seconds, they will dive for the coral, with the subsequent loss of a lure.

If trolling artificials, a higher speed than for fresh bait is required—perhaps six or seven knots. This is certainly the case when skipjack, bonito, or yellow-fin tuna are encountered, for they seem to strike better at a fast-trolled lure. With these fish, a feather or a *viavia* is a must, as they rarely strike at spoons or spinners.

A variation of surface trolling is the use of a paravane. A short length of line with either artificial or fresh bait is attached to the paravane, which is then lowered to the required depth. The paravane keeps the lure down deep. This method has been found to produce better results than with surface fishing.

Selecting A Spin-Fishing Outfit

For the potential angler who, because of the nature of his work, or for other reasons, cannot take the time to troll or still-fish, there is a medium by which he can enjoy the sport and at the same time bring home "pan-fish" for the table. This method is known as spin-fishing or, as some people call it, "thread-line" fishing. It involves an outlay on a spinning reel and rod, but if care is taken this outfit will give many years of good service and untold pleasure and will provide many fish for the table.

The reel has a fixed spool, and its axis is parallel to the rod. The simplicity of operation obviates the necessity of "know-how", and such things as backlash, over-running, "bird's-nests" and other hazards which are to be contended with in a conventional reel, are non-existent with a spinning outfit.

The reel itself is attached beneath the rod handle and is generally operated by the left hand, leaving the right free to hold the rod and do the casting. Attached to the rim of the reel is a pick-up finger or bail.

When a cast is to be made, the bail is snapped back and the line taken on the forefinger to take the weight of the lure. The rod is moved backwards in a vertical arc and then snapped forward, the movement being arrested just beyond the vertical position. The effect of this whipping motion sends the lure out with speed and accuracy, and the line springs off the spool unrestricted. When the lure hits the water, a turn of the handle brings the bail into play, and this picks up the line and winds it on to the reel. The reels have high-ratio gearing, and the retrieve can be effected as fast or as slowly as desired. In effect, it is a form of stationary trolling.

Many reels of this type are on the market. Pick one which has a good spool capacity—say, 250-300 yards of 8-pound line. It is wise to secure at the same time an additional spool should you wish to change to heavier or lighter line. For salt-water fishing it is important that the reel be corrosion- and rust-proof.

The rod may be either of cane or fibreglass, the best length being between 6-7 ft. Make sure it has a reliable reel seat and that it is fitted with large "spinning guides." The largest guide—that closest to the reel—should be at least an inch in diameter. If the spinning guides are smaller they will restrict the spiralling action of the line as it peels off the reel, thus impeding the cast. The rod may be of one piece, but, for portability, two lengths are preferable.

Any light artificial lure and strip bait may be used with the spinning outfit. (Anyone with access to a workshop can turn spoons and spinners out of such things as broken car headlamps, etc.)

The spinning outfit can be used anywhere along the shoreline; near reefs, in river mouths, or in rivers. The water need not be deep; in fact, a good percentage of catches are made in depths little over a fathom, and sometimes much less. Sea bream, red-cod, small barracouda, jack crevally, salmon cod, surmullet, red fish and a variety of other fish have been taken with spinning outfits. For a person who does not have access to a boat, or who wishes to spend only an hour or two fishing, this tackle is to be recommended.

Some Pointers On Spearfishing

For the more active types who wish to spend their fishing time under water, there is a variety of equipment available. The islands of the Pacific abound with spots where this type of hunting may be used with excellent results.

The simplest form of underwater weapon is the Hawaiian sling, which is a deadly weapon up to a distance of ten feet. Two pieces of surgical tubing are bound to a piece of bamboo about six inches in length, which has the centre pieces punched out. The ends of the tubing are connected with a piece of nylon cord, and a five- or six-foot $\frac{1}{4}$" steel spear is fitted.

To use this weapon it is only necessary to draw back the tubing and spear—something like a catapult—and release it when the prey is lined up.

A good face mask, a snorkel to breathe through, a pair of rubber swim fins, and a lead belt to neutralize buoyancy are

A fine bag of yellowfin tuna caught while trolling in the Yasawas.

items of equipment necessary for the underwater fisherman.

Reef patches and crevices in the reef are ideal places for this sport. It is a wise precaution not to venture too far from the reef, which may be used as a haven in the event of a nosy shark or other large denizen appearing. When a fish is speared it should be taken immediately on to the reef or placed in a boat. This is a measure of self-preservation which should be followed at all times.

When stalking fish, do not make hurried motions; this frightens them. Do not get into a tide rip or surf combers. Above all, never attempt to spearfish in water that is murky and where visibility is limited.

Done properly, spearfishing is an exciting and productive way of taking fish.

Rhinoceros Beetle Control

(Continued from page 20)

natural controlling agents in India, Ceylon, Burma, East Africa and Madagascar. In 1955, the programme was expanded to include a survey of infectious diseases attacking the beetle.

The initial survey carried out in South-East Asia for insect enemies of the rhinoceros beetle did not prove rewarding, and in 1957 it was decided to concentrate efforts along these lines in the island of Madagascar, where there are known to be some fifteen or more species of rhinoceros beetles.

A five-months' survey by the Commission's Technical Officer (Pests and Diseases) carried out in Madagascar during 1957 indicated that in the forest regions of the island, the native home of the various species of rhinoceros beetles, there were many natural controlling factors. However, due to the inter-play of the many species of predators as well as rhinoceros beetles the important ones were difficult to ascertain. It was therefore proposed that at least a year's study be made of the general ecology of the beetles in order to determine the major controlling factors of their populations.

During the survey a promising predator (*Scarites madagascariensis*) of *Oryctes* grubs was found, and it was decided that this predator might be of use in helping to control the pest in certain environments in the South Pacific. Collections were made and three consignments of this insect were sent to Fiji and Wallis Island for liberation in the field.

In January 1958, the *Institut de Recherche Scientifique de Madagascar* undertook an intensive study of the ecology and controlling factors of the rhinoceros beetles in Madagascar under a South Pacific Commission grant.

In the meantime, the survey of the diseases attacking rhinoceros beetles which had been carried out since 1955 by Dr. Paul Surany under a grant to the South Pacific Commission from the Rockefeller Foundation (USA), indicated that there were some types of diseases which played an important, and, perhaps, a primary role in checking the populations of this pest in South-East Asia and Africa. Unfortunately, many of these occurred in combination with each other, a fact which makes their determination extremely difficult and their importance in the final death of the beetles very hard to follow.

In 1958 it was decided that this initial survey had shown such promise of possible means of control of rhinoceros beetles that additional work on the most promising of the diseases discovered was definitely warranted. Following application from the South Pacific Commission to the Rockefeller Foundation for additional funds to carry out this research, the Foundation generously granted the necessary funds to enable an intensive study to be carried out on the identity and modes of transmission of these pathogenic organisms.

The following is a list of the various biological control agents which have been discovered and tried in various countries for the control of rhinoceros beetles.

CONTROL OF—

ORYCTES RHINOCEROS

AGENT

Scolia oryctophaga (parasitic wasp).
Metarrhizium anisopoliae (parasitic fungus).
Carabus sp. (predatory beetle).
Catascopus facilais (predatory beetle).
Elis romandi (parasitic wasp).
Scolia ruficornis (parasitic wasp).
Placodes ebeninus (predatory beetle).
Leionota (predatory beetle).
Pachlyster chinensis (predatory beetle).
Leionota columbiana (predatory beetle).
Leionota quadridentata (predatory beetle).
Scarites madagascariensis (predatory beetle).
Pyrophorus pellucens (predatory beetle).
Mecodema spinifer (predatory beetle).
Agrypnus fuscipes (predatory beetle).
Alaus speciosus (predatory beetle).
Plaesius javanus (predatory beetle).
Scolia patricialis plebeja (parasitic wasp).
Nematode: *Rhabditis* (*Rhabditis*) near *Maupasi*—Ceylon.
Nematode: Parasitic, Genus? species? Madagascar.

ORYCTES TARANDUS

Scolia oryctophaga (parasitic wasp).

REFERENCES

CUMBER, R. A.: 1957. Ecological Studies of the Coconut Rhinoceros Beetle (*Oryctes rhinoceros* (L.)) in Western Samoa. Technical Paper No. 107. South Pacific Commission.

GRESSIT, J. L.: 1953. The Coconut Rhinoceros Beetle (*Oryctes rhinoceros*) with particular reference to the Palau Islands. Bulletin 212, Bernice P. Bishop Museum.

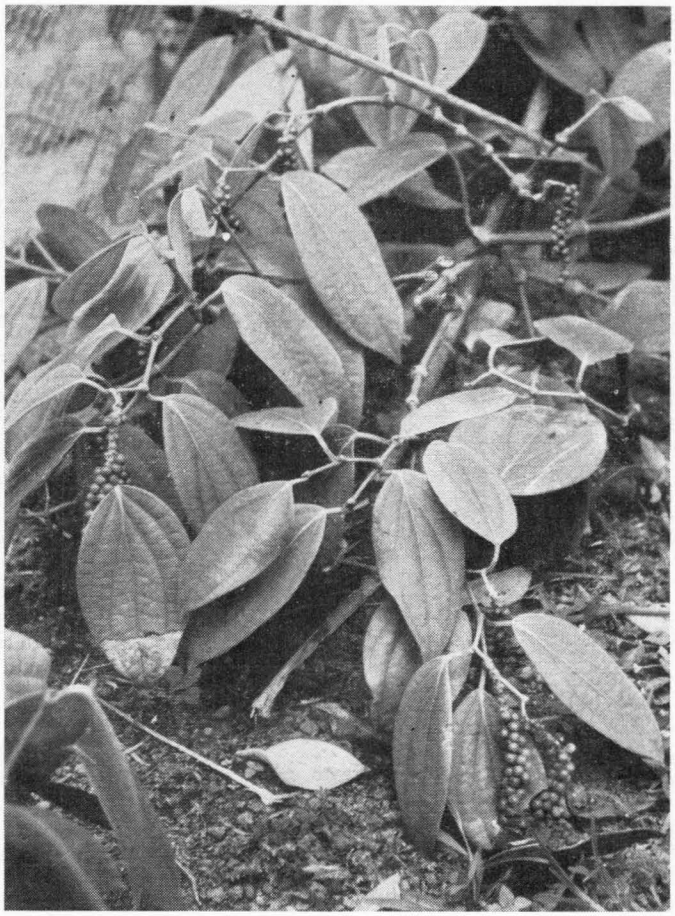
JEPSON, F. P.: 1912. The Rhinoceros Beetle (*Oryctes rhinoceros* Linn.) in Samoa. Department of Agriculture, Fiji. Bulletin 3.

LEEFMANS, S.: 1920. De Klappertor (*Oryctes rhinoceros* L.). Mededeelingen van het Instituut voor Plantenziekten No. 41 (Department van Landbouw, Nijverheid en Handel) Batavia.

O'CONNOR, B. A.: 1953. The Rhinoceros Beetle (*Oryctes rhinoceros* L.) in Fiji. Department of Agriculture, Fiji. Journal Vol. 24. Nos. 1-2, pp. 35-46.

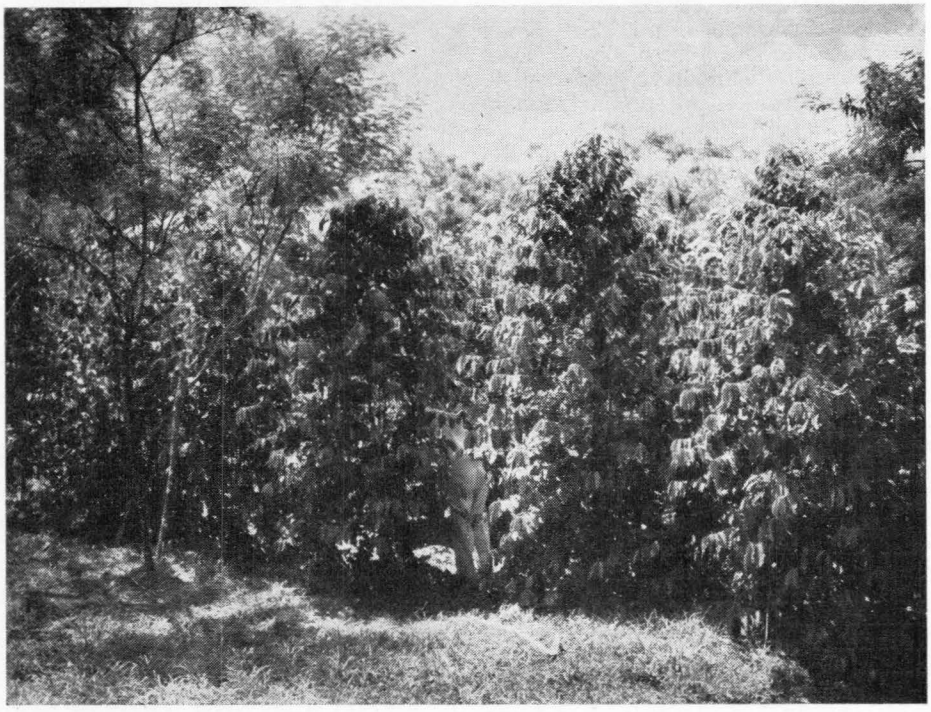
O'CONNOR, B. A.: 1957. Rhinoceros Beetle Campaign in Fiji. SPC *Quarterly Bulletin.* Vol. 7. No. 4, p. 32 (October 1957).

A fine specimen of a young cocoa tree in bearing at Naduruloulou.



A bearing vine of the black pepper collection, which is being assembled in one plot.

Plant Introduction At Naduruloulou



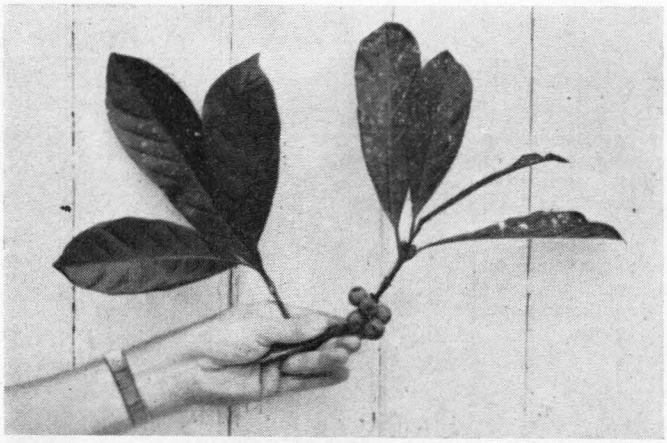
"Arabica" coffee trees on the station.

This brief review of the past year's activities at Fiji's main plant introduction station was prepared by the Commission's plant introduction officer . . .

By JACQUES BARRAU

AS a result of the full collaboration between the South Pacific Comission and the Fiji Department of Agriculture, the latter's plant introduction and quarantine station at Naduruloulou has become an active centre of introduction and propogation of economic plants.

At its annual meeting held at Nouméa in November 1957 the Commission approved a contribution to the work of Naduruloulou in recognition of the useful work being carried out there. The past year's experience has shown that the services rendered by this Station to the economic development of the South Pacific area will be increased still further by concentrating its activities on three main cash crops: cacao, coffee and black pepper.



Above: Specimen of the Liberian coffee growing at Naduruloulou (Coffea Liberica). Right: The Arabian coffee, or "Arabica" (Coffea Arabica). More than 5000 seedlings of this coffee were distributed during the first six months of this year.

Station Completely Reorganized

To implement this new orientation, a complete reorganization of the Station has been undertaken.

Today, the collections of Naduruloulou include 20 clones of cacao trees, *Trinitarios* and *Forasteros*. They were introduced from the Imperial College of Tropical Agriculture in Trinidad, Granada, Keravat Station in New Britain and Western Samoa. There are even some Amazonian *Forasteros*. In addition, several valuable selections made from cacao trees already present in Fiji are also being propagated in Naduruloulou.

The Fiji Department of Agriculture is now considering adding to this collection, with all possible quarantine precautions, some *Amelonados* from Malaya.

The collection of coffee trees is also important. It includes 24 varieties of *Arabica,* 7 varieties of *Robusta* and one of *Liberia.*

In addition, 7 varieties of black pepper of various origins are also propagated for distribution.

Extensive Distributions

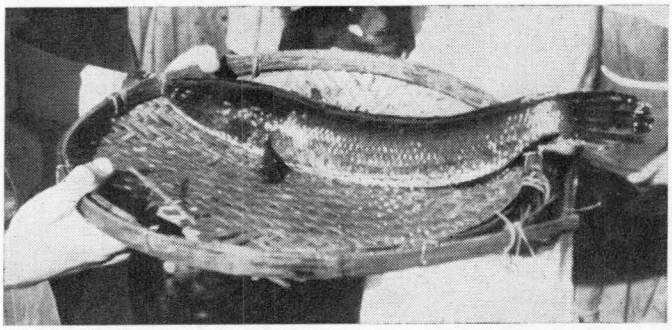
During the first half of 1958, the reorganization work in progress at Naduruloulou limited the activities of the Station in the distribution of plant material. Nevertheless, more than 5000 seedlings of coffee trees have been distributed, as well as 200 rooted cuttings of black pepper, thousands of cacao pods and a considerable number of rooted cuttings of the same species.

Beside the above-mentioned economic plants, tea, a large number of taro varieties, and several species of bamboo are grown on the Station which is also propagating oil palm, a cash crop which is the object of trials in some territories in the area.

New Introductions Pending

New introductions of coffee and black pepper varieties, as well as of bamboo species, will be made in the near future. Thus it is hoped to increase again the contribution of Naduruloulou to the economic development of the South Pacific Islands.

Above: Part of the taro garden in which are a number of varieties assembled by Dr. R. C. Cooper, botanist of the Auckland Institute and Museum. Dr. Cooper is engaged in a thorough study of this plant, aided by a grant from the Rockefeller Foundation. Below: Seedlings of coffee and cuttings of black pepper and cacao ready for distribution.



Left: An adult murrell, a newly-introduced species of edible game fish under study in the Commission's experimental fish ponds at Port Laguerre, near Noumea. Right: Sepat Siam grown in the Commission's ponds.

Fresh Water Fish For The Pacific

Some observations on recent introductions of freshwater fish already made to Pacific territories, and on other new species now undergoing trials in the Commission's experimental fish ponds in New Caledonia, are recorded in the article below.

By H. van PEL*

THE endemic fish fauna of streams and rivers, ponds and lakes within the South Pacific Commission's area is poor. Various theories have been proposed to explain this sparsity of population, but cannot be elaborated here. In a few instances waters have been stocked with imported species, thus creating populations comparable with those existing in more favoured countries.

In a region like the South Pacific, where human diet is often deficient in the protein that fish can provide, an important question is: Can all—or most—natural as well as artificial bodies of water in the area be stocked with fish?

Part of the answer to this question lies in the trials that have been made and observations recorded in various Pacific locations offering different conditions of environment. It has been possible to accomplish this work only through the co-operation of territorial officers and several private individuals. Because of the wide variety of environments, differing sets of biological and ecological factors must be taken into consideration, apart from the fact that some components are still new to us.

Eight Species Introduced So Far

So far, recorded fish introductions in the South Pacific include eight species: Kissing gouramy, sepat Siam, trout, giant gouramy, carp, murrell, and two species of tilapia (*T. mossambica* and *T. zilli*).

Of these, the giant gouramy, carp and murrell are being kept in observation ponds in New Caledonia, but no conclusions have been reached as yet. The introduction of *Tilapia zilli* into Guam is too recent for any opinion to be formed as to its success. Kissing gouramy and sepat Siam are already thriving in some lakes and ponds, while *Tilapia mossambica* is successfully established in similar habitats as well as in streams.

Kissing gouramy, sepat Siam and *Tilapia mossambica* are already appreciated as food in some islands.

All these species vary considerably in their characteristics. All are palatable, but some—notably trout, murrell and giant gouramy—are tastier than the rest. Trout favour cold, clear waters while murrell finds its normal habitat in warmer lakes and streams. These two species are much esteemed by anglers for their fighting ability.

On the other hand, quantity production of smaller "pan fish" averaging 8″ in length can be expected with tilapia

* Fisheries Officer, South Pacific Commission.

Catching and cleaning tilapia introduced to fish ponds near Rarotonga, in the Cook Islands, by Mr. van Pel several years ago.

Mr. van Pel with an assistant, netting tilapia in one of the Commission's fish ponds, for transfer to the lake pictured below.

and sepat. Yields of 800 pounds per acre/year can be expected, and are quite frequently exceeded.

Tilapia And Sepat Best Known

The two species whose reactions to various South Pacific environments are best known to us are *Tilapia mossambica* Peters and *Trichogaster pectoralis* Regan (sepat Siam).

Several introductions of the first were made from the Philippines, Singapore and Hawaii. Its country of origin is Africa. Although known as a fresh-water fish, its adaptability to brackish or salt water is quite remarkable. However, satisfactory reproduction does not occur in waters where salt concentration exceeds 25 parts per 1000.

This tilapia thrives in the tropics—from sea level to altitudes of 6000 feet—though it reproduces with difficulty above 5500 feet. It will thrive in temperatures ranging from 68° to 95° F. Although female tilapia have spawned in mid-winter in New Caledonia, in practically all cases the eggs did not hatch at water temperatures of 62° F. or lower.

Male tilapia reach a larger size than females. When mature, the males become darker and their fins acquire a red edge, while females adopt an olive colouring. Differentiation of sexes should be made on specimens 3″ long immediately after withdrawal from a pond; it becomes more difficult when they have been kept in a light coloured or transparent container for any length of time, as mimetic discolouration takes place almost instantly.

When ready to breed, a male tilapia makes a nest, a saucer-shaped depression in the bottom, one to two feet across and about 3″ deep, and the female lays eggs in it. After fecundation has taken place the eggs are scooped into the female's (or sometimes the male's) mouth, where they are incubated. This incubation period is short, but the very young fry will still take refuge in the parent's mouth when danger threatens.

At their first spawning, very young females produce about 80 eggs of a dull yellow colour. Later, the number of eggs increases. (One female 4½″ long, for instance, was found to be carrying 236 eggs). We do not know how often tilapia spawn, though are certain that it is at least three or four times a year. Females are mature at four months, and reproduction continues periodically until at least the age of eighteen months, possibly even later.

In pond culture, good-sized tilapia can be obtained by growing only males selected from the spawn of large genitors. As mentioned earlier, sexing is easy, but care should be taken to see that the males are not carrying eggs or young fry in their mouths, as occasionally happens. A very simple way to avoid this is to keep the fish selected in a small pond for a week before transferring them to the raising pond.

Observations in natural and artificial ponds, as well as a series of aquarium tests, have shown that mosquito larvae are taken freely by tilapia measuring 3″ and over.

This fish can live in waters where the pH ranges from 6 to 8, but the best results are obtained in slightly alkaline waters with a pH of 7 or over.

Several other species of tilapia grow bigger than *Tilapia mossambica,* but generally they are not as easy to raise. As mentioned above, one of them, *Tilapia zilli,* has been introduced in the area by the Commission, and its possibilities for the Pacific are being investigated.

Sepat Siam

The sepat Siam came to this area from the Philippines and from Indonesia. Shallow lakes and swamps are their normal habitat, but they can be raised in ponds as well. This species lives in fresh water only.

Our records on sepat Siam show that they thrive from sea level to 800 feet in

(Continued on page 52)

Mr. van Pel releasing tilapia fry in a large, shallow, freshwater lake on the plateau extending across the southern part of New Caledonia. In the background on the right is Mr. J. Marinet, Director of the Department of Agriculture. With him is Mr. L. Bernier, Forestry Officer.

Group of Gilbertese on Onotoa island.

Gilbertese hut raised on coral blocks.

Atoll Study In The Gilberts

In 1953 Dr. René Catala, of the French Institute of Oceania, carried out in the Gilbert and Ellice Islands for the South Pacific Commission a six months' pilot study on the economic development of coral atolls. His main tasks were to investigate ways of increasing the quantity and variety of subsistence and cash crops and of improving domestic animals and fisheries. His report was published last year with the assistance of a Commission grant by the Bishop Museum in Honolulu, as No. 59 in the Pacific Science Board's Atoll Research Bulletin series. It is reviewed below . . .

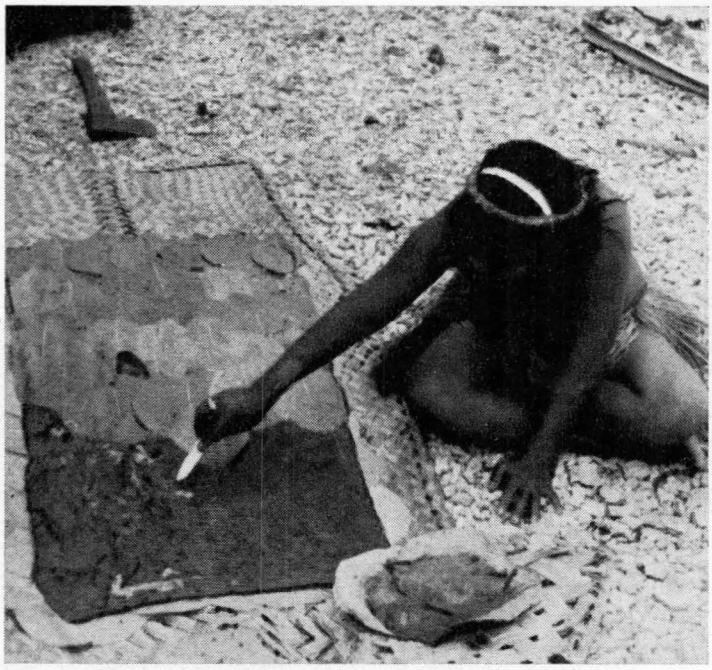
By A. H. J. KROON*

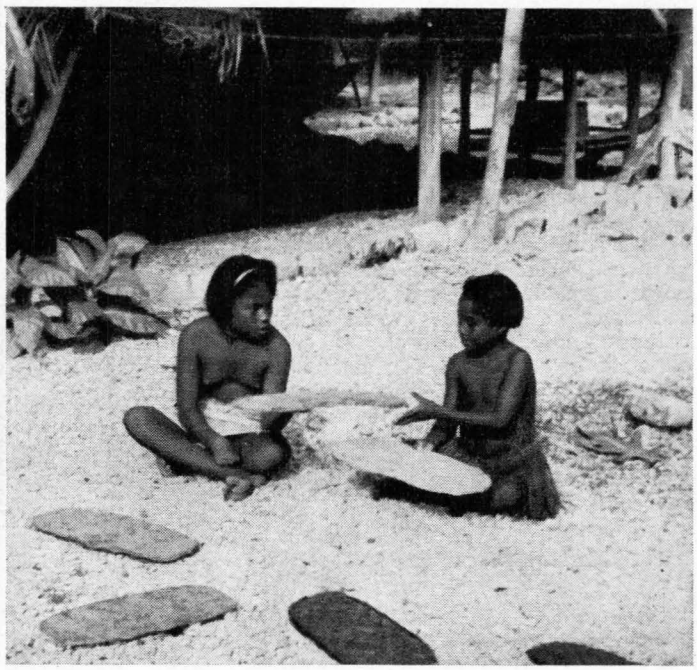
IN December 1950 Dr. René Catala left Nouméa for Fiji en route to Tarawa on a short-term appointment with the South Pacific Commission, to carry out a survey in the Gilbert Group of which the objectives were:

(1) "To study and assess the physical environment, particularly the soil, water, and climatological relations; the vegetation in its economic or other relationships; the production of the sea and its parts; in a word, the ecology of this representative area;

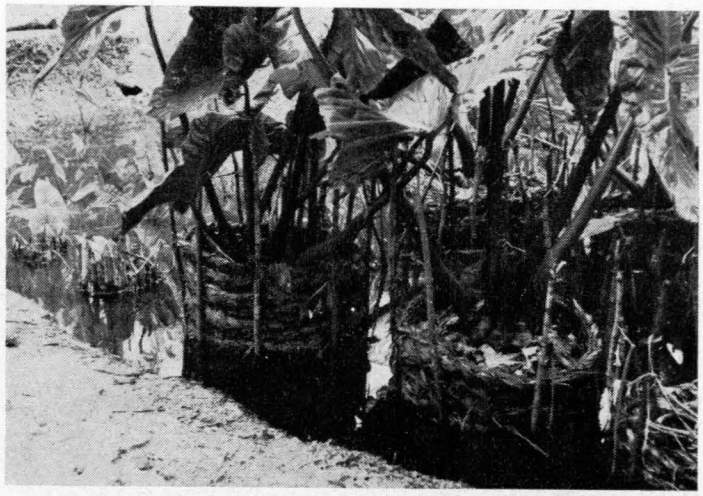
(2) "the improvement of the human ecology

* Executive Officer for Economic Development, South Pacific Commission.





Te tuae paste, made from pandanus, is spread on Guettarda leaves, and then covered with them as well. Right: Cakes of te tuae in the last stage of drying, spread on the ground.



Babai (a giant taro) at various ages. On the ground is an old round basket which has been used to mix compost, while hanging is a long basket used to carry it. Right: Baskets holding compost around babai plants.

> of the area, striving to discover ways and means of increasing quantity and variety of subsistence and commercial crops, greater production by improved fertility and method; the improvement of domestic animals; the improvement of fisheries and other products of the sea."

These were the terms of reference for the enormous task Dr. Catala undertook to carry out by means of a survey covering a period of six months of field work in eleven islands of the Gilbert Group.

Although the investigator had the assistance of his wife, who constantly helped in all spheres of the survey (and to whom he duly pays tribute in the introduction of his report), it is nevertheless a most laudable fact that he could collect and evaluate such a wealth of data in so short a time.

Dr. Catala's report covers climate and soils, and the population. It discusses the plants of economic value, in particular the coconut palms, pandanus, breadfruit tree and "babai" (*Cyrtosperma chamissonis*). It includes an interesting list of insects collected in the islands. The chapter on marine resources is of great importance.

In addition, Dr. Catala carried out surveys of the domestic animals, and of Gilbertese handcrafts; he made a quantitative study of the Gilbertese diets, studied the co-operative societies, and compiled a Gilbertese vocabulary. Some interesting photographs are reproduced in his report[1], which also contains a comprehensive list of references.

Delicate Balance Between People And Environment

Dr. Catala repeatedly emphasises the fact that there exists a wonderful but delicate equilibrium between the people and their environment, and stresses the need to maintain this. He warns against well-intentioned measures aimed at improvements which could, however, unfavourably influence this balance. He pleads for the preservation of vegetable and animal sources of supply, and urges that a survey should be made of the Gilbertese diet.

In accordance with his terms of reference, Dr. Catala made many valuable recommendations aimed at improving existing conditions. His proposed programme of agricultural development emphasises the improvement of economic plants already existing in the islands. It is especially devoted to the coconut palm, which is of such paramount importance to the Gilbertese, both as a subsistence as well as a commercial crop.

Dr. Catala strongly urges the establishment of an agricultural experiment station to study the selection and improvement of species of basic economic importance, such as the coconut palm, *Cyrtosperma*, *Pandanus*, *Artocarpus* (breadfruit).

Pending the establishment of a research station, some measures are recommended which could lead to more direct improvements. Dr. Catala mentions, for instance, the removal of coconut palms which are undeniably unproductive because of their age or other defects, and trees killed by fire, followed by the replanting of suitable areas.

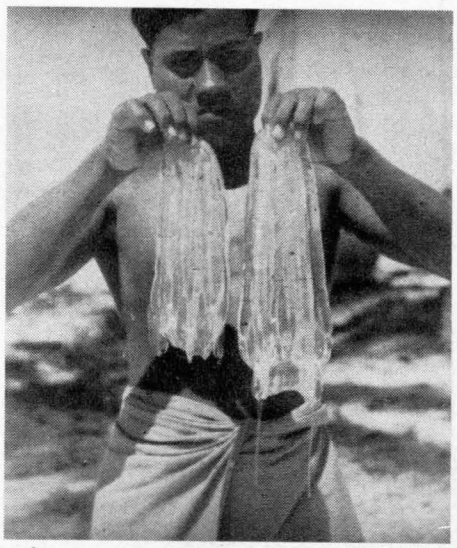
Dr. Catala warns against the introduction of certain mammals, in particular, rabbits and goats.

Firmly convinced that the Gilbertese would not be able to exist for any length of time without the coconut palm, he stresses the importance of quarantine measures to protect the palm, as "any serious attack affecting the existence of these palms would threaten the very life of these people".

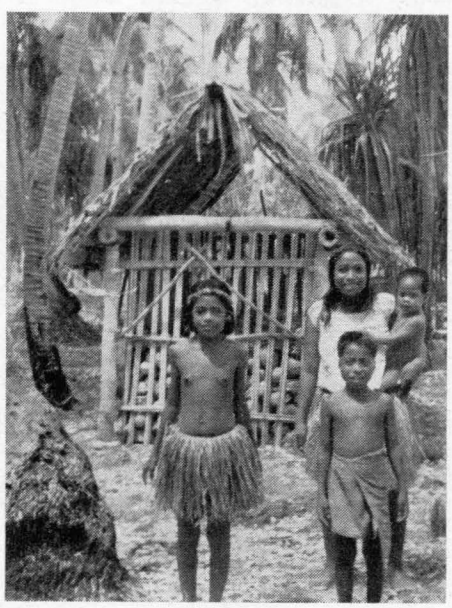
Oryctes rhinoceros does not exist in these islands, and the coconut palms are also free of the other major pests found elsewhere in the Pacific. However, *Graeffea cocophaga* (a locust) does exist on one of the islands, and is slowly spreading.

Better Land Utilization Needed

Summarizing, Dr. Catala states that all his recommendations for the im-

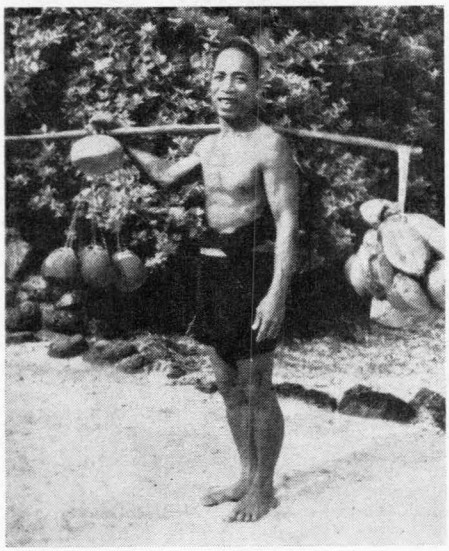


Edible jellyfish (te baitari). Tarawa atoll. Below: Small shelters for the storage of coconuts as a reserve food supply (te okai).



[1] A selection accompanies this review.—Editor.

Part of a catch of 2000 ikari trapped in one night. Average weight of the fish was two pounds. Right: The ikari, carefully opened out, are left to dry in the sun without any preliminary processing except dipping in salt water.



Gilbert islander bringing back nuts for food and toddy in coconut shells. Below: Aratokotoko, a variety of pandanus. A dwarf specimen of remarkably precocious growth.

provement of the present conditions in coconut groves revert to the need for better land utilization. The author stresses the fact that "any result obtained on the Gilbert Islands will automatically apply to the coconut groves of other low coral islands in the Pacific where prevailing conditions are comparable".

With regard to more efficient use of marine resources, Dr. Catala recommends that the Gilbertese be given all possible facilities for improving their equipment (canoes and fishing gear). He also recommends better use of certain fish ponds.

It is interesting to note that fish ponds are well known in these islands. Dr. Catala divides them into four types. The first comprises small ponds of stagnant water, of very little economic importance. The second type are lagoon enclosures, generally bounded by earthen dykes of about 3 to 4 hectares in area. Their depth at high tide is about 40 centimetres, at low tide only a few centimetres. These ponds are exploited in exceptional circumstances only, as, for instance, when fishing conditions in the lagoon itself are unfavourable, or when fish are urgently needed for feasts.

The third type of fish pond is a chess board of little enclosures, bounded by low stone walls.

The fourth type are not really ponds at all, but lakes. The lakes of Nikunau Island are typical. They are rather large, about a kilometre long and 400 metres wide. Although they must have flourished in the past, due to local quarrels they are now completely neglected.

Only one fish species is used to stock all these fish ponds, the milk-fish, which is considered superior to all other species.

In a short review it is impossible to do full justice to this interesting study, nor is it possible to highlight the many valuable observations made by the author. However, no doubt all who are interested in atoll development will no doubt not miss reading Dr. Catala's valuable contribution to the subject.

Mention should be made of the fact that the same volume also includes an interesting paper, *Climate and Meteorology of the Gilbert Islands*, by Marie-Hélène Sachet, adding complementary data to Dr. Catala's study.

Fresh Water Fish For The Pacific

(Continued from page 49)

the tropics, though successful results can probably be obtained at higher altitudes.

As far as we know at present, this fish can live, grow and spawn in temperatures ranging from 68° to 90° F.

Sepat start breeding at the age of seven months. The male builds a nest of bubbles in which the female lays several hundreds of yellow eggs. Under suitable temperature conditions the eggs hatch out in 36 to 48 hours. The young fish have a yolk bag which is absorbed in three to seven days. After this natural food reserve is exhausted the fry feed on microscopic plants and animals, and at about two months, start eating the normal food of the species.

After they become mature, males can be distinguished from females by their much darker stripes and their longer dorsal fin.

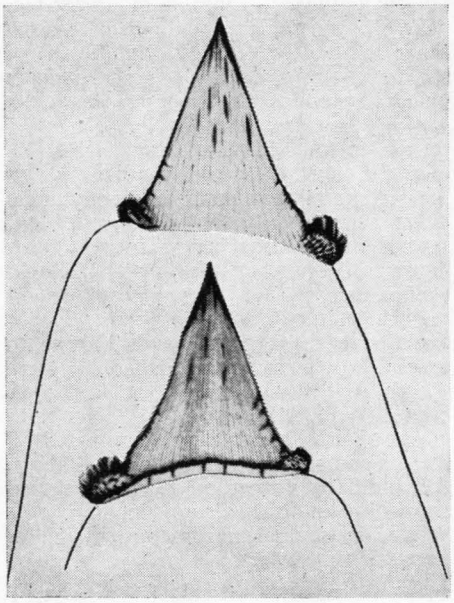
Sepat favours areas where aquatic plants grow well. The species is resistant to low oxygen tension and thrives in waters with pH of from 6.5 to 8. The largest specimen we have observed was $9\frac{1}{2}$" long at eighteen months. Tilapia and sepat can be raised together without difficulty.

This account of observations recorded on several introduced fish species briefly reviews essential facts only. Some setbacks have been experienced in the course of our experimental work, such as exceptionally heavy rains filling ponds to overflowing, and a drought of such length that many thousands of fish died.

Bamboos For The Pacific Islands (3)

In this concluding instalment the author describes the remaining six of the eleven species being introduced to the Pacific under his direction.

By F. A. McCLURE*



Bambusa tuldoides (x ¼).

BAMBUSA TULOIDES Munro

COMMON NAMES: Ch'aang Ko Chuk (Cantonese)—Punting Pole Bamboo.

ORIGIN: China, Kwangtung Province; widespread in cultivation.

USES: Structural purposes, heavy and light; basketry and punting poles; a good general-purpose bamboo.

GENERAL FEATURES: Forming moderately compact clumps, the culms of ascending habit in small plants, stiffly erect in clumps of mature stature, under favourable conditions reaching a height of 15 metres and a basal diameter of 5 cm. with wood about 1cm. thick; internodes cylindrical, glabrous, of moderate length (to about 40 cm.), partially covered at first with white powder; nodes only slightly inflated above the sheath scar, all or nearly all bearing branches, the median one in each complement moderately heavy, all unarmed.

NOTABLE FEATURES: A vigorous, very productive bamboo, with strong, gently tapered culms, having a noticeable tendency to a zigzag development from node to node; this does not, however, interfere with their usefulness for most purposes. The culms are susceptible to the attacks of the powderpost beetle unless well matured and properly seasoned in a place free of beetles.

BAMBUSA VENTRICOSA McClure

COMMON NAME: Buddha Bamboo.

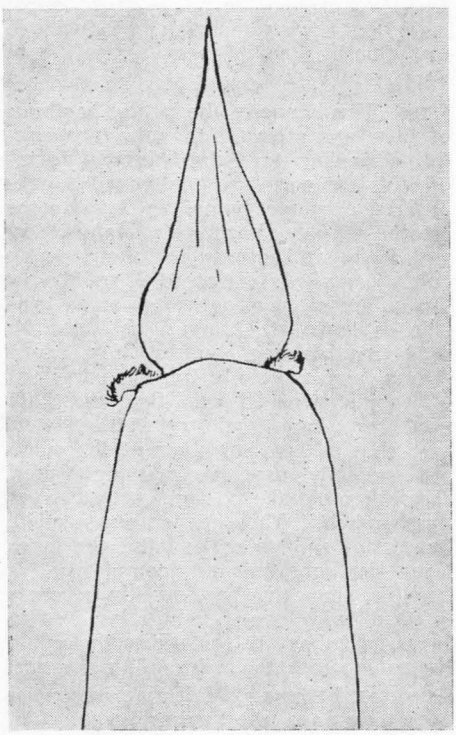
ORIGIN: (Unknown) Cultivated in Southern China as a potted ornamental.

USES: This bamboo may prove to be a valuable source of forage for livestock on lands now marginal because of conditions, too dry for other good forage plants. Experimental plantings and feeding trials are recommended. The normal culms are strong and of good technical properties relating to general construction.

GENERAL FEATURES: Forming compact clumps, the culms erect or nearly so, usually perceptibly flexuose (zigzag), under favourable conditions reaching a height of nearly 16 metres and a basal diameter of 5 cm., the wood about 1 cm. thick; the internodes cylindrical or slightly asymmetrical and inflated, glabrous; nodes slightly flared at the sheath scar, all or nearly all bearing branches, the branches unarmed, the median one dominant, but not heavy.

SPECIAL FEATURES: Observations of this bamboo under various conditions of field growth in the Western Hemisphere have shown that when the plant is dwarfed to a height of 1.5 to 3 metres by dry conditions, the production of leafy twigs is not commensurately reduced, with the effect that the foliage becomes very dense and crowded. This circumstance suggests the possibility that this plant might be used to advantage as a supplementary source of forage for livestock. This suggestion was communicated to Dr. Robert Squibb, specialist in animal nutrition, who carried out preliminary studies in Guatemala on the foliage as a green fodder and found it acceptable to cattle. No analytical studies on relative palatability or nutritive value have been published, however. The powdered dried leaves were found to be a satisfactory source of vitamin "A" in chick diets.

When grown under unfavourable conditions, such as infertility of the soil or excessive drought, the culms may be dwarfed to a height of 0.3 - 0.7 metres and in extreme cases more or less strongly deflected to one side in their growth, the internodes of culms and branches becoming shortened and flask-shaped. This teratological response may disappear in the upper internodes of the culm, which are then cylindrical and often more or less normally elongated. The response of this bamboo to dwarfing procedures is exploited at Canton and elsewhere by Chinese gardeners and plant fanciers who value the plant as a potted curiosity.



Bambusa ventricosa (x ½).

GIGANTOCHLOA APUS (Roem. & Shult.) Kurz ex Munro

COMMON NAMES: Bambu apoos (Mal.)—Tabashir Bamboo; Bambu tali (Mal.) Cordage Bamboo, or Bamboo for Lashings.

ORIGIN: Probably Malayan, now widely cultivated in adjacent countries and in Indonesia, whence it was first described.

USES: According to Ochse—"One of the most useful bamboos, much planted throughout Java, from the plains up to high in the mountains." Kurz says that in Java it occurs at elevations up to 4,000 and 5,000 feet, but grows best in the plains. According to him, plants found above 3,000 feet remain low and form thin culms only. Immature culms are usually called *bambu tali* because in

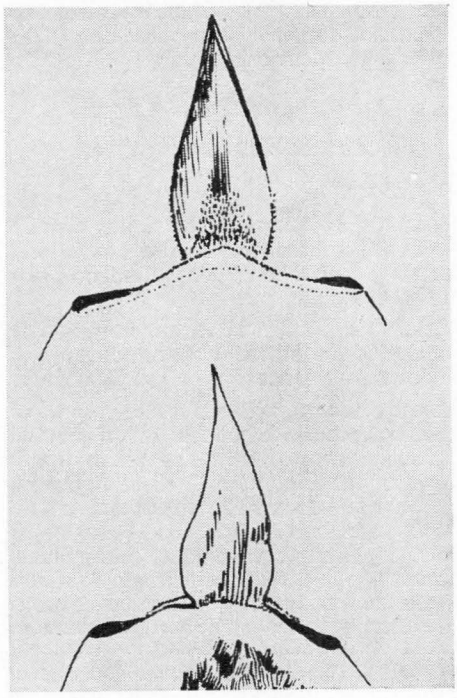
* Dr. McClure, a leading world authority on bamboos, is consultant in tropical forestry to the Maria Moors Cabot Foundation of Harvard University.

this state they are suitable and chiefly used for withes, ropes, etc. Mature culms are generally known as *bambu apoos*.

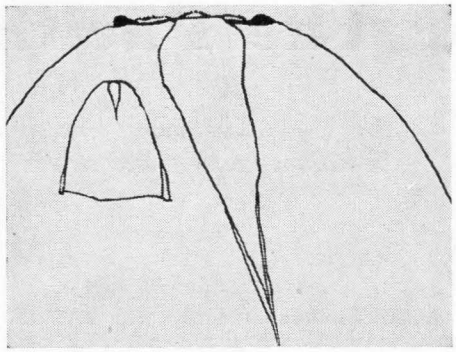
Ochse says—"The young shoots, like those of many other species, are eaten, not in the usual way, however. These shoots are very bitter and are reputed to possess narcotic qualities. The natives (of Java) know how to remove this drawback. The severed shoots are buried for three or four days in mud, then washed and treated in the same way as those of other edible bamboos, having been divested, by the mud treatment, of all or most of the bitterness."

They are then very savoury and are eaten cooked either as a vegetable or as a pickle. The culms are so valuable as a building material that the use of the young shoots for food is restricted for economic reasons. As signalized by the specific designation apus, the culms of this species commonly contain in their lower internodes a deposit of siliceous matter called tabashir, a substance whose use as a catalytic agent has been registered in the Netherlands under Dutch patent No. 53,471 (1942).

GENERAL FEATURES: Forming somewhat open clumps, the culms erect or suberect, arching above, under favourable conditions reaching a height of 20 metres and a basal diameter of 15 cm., the wood of moderate thickness (up to about 1.5 cm.); the internodes rather long (to 65 cm.), cylindrical, bearing a conspicuous coating of white powder and strewn with antrorse hairs at first; the nodes not at all or only slightly inflated, those in plants of mature



Gigantochloa apus (x 2/3).



Gigantochloa verticillata (x 1/3).

stature without branches in the lower half of the culm (Heyne), the median branch of moderate size, usually flanked by several smaller ones, all unarmed.

SPECIAL FEATURES: Besides those features mentioned above, under uses, the culms have excellent splitting qualities and good durability. The plant propagates readily, even from cuttings of the basal portions of the large branches (the median ones at lower nodes particularly) on the bulbous basal portion of which root primordia form during the course of their original growth.

GIGANTOCHLOA VERTICILLATA (Willd.) Munro

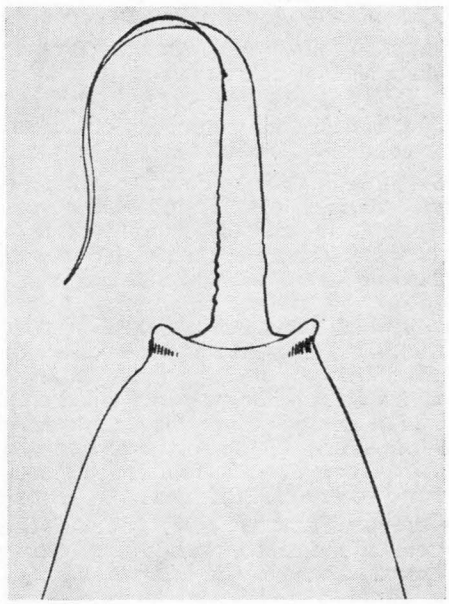
COMMON NAMES: Gambong; Awi andong gambong (Jav.).

ORIGIN: According to Brandis, "cultivated and wild in the Malay Peninsula and Archipelago, forming large forests in Java." The strain being introduced in the South Pacific area came from Sumatra.

USES: This is one of the largest bamboos of Java, and after *G. apus* the most useful, according to Ochse. Several forms of this species are cultivated under distinctive native names in Java, some for their edible shoots (e.g. *andong* and *awi leah*) and others for their strong culms (*gambong*). According to Heyne, the culms of *gambong* are not as durable as those of *G. apus*, yet they are used in building houses, for posts, rafters, and especially for the partitions of rooms. Opened out flat, they are used for floors and for beds. Heyne says that in Java segments of the culms are in daily use for carrying water, "since liquids take no foreign taste from this bamboo." When opened out to make boards, or split to make laths, the inner layer is removed as completely as possible, since this part quickly becomes infested with wood-eating insects. In Java the culms are sometimes soaked in lye to increase their durability.

GENERAL FEATURES: Forming somewhat open clumps, the culms erect and straight, under favourable conditions attaining a height of 26 metres and a basal diameter of 10 - 15 cm., the wood about 1.5 to 2 cm. thick in the lower internodes; internodes relatively long (the 5th one in large culms measuring 50 cm.) those at mid-culm sometimes nearly a metre long, cylindrical, sometimes striped with white, glabrous or sparsely strewn with very sharp hairs below the nodes when young; the nodes scarcely inflated, marked at first by a brown to buff-coloured zone (just below the sheath scar) of densely appressed hairs that make a woolly mass when scraped off, losing these in age, several of the basal nodes usually bearing small branches, the next 10 - 12 (sometimes 20 or more in plants of mature stature) without buds, ringed just above the sheath scar with one to several rows of root primordia, the sheath scar thick, fringed at first with brown hairs, the branches sometimes more or less completely suppressed at the lower nodes and in nodes well above the middle of the culm, when developed consisting of one strong median one, flanked by several pairs of much smaller ones, all unarmed.

NOTABLE FEATURES: The culms are very straight and easily worked because of their straight grain, freedom from branches, and almost uninflated nodes. The relatively high susceptibility of the



Melocanna baccifera (x 1/3).

wood to infestation by wood-eating beetles is an unfortunate weakness, but this can be overcome to a large extent by allowing the culms to mature thoroughly (three years) before felling, by curing them in the field (clump curing) and spraying or dusting once in six months with DDT (a 5% aqueous solution or a 5% mixture with powdered talc.), a treatment that is easy to carry out and relatively inexpensive.

MELOCANNA BACCIFERA (Roxb.) Kurz (*M. bambusaeoides* (Roxb.) Trin.)

COMMON NAMES: Muli (Beng.) Kayinwa (Burm.).

ORIGIN: Gamble says—"Throughout Eastern Bengal and Burma from the Garo and Khasia Hills to Chittagong and Aracan, and again in Tenasserim. In parts of the above region, and certainly in Chittagong, this is the most common species." Established in the Western Hemisphere at Honolulu, T.H., Mayaguez, P.R., Guatemala and Castleton Gardens, Jamaica, B.W.I.

USES: One of the mose useful bamboos in the area of its nativity. It is the principal material used for building houses, for making woven ware and is an important source of superior paper pulp.

GENERAL FEATURES: Forming open clumps (spreading by tardily determinate sympodial rhizomes), the culms erect or sub-erect, with a slender, broadly-arched or nodding top, in favourable situations exceeding 20 metres in height and with a basal diameter of 7.5 cm., the wood very thick at the base and less than 1 cm. above; internodes of moderate length, at midculm 30 - 50 cm. long, cylindrical, smooth, glabrous; sheath scar thin, but nodes not inflated, a few of the lowest ones sometimes bearing branches but usually those in the lower half or more of the culm without buds or branches; branches numerous, slender, sub-equal, the whole branch complement at a given node easily removed by a blow with a stick, all unarmed.

SPECIAL FEATURES: The culms are strong and durable, straight and straight-grained, with inconspicuous nodes. The branches are easily removed without damage to the culms. This bamboo establishes itself quickly from rhizome cuttings, producing a vigorous, very productive clump that recovers promptly after clear-cutting, at least while relatively young.

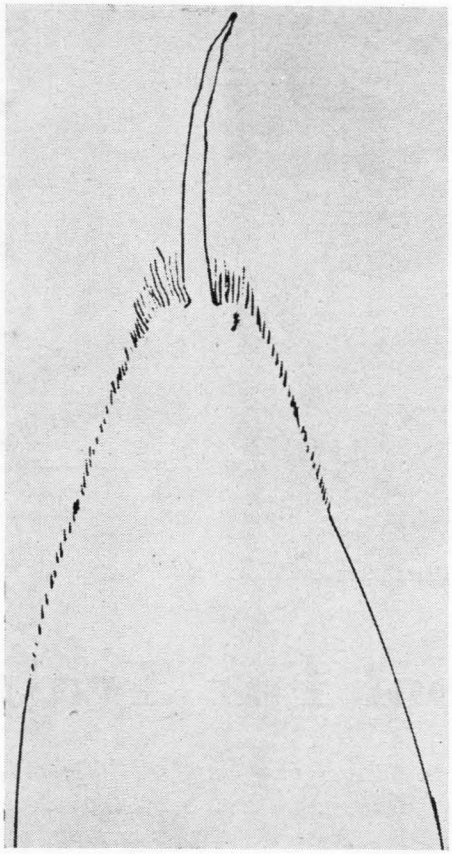
OCHLANDRA TRAVANCORICA Bentham ex Gamble

COMMON NAMES: Etta; Irul Itakalli (Trav.) Elephant grass (Beddome.)

ORIGIN: Mountains of southern India in Tinnevelly and Travancore at elevations of 3,000 to 5,000 feet; cultivated in Madras and Peradeniya in Ceylon; established in the Western Hemisphere at Mayaguez, Puerto Rico.

USES: The culms are used in Travancore for paper-making, the pulp being considered superior to Esparto (*Spartina townsendii*), and reported to give a yield of alpha cellulose high enough to make it a source of dissolving pulp for rayon. (Fibers).

GENERAL FEATURES: Forming rather dense clumps, the culms slender, reed-like, weak, sometimes climbing, up to 6 metres tall and 5.5 cm. in basal diameter; internodes cylindrical, rather long, 0.6 to 1.5 metres long, thin walled; nodes somewhat prominent, the sheath scar bearing the persistent base of fallen sheaths; branches unarmed, lower ones suppressed in mature clumps.



Ochlandra travancorica (x 1).

NOTABLE FEATURES: This bamboo flourishes on the plains where it forms impenetrable groves of culms up to 6 metres in height; in open mountain tracts it is smaller (2 to 2.5 metres) but excludes all other vegetation. According to Beddome, its discoverer, it flowers more or less regularly about every seven years and fruits freely.

REFERENCES

BEDDOME, R. H.: Forester's manual of botany for southern India. (App. to his Flora sylvatica). 238 pp. Madras. 1873.

BRANDIS, D.: Indian trees, an account of the trees, shrubs, woody climbers, bamboos and palms. 767 pp. London. 1906.

FIBERS: Bamboo pulp; its possibilities for rayon manufacture. Fibres 8:82-84. 1947.

GAMBLE, J. S.: Bambuseae of British India. Calcutta Royal Botanic Garden. Annals 7; 133 pp., 119 pls. 1896.

HEYNE, K.: De nuttige planten van Nederlandsch-Indie. ed. 3. Batavia. 1950.

KURZ, S.: Bamboo and its use. Indian Forester. 1:219-265; 335-362, pl. I-IV. 1876.

MUNRO, W.: A monograph of the Bambusaceae, including descriptions of all the species. Linn. Soc. London. Trans. 26:1-157. 1868.

MCCLURE, F. A.: *Bambusa ventricosa*, a new species with a terato-logical bent. Lingnan Sci. Jour. 17:57-62. 1938.

MCCLURE, F. A.: New genera and species of Bambusaceae from Eastern Asia. Lingnan Univ. Sci. Bul. 9:1-67. 1940.

MCCLURE, F. A.: Two new thorny species of Bambusa from southern China. Lingnan Sci. Jour. 19:411-416. 1940.

MCCLURE, F. A.: Bamboo as a source of forage and fodder for livestock, with special reference to tropical species. Pacific Science Congress 8, Abstr. of Papers, p. 291-292. Quezon City, Philippines. 1953.

MCCLURE, F. A., & W. C. KENNARDS Propagation of bamboo by whole-culm cuttings. Amer. Soc. Hort. Sci. Proc. 65:283-288. 1955.

OCHSE, J. J.: Vegetables of the Dutch East Indies. 1005 pp. Buitenzorg, Java. 1931.

ROXBURGH, W.: Plants of the coast of Coromandel. Vol. 3, 1819.

ROXBURGH, W.: Flora indica. 2 vols. London. 1832.

U.S. DEPT. AGRICULTURE: Plant Inventory, No. 135 (1949), p. 26; No. 146 (1950), p. 9-10; No. 156 (1955), p. 106; No. 150 (1957), p. 173. Washington, D.C.

WALTHER, O.: Et al Ueber den blausauregehalt der Bambusschoszlinge. Netherlands Indies. Dept. Agr. Bul. 42:1-4. English translation by May Coult and F. A. McClure, Foreign Agr. Serv. U.S. Dept. Agr. 1953. Mimeo.

WHITE, D. G.: Longevity of bamboo seed under different storage conditions. Trop. Agr. (Trinidad) 24:51-53. 1947.

WHITE, D. G.: Propagation of bamboo by branch cuttings. Amer. Soc. Hort. Sci. Proc. 50:292-294. 1947.

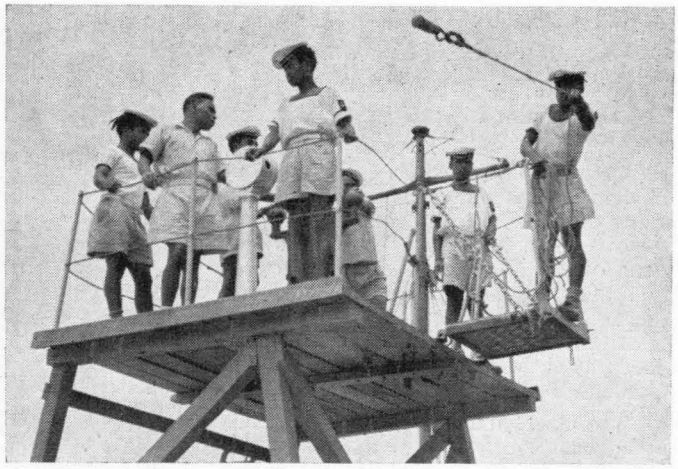
Commission Appoints Women's Interests Officer

Promoting the interests of Pacific islands women will be the main concern of a women's interests officer just appointed by the South Pacific Commission. She is Miss Marjorie Stewart, who is at present director of the tropical community development centre maintained in London by the Young Women's Christian Association, a post she has held since 1953.

In the Pacific, Miss Stewart will collaborate with village and community authorities in establishing a programme for women's activities that will take account of their home and community needs and opportunities. She will develop women's groups as one way of furthering their progress towards family and community betterment.

Miss Stewart has had many years' experience in training leaders for club and rural work in the West Indies, where from 1934 she was for ten years general secretary of the Y.W.C.A. in Jamaica.

A leading women's organization in the United States of America, United Church Women, is taking a keen interest in the project, and has made a grant of $30,000 to assist the South Pacific Commission in this new field of activity.



Left: Under the guidance of an instructor, a student takes a compass bearing.

Above: On the bridge of the training ship a trainee practises heaving the lead for taking soundings.

Nautical School For Training Papuans

Over two hundred Papuans have been trained as seamen at the Nautical School of Netherlands New Guinea since its establishment in Hollandia in 1953.

ON the waterfront in Hollandia, only five minutes' walk from Humboldt Bay, is a ship. While made of concrete, she has the same equipment as her sea-going sisters—bridge, engine-room, radio cabin, derrick, davits, and so on.

Though a ship on dry land, she is, however, far from idle, for her primary purpose is for the training of indigenous naval personnel. She belongs to the Nautical School of Netherlands New Guinea, an institution which since it was established in 1953 has trained more than 200 fully-qualified Papuan seamen. Mainly they serve on Government ships, though a few in the higher ranks are trained for privately-owned vessels.

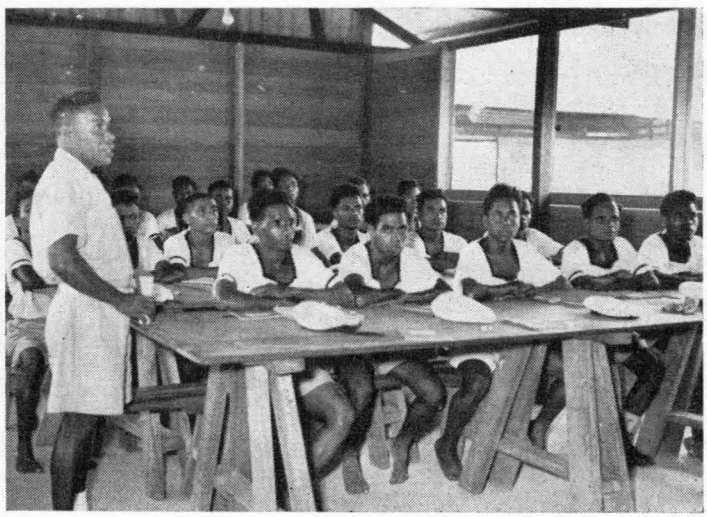
The Director of the School is assisted by three instructors and three vocational teachers. Lessons total 31 to 35 hours a week, and there are also compulsory study periods.

Selection Of Candidates

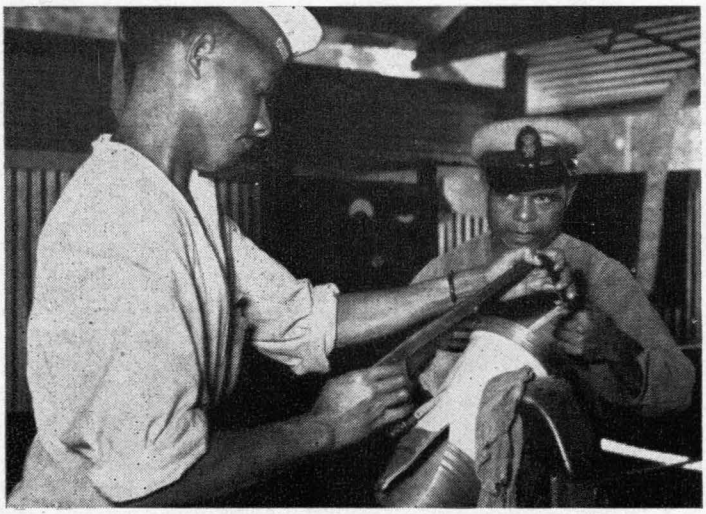
The School is open to Papuans from the whole of Netherlands New Guinea, though some areas produce better seamen than others. It attracts many young people, and the number of candidates is usually four times as many as the vacancies. It is easy, therefore, to select only the best, so that a high standard of trainee can be maintained.

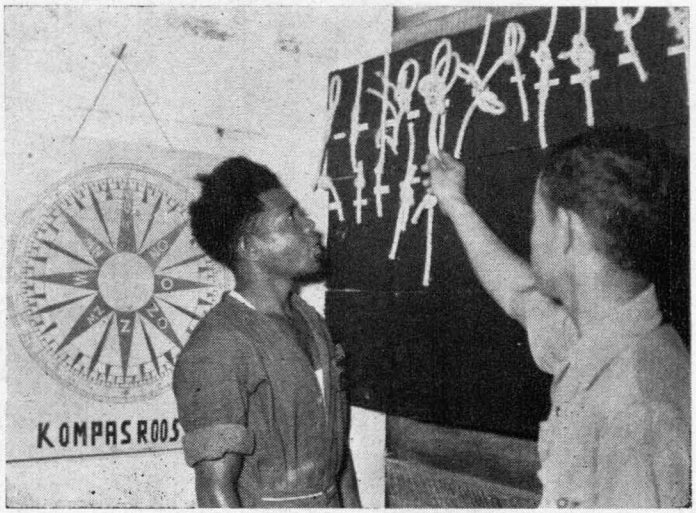
To be admitted to the Nautical School, candidates should be aged between 16 and 24, and unmarried. They must have had three years' elementary schooling, be in good health (especially as far as hearing and eyesight go) and pass a simple examination in arithmetic.

The number who drop out in the course of training is very small (20% only). The percentage of those who do not pass the examinations is also 20%, on the average.



A lesson in the art of operating a derrick for loading and unloading cargo. Right: Students concentrate on a classroom lesson.





A good engineer should also be an experienced metal worker. Right: A sound knowledge of knots and rope splicing is compulsory.

Elementary And Advanced Training

For trainees for deck and engine-room crews, the first elementary course lasts ten months. Advanced training takes six to eight months.

At the end of the initial training course, those who have succeeded receive a diploma and are given berths as ordinary seamen, or wipers, on a Government ship.

At the end of two years the ordinary seaman may be promoted to the rank of able seaman, and, after another two years, to that of quartermaster. In this capacity he is often placed in charge of a small ship such as a pilot boat or other harbour craft. If he has worked in the engine-room, the wiper can become an assistant donkeyman after two years' service.

Promotion To High Ranks Possible

The best men among the quartermasters and assistant donkeymen are selected for further training. At the end of this they prepare for their mate's ticket for local navigation, or their donkeyman's certificate. If they pass, they receive a Government diploma. After sufficient length of service, deck crew members can seek promotion to the ranks of boatswain, boatswain's mate or even skipper, and engine-room crew to the ranks of donkeyman, chief donkeyman, or leading donkeyman.

Training is free of charge for Government students, who also receive free board and lodging, uniforms and working clothes, and pocket money.

Much attention is given to recreational pursuits, which include such games as badminton, volleyball and football.

SPC Pacific Co-operatives Meeting

(Continued from page 24)

operatives themselves as rapidly as their members and employees gain the necessary experience and abilities.

The success of co-operatives, particularly among newly-developing peoples, depends largely upon the effective participation of members. Consequently, the further education of members in co-operative principles, legislation, techniques, business management and the like, is of prime importance. This education should be directed towards inculcating attitudes of self-reliance, self-help and responsibility, making use of existing social institutions wherever possible. The meeting therefore gave special consideration to ways in which the education of members and office-bearers of societies and the training of governmental co-operative staff might be further developed.

Possibilities Of Commission Assistance

The meeting was specifically asked to give close attention to ways in which it considered the Commission could be of assistance to territorial administrations in relation to the development of co-operatives, and it has made a number of submissions in this regard that will be considered by the Commission at its forthcoming session.

Enough has been said to indicate the main lines along which discussion proceeded, but it may be said in conclusion that many things other than the actual course of discussion go towards the making of an effective meeting. The excellence of the Co-operatives Education Centre as a meeting-place, the generous provision of facilities and assistance by the Administration of the Territory of Papua and New Guinea, Port Moresby's customary hospitality, and, above all, the enthusiasm of the participants all contributed towards a pleasant and profitable fortnight.

Cocoa Industry In New Britain

(Continued from page 36)

thrived from planting to maturity. Some of these dual-crop plantations have blocks of rising six-year-old cocoa, and these trees are bearing heavily. On some of the much older coconut estates on Buka with inter-planted cocoa, the latter has been yielding well for many years. So far, all those I have seen are free from any diseases usually associated with either too much or too little shade. The shade supplied by the high palm heads has proved completely adequate.

Palm head shadows move over the ground as the sun climbs to the zenith and falls towards the west. They move in a relatively large arc, and the inter-planted cocoa is sometimes in shadow, sometimes in sunlight. Each tree receives a period of direct sunlight daily, and this seems to provide optimum conditions for its development and yield.

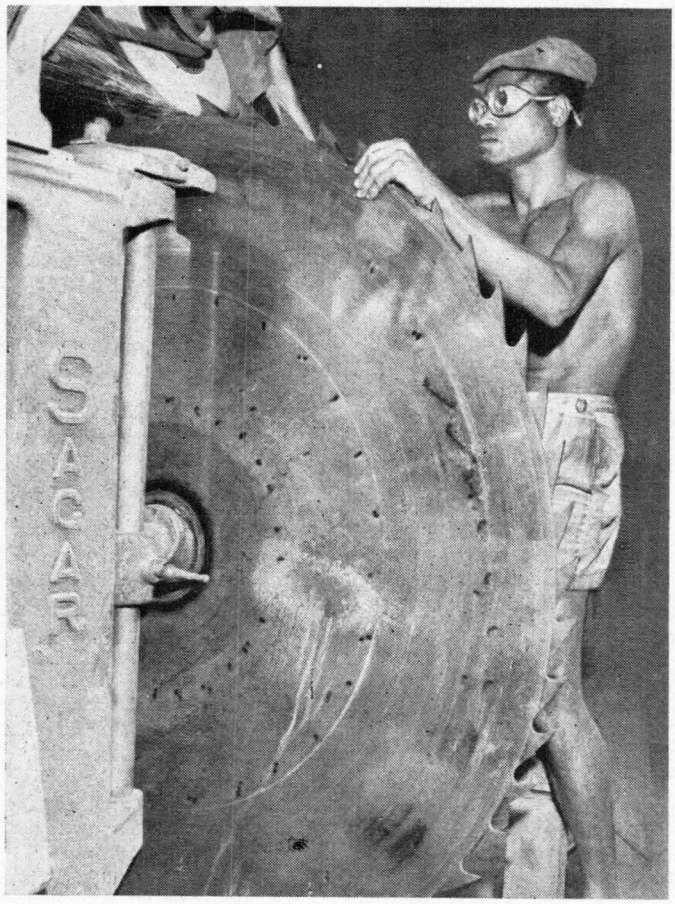
On the other hand, where the cocoa is heavily shaded by *Leucaena*, the sunlight is screened by myriads of tiny legume leaves. The movements of this foliage, which is disturbed even by the lightest air movements, make a further filter for the light. When the shadows cast by the *Leucaena* on bare patches of ground are observed this filtering effect can be plainly seen. The shade resembles a pattern cast by a fine lace curtain when the sun shines through, but the legume pattern flickers like images on an early movie screen. When the legumes are planted in lines closely together the shading becomes very heavy, and little or no direct sunlight penetrates the filter of foliage.

Everything I have observed points to the fact that cocoa requires some shade and some direct sunlight. It requires the sunlight not so much for growth, since the species originated in the Central American rain forests, but as a cultivated fruit tree, for maximum yield.

Hazards Of Occupation In The Pacific

The economic development of the Pacific islands is creating for their inhabitants new hazards of occupation for which adequate safeguards must be provided.

By T. C. LONIE*



A common cause of accidents are circular saws, from the hobbyist's variety a few inches across to large rotary blades such as this one being sharpened in a sawmill near Rabaul.

IN contrast to the epidemic diseases, and indeed to most common illnesses, the accidents and diseases of occupation seldom affect large groups of the population, and the environmental circumstances producing them are associated with individuals personally engaged in the processes concerned. So what is required for their satisfactory control and treatment must be directed to the individual circumstances, and the individual case involved. Nor is a large commitment of public funds called for, since the responsibility for action falls primarily upon the employer, and perhaps upon the employee himself.

It needs to be emphasized that occupational hazards, whether of disease or injury, cannot be neglected or lightly dismissed because of an assumption that they are of importance only in heavily-industrialised communities. Actually, the more industrialised the country, by and large, the more complete are the measures taken in the prevention of industrial disease and injury.

It should be further remembered that industries include those in which mechanical processes are involved, but do not exclude many which are not primarily concerned with machinery at all, such as those involving the manipulation by hand of natural products of animal or vegetable origin in the unprocessed or raw state, oil and oil products, insecticides, etc. Everyone concerned in the handling of any product, whether as workman or employer, should be alive to the possibilities of disease or disability arising from the handling of the materials concerned.

In many territories, machinery and dangerous processes and materials are utilized with a fine abandon and casualness in which foolhardiness and ignorance appear to be equal partners. While the prime responsibility in this matter rests upon the employer and the employee, administrations and their technical advisers particularly must also take cognizance of the situation, and of course have done so whenever they have become aware of particular dangers.

But the picture is changing all the time, and all of those concerned have a duty to inform themselves of the advances being made, and of any fresh hazards developing. Nevertheless the prime responsibility must still rest upon those who engage in a dangerous process or use a dangerous product.

Some Machinery Hazards

Let us now consider some of the more common processes to be found in many territories. In these days where engines of one sort or another are a common feature, even in quite remote places, and where their uses in the driving of machinery are legion, the power saw is everywhere in use. The facilities provided, however, are often quite amateur, and the users of these tools have frequently little appreciation of their dangers.

Whatever guarding of the blade may or may not be possible, it is the responsibility of the user and the employer to make it difficult, and indeed unnecessary, for parts of the body — limbs and fingers especially—to come into contact with blades or moving parts. The necessity of stopping the machinery if clearing or readjustment becomes necessary is of great importance. The loss of fingers by carelessness of this sort is much too common and often, if not in fact always, quite unnecessary. Incidentally, the dangers to bystanders of moving timber are frequently overlooked.

The belts generally used for the driving of saws, lathes, grinding machinery, etc., are more often than not in entirely unsafe positions and very frequently are without guards of any kind. That accidents do not happen more often under these circumstances is remarkable, but they *do* happen, and happen sufficiently frequently to make the question of the provision of guards a matter of necessity, reinforced by law wherever and whenever it can be enforced. Accidents due to entanglement of body or clothing in moving belts, pulleys, and shafting commonly produce severe and mutilating injuries, and frequently death. They are the more liable to do so if the operators or bystanders are wearing loose clothing of any kind—and much clothing worn in the tropics is of loose pattern.

If it is necessary to protect a workman against such dangers in Paris, or Sydney, or New York, it is equally important to do so in Papeete or Port Moresby or Apia. Machinery kills its victims one by one and is not concerned with their race or colour. It is criminal not to protect them.

---

* Public Health Officer, South Pacific Commission.

Risks Of Electrical Installations

The extension of the uses of electric power has introduced an entirely new set of risks to Pacific island life, and the hazards are particularly great because the general level of education and experience in relation to the management and use of electrical apparatus is very low. Many quite remote plantations and settlements have their own power supplies, often installed without any adequate technical advice or qualified assistance.

Now all this involves new risks to the users, risks made not less by the generally amateurish nature of so much of the installation work, and the risk that important safeguards may be omitted, or even that the installation may be thoughtlessly or mischievously interfered with. While voltages of 110-125 are usual in many installations and are not so dangerous as higher voltages, it is also a feature in such cases that the output is very variable, and this is reflected in risks of misuse.

Two other matters require also to be borne in mind. Most installations of any size transmit current over part of the distance by high tension cables, which can be extremely dangerous. Another feature is that there is an increasing tendency for the replacement of a domestic power voltage of 110-125 by 220-250 volts. This has definite electrical advantages, but has the disadvantage that in unskilled hands it may be much more dangerous.

Though this article is more especially concerned with occupational risks and not domestic ones, one must not forget the constantly extending provision of small electrical appliances used in many occupations by many people, the vast majority of whom are quite untrained in the operation and maintenance of electrical tools. There is a material risk to the user with all such instruments. However, this is not the place to go further into the hazards of electrical apparatus, though it should be a function and responsibility of health and labour departments who are concerned with the casualties from improper use to see to it as far as possible that the various electrical authorities and the public have a proper care to the prevention of accidents involving life and health, and are properly advised as to necessary first-aid procedures should such accidents unfortunately occur.

Danger From Paints And Paint Spraying

The painting trades, including spray painting, have an unenviable record with regard to illness arising from the methods and materials they use.

This is especially the case nowadays in relation to spray painting carried on in enclosed or badly-ventilated premises. Danger in such cases may arise either from the paint or from the material in which it is dissolved. These 'solvents' are usually highly volatile, and apart from their fire risks may be very toxic. Some countries require that the work of spray painting shall be carried on in a special booth provided with exhaust ventilation, and that the worker using the spray shall not only be protected by a special mask, but should have his work so arranged that the spray gun is always directed towards the exhaust fan and away from the worker himself.

Constant care must be taken in the operation of tractors and of agricultural machinery driven by them, such as this peanut thresher on a plantation near Port Moresby.

Many paints contain lead, and lead poisoning is one of the oldest known kinds of occupational disease. Nowadays manufacturers have learned how to make up their lead paints in such a way that if they are applied with a brush and not a spray they are reasonably safe in application. In fact, the real danger of lead poisoning is in relation to the breathing in and swallowing of lead dust or fumes.

There are several sources of both. We have mentioned paint as not being a particular source of danger when it is being brushed on. But old lead paint which has to be removed from wood or iron can be a great source of danger if it is being rubbed down by any dry, and therefore dusty, method.

Red lead is a kind of paint which is much used for outside or exposed surfaces—ships' hulls and fittings, steel and iron bridges, etc. Sometimes such structures have to be cut into or even broken up, and oxy-acetylene blowlamps are used for this purpose. When used on lead-painted structures these have been a source of lead poisoning, since the intense heat of the oxy-acetylene flame vaporizes the lead in the paint.

There is record of children in Queensland having suffered from lead poisoning, presumably caused by absorption of lead from old flaking paint from the outsides of houses, which got under their finger nails and thence to their mouths. Lead painting of the outside of houses has been made illegal in Queensland for this reason.

Other Lead Dangers

Lead dust and fumes may arise in small printing establishments from the type metal in use, especially where the premises and the methods of handling are not clean.

Persons handling old batteries—especially if breaking them up, or smelting them—are exposed to danger, as also may be plumbers and solderers.

A fairly new lead hazard has arisen with the use of tetra-ethyl lead in petrol (ethyl petrol), which now accounts for the consumption of nearly one-eighth of all the lead used for all purposes. It is absorbed through the skin, and by inhaling the fumes containing it. The symptoms of tetra-ethyl lead poisoning are predominantly mental and sufferers may have delusions and even acute mania, though it was a long time before the cause of these symptoms in tetra-ethyl lead workers was recognised.

This may be a source of hazard to men cleaning out petrol tanks; it may also, as dust, be a source of danger to garage workers decarbonizing engines which have burnt lead petrols. It has caused the poisoning of persons using aviation spirit for dry-cleaning.

It is now generally coloured to prevent misuse, but export regulations in manufacturing countries are not always so rigid as those applied to users within the country of origin itself, and small importing countries are not always sufficiently aware of the nature and risks of the goods they permit to be imported.

In this matter of the mishandling of such petrol products, and because these are now so very widely used, under such

diverse conditions and often in quite remote places, it is perhaps necessary to emphasize again the point that hazards to the employee handling a dangerous substance are at least as great in such a place as they would be for the same work carried on in a city.

A very important precaution in relation to lead is that those who handle lead products must be extremely careful in keeping themselves clean. Hands and outside clothing especially need frequent washing to get rid of dust which may otherwise be breathed in or swallowed. Masks of course are necessary during any dusty work of this sort.

Improper Use Of Masks

This seems an appropriate place to introduce a warning about protective face masks and respirators. The containers of respirators are by no means identical. In fact, they are specially designed to suit the purpose for which they are intended. Those which deal with poisonous gas or fumes contain substances which absorb or neutralize the particular gas or fumes requiring their use. Dust respirators must be so made as to deal with the special dust concerned. The wrong type of mask may be quite useless or even dangerous.

At all times masks must be kept clean, and new filters and new containers must be available as renewals when necessary. Manufacturers' directions as to their use must be strictly followed.

Risks From Pesticides And Weed Killers

Improvements in agricultural methods have led to the widespread application of pesticides and weed killers of various sorts. Insect control for health reasons has led to the use of insecticides of varied chemical composition. Rat control also involves the use of poisonous materials.

Of the substances used, a proportion may be dangerous to those who handle them, or they may contaminate produce on which they are used. For these reasons there is close control in most civilised countries, of their sale, storage and use. In unskilled and inexperienced hands some of them may be very dangerous indeed to the health and even the life of those having to use them, and as agriculture and pest control become more intensive, their use is likely to become much more common in the Pacific. The danger may be to the persons applying the pesticide, but in the case of vegetables and fruits supplied and eaten raw, there may be danger also to the consumer if care is not taken by washing to get rid of deposits of the pesticide concerned.

Arsenic is a frequent constituent of agricultural sprays, and requires considerable care in handling. Arsenic is also a constituent of many stock sprays and dips. Hydrogen cyanide is widely used as a fumigant as it is a most violent poison for all forms of animal life. It is used for killing rats in houses, stores, and ships, and enclosed spaces generally. It is used for killing all forms of insect pest under the same circumstances, and finds a particular use in grain and food stores. Though readily absorbed by such materials, it is equally readily given off, and the important precautions here are the prohibition of unauthorised persons in the vicinity of the place of use of the cyanide, masking of the actual workers, and thorough ventilation of the goods and premises for at least twenty-four hours after the gas is used.

In recent years, new pesticides and insecticides have been developed in considerable number, most of them being organic compounds capable of much minor variation resulting partly from attempts to counter one or other defect (e.g. development of parasite resistance), or in some cases for sales reasons. Add to this an infinite number and variety of trade names and patents, plus a far from complete knowledge of the possibly dangerous qualities of these products, and it will be appreciated that the subject is a complicated one. What seems to be clear, however, is that whereas the earlier members of this group carried a relatively low risk to the operator, this is not necessarily true of the newer types whose increased potency as pesticides appears in some cases to be related to greater danger to the user. One disquieting feature is that, in the earlier stages in some instances, the symptoms of poisoning are vague and indefinite, but the condition may be progressive, serious, and even fatal.

As to the large number of these substances on the market, we may observe that an American publication lists no fewer than 6,234 sold in that country. A list issued by the Department of Health in New Zealand contains the names of 340 products on the market in New Zealand.

As to the danger of poisoning from misuse, the WHO publication *Toxic Hazards of Pesticides to Man* gives a long list containing nearly all the common types of pesticide, and refers to the fact that "cases of human poisoning uncomplicated by other diseases, including disease induced by other toxic materials, are known" for each one of them.

There is no space here, however, to do more than draw attention to possible dangers in the handling of these preparations by the ignorant and unskilled.

The Hazard Problem In Summary

It is clear then that there are considerable and growing hazards from the many changes and advances taking place in relation to the economic development of Pacific island territories, and the consequent changes in the way of life and occupation of its people.

It makes no whit of difference in what

place a process or a material is employed, or who the employees are, the human dangers are identical. What *does* make the difference is whether the employee is aware of the dangers of his work, and understands in some measure the reason for the danger. If he is so aware and does understand, he will be the more likely to take the necessary precautions.

It must, however, be recognised that many workers in tropical lands have not sufficient general education and experience to enable them to be relied on to take these personal precautions. It is therefore all the more necessary that employers should be meticulous in seeing that such precautions are observed, and for administrations to see to it that by informed inspection, and by legislative provision, the worker is protected from the consequences of his ignorance.

Control by inspection and legislation, however, must be matched by the education and training of both employer and employee in the nature of the hazards which may be encountered and in the measures of protection which are necessary. If he is informed of the reasons which lie behind the advice, the legislation and the inspection, he is not only more likely to be a willing co-operator, but will also be more alert in using his own judgment and knowledge to perceive new or unrecognised risks.

The particular hazards of any industry and the particular methods whereby they may be avoided are matters to be dealt with as the conditions present themselves. For most of them the expert knowledge and advice is readily obtainable. Where it is not to be had locally, advice can be sought from authorities in the particular fields concerned, including manufacturers.

Most manufacturers of apparatus or of hazardous products are well aware of common dangers and how to deal with them. Though they may not be prepared to give this full information unasked, a direct enquiry may produce it. If, however, the information is not forthcoming at this level, research bodies and appropriate government agencies can certainly give assistance. The important thing is to recognize that the risks exist.

Reference Material

Those who may wish to have available further information regarding some of the matters raised in this paper might be interested in one or more of the following reference books.

For an interesting, reasonably comprehensive and recent book on the whole subject, *The Diseases of Occupation,* by Dr. Donald Hunter, 2nd Edition, 1957, English Universities Press (£5/5/-), will be found most useful. It contains excellent bibliographies of each of the industrial fields covered. It is a fascinating account of the life and work of industrial man, and while rather too bulky

to be an ideal "bedside" book, it is none the less difficult to put down, and will interest the layman as much as the doctor.

In French, there is the *Précis de Médecine du Travail,* edited by Prof. C. Simonin, Librairie Maloine, Paris, 1950, which covers a wider general field than Hunter's book, but is not so large, and therefore not generally so detailed in the information given.

The World Health Organization has several of its Technical Report Series which deal with insecticides and pesticides. The most useful relevant to this paper is No. 114 in the WHO Technical Report Series: *Toxic Hazards of Pesticides to Man,* October, 1956 (price 3/6, $0.60). However, other useful information and guidance on matters of composition, standards and proper use may be found, inter alia, in No. 125 of the WHO Technical Report Series: *Expert Committee on Insecticides,* Seventh Report (price 1/9, $0.30), and the earlier reports of the same Expert Committee. A useful manual published by the World Health Organization, *Specifications for Pesticides,* (price £2, $8.00), is designed as a work of reference both for users and manufacturers. It is useful for governments contemplating legislation also, as it prescribes suitable packaging and descriptive labelling for the various types of insecticide, and its international status is likely to assist in making these standards generally used by manufacturers, and therefore able to be prescribed in territorial enactments.

A discussion of some weed killers used in the South Pacific will be found in South Pacific Commission Technical Paper No. 108, *Weed Killing by Chemicals in Tropical Crops,* by E. J. E. Lefort (price 2/-.). The lists of these weed killers appearing in this publication will be useful, but it should be noted that precautions to be observed in their use, and possible dangers in handling are not discussed. However, a useful feature of the lists is that products are separately listed as being available in New Zealand and in Australia, and sufficient clue is given as to their general composition to enable dangerous types to be identified.

The division of Occupational Health, Department of Health, New Zealand, gives a comprehensive list as already noted. The list is in typescript and doubtless the Department of Health, Wellington, New Zealand, would supply copies to any enquirer.

The American *Pesticide Handbook,* by D. C. H. Frear, an annual published by College Science Publishers, State College, Pennsylvania, is not only very extensive in its actual listings (over 6,000 preparations) but also gives much useful general information as to the risks of types of pesticides. It costs $1.50 in paper, $3.00 in cloth.

Village Sanitation Campaigns On Guam

The article below was prepared as a background paper for the health education training course for Pacific islanders held under SPC-WHO auspices at Commission headquarters in July and August of last year.

By L. T. COWPER, J. S. RIOS, and F. L. GUERRERO*

Sanitarian Sus Rios at Barragada village, Guam.

THE basic philosophy of our sanitation programmes in the villages and outlying areas of Guam can be summed up by the idea that "Sanitation Is a Way of Life". Indeed, good home sanitation and public health result from daily practices of proper sanitary and public health measures around the home and community by the people, and not from occasional clean-ups or special drives. It is the purpose of the public health and sanitation workers in all village sanitation improvement programmes to create a desire from within the people themselves to improve their sanitation habits, and not to force upon them the rules and practices of good hygiene. It is well realized that the latter will be carried out only when the people believe good sanitation is desirable and will work for it themselves.

To illustrate how a village sanitation improvement programme is planned and carried out on Guam, a brief description of such a programme implemented in the village of Yona is offered as an example.

Through a study of the hospital records and medical examination of people coming from the area, we as public health workers knew that the village of Yona, with a population of about 2000 people, was an area with a high incidence of gastro-enteritis. Many cases of scabies, impetigo, and intestinal parasites occurring in infant and preschool age children had also been reported by the village nurse. A study of hospital records over a three-year period revealed that some community action was needed in the village if unnecessary sickness was to be avoided.

Poor nutrition was ruled out as a major causative factor of the gastro-enteritis, as a study by Dr. Oomen of the South Pacific Commission of nutrition on Guam had shown definitely that severe malnutrition is not present on the island. It was therefore reasonable to assume that the gastro-enteritis cases in Yona village were resulting from sanitation defects. It was also known that the village had an acute fly and mosquito problem.

Preliminary Investigations

A sanitarian and public health representative visited the Commissioner of Yona village to discuss the matter with him and to get his ideas on what action was possible. He was most interested and offered his co-operation.

The public health personnel suggested that prior to any discussions with the village about specific problems, a sanitary survey should be carried out to determine where the weak points lay. It was agreed that this should be done by the sanitarian, and the Commissioner offered his aid.

Obtaining the village Commissioner's help at the beginning of any public health programme is extremely important, for he is their leader in all official and quasi-official events. He is elected by them for a term of four years, holding much the same place as a mayor of a small town or an elected chief of a village.

The public health team also talked with other lay leaders in the village about their health problems and the sanitary survey.

On the appointed day the sanitarian began his survey by going from house to house making notes in each on refuse and human waste disposal, water supply, and on mosquito, fly and rodent breeding areas. A simple check list was prepared for each home.

Considerable interest was shown by home owners, who questioned the sanitarian on what he was doing, and why. Answering these questions took considerable time, but the sanitarian realized it was an excellent opportunity to provide sound health education information to people who had high personal interest at the time.

The news of what the sanitarian was doing soon spread through the village by "bamboo telegraph", and the job of making the sanitary survey became progressively easier. At the end of five days the initial survey was complete, and the results were tabulated.

---

* Mr. Cowper is Chief of the Sanitation Section, Mr. Rios (since deceased), District Sanitarian, and Mr. Guerrero, Sanitarian, Department of Medical Services, Administration of Guam. Mr. Cowper attended the SPC-WHO health education training course as an instructor; Mr. Rios and Mr. Guerrero as trainees.

Results Of Survey

The village water supply was found to be generally satisfactory as it had a central source, and the water was treated and chlorinated. Most of the homes were connected to it, although many people had barrels for rain-water storage.

Refuse disposal at homes was generally poor. Also, the community refuse dump was too close to the village, which over several years had grown almost around it. The dump was heavily infested with flies and rats, and was odorous and unsightly.

The human waste disposal picture was also unsatisfactory, as while almost all the homes had earth-pit privies, about 50 per cent were not of good construction, and were not fly or rodent proof. Some mosquito breeding areas were also located, and plotted on a map.

As part of the sanitary survey a fly count of Yona village was made using the fly grill method. A fly grill is a simple wooden frame approximately a metre square, with slats attached. The sanitarian takes a fly grill into the village and makes several fly counts on a block square area. These are made by finding a fly attractant such as a pile of garbage, rotten fruit, or carabao dung, and placing the grill directly over the attractant. After a certain period of time (usually two or three minutes) the flies on the grill are counted. Averaging the fly counts on the block area being sampled and basing the average count on a scale of *light* (2-4), *medium* (5-10), or *heavy* (over 10), reveals where the heavy concentrations of flies are located.

In Yona village this method helped outline the main areas where fly breeding was heaviest.

Health Education Programme Launched

With the facts already known about the disease problems of the village, together with the results of the sanitary survey, the public health team was ready to direct an active health education programme to the people covering the problems of the village.

The sanitarian began his task by going to the village school and contacting the principal and teachers. The facts about the sanitary condition of Yona village were presented and discussed with the Education Department. Suggestions for using the sanitary survey material in discussions and talks in the school classroom were made by the teachers. The sanitarian also tried to bring out from these people what they thought the problems of the village were, and if the programme suggestions and ideas he had put forward would be acceptable.

By agreement with the Education Department, classroom talks in English were given by the sanitarian, who used as a visual aid a flip chart on home sanitation devised earlier by the Sanitation Unit. Talks were given in both the Catholic and public schools in the village, and

discussions based on questions from the students were encouraged. The teachers co-operated by arranging classroom work on sanitation and by giving written assignments on good sanitation in the home.

During this time all the various civic and religious groups of the village had been contacted. Such groups as the Holy Names Society, Christian Mothers, Boy Scouts, Civic Improvement Club, and Parent-Teachers' Association were asked to help in making Yona village a clean and healthy one. Talks in Chamorro or English had been given to them on the sanitation problems of the village, and ways in which they could help were indicated. Care was taken by the sanitarian to draw suggestions from these groups as to what sanitation or public health problems were important to them. The Yona community response was overwhelming, and public interest in the village programme rapidly gained in momentum.

The climax of the health education programme at this point in the sanitation improvement programme came at a general village meeting called by the village Commissioner. At this meeting, a community decision was made to have a clean village, and a programme for the work was laid out. This meeting was quite a spirited one and a good many questions were raised over past, present, and future issues. Coloured sound movies *Clean Village* and *Insects as Carriers of Diseases,* produced by the Office of Inter-American Affairs, were shown to aid in putting across various points on proper home sanitation. At this meeting the Commissioner asked the sanitarian to accompany him to each home in the village and give technical advice on what was needed.

Visits By Sanitation Team

The third phase of the "premise work" stage was carried out by the village Commissioner, the sanitarian, and where possible the village nurse. Home visits were made by the "sanitation team" and personal contact made with the owners. The programme of community sanitation improvement, and the purpose of the visit, were explained to the occupants. In most cases they were well aware of the reasons for the visit, and there were very few objections.

Each owner was asked if he would like to accompany the sanitarian on an inspection of his home, and discuss any recommendations that might be offered. Again, the great majority of the people were willing to listen to the latter, and in most cases promised to make the proper corrections.

In a few cases, more positive visual health education was necessary to enable the household occupants to understand the recommendations. For example, at least a dozen people did not believe that the "wigglers" in their open drainage pits

and water barrels were mosquito larvae, and would become flying insects. To help illustrate to such occupants the biology of the mosquito, samples of waste water with mosquito larvae were collected in jars from the drainage pit or water barrels. The sanitarian would cover the jars with mesh cloth and leave them with the occupants. After a week he would return. In the meantime the mosquitoes would have hatched out and the people would have thus become convinced that the "wigglers" were truly part of the mosquito life cycle. Needless to say, they then co-operated very well by placing proper covers on their drainage pits and screening on their water barrels. Further, they aided the sanitation improvement programme generally by talking about their experiences with their friends and neighbours.

Day after day the "sanitation team" made personal visits to homes until the village had been completely covered. Results at this point were most gratifying. As time went on, more and more lay persons became involved personally with the programme, through community groups or religious organizations. Through the efforts of the various health committees and civic-minded people, vacant lots which were government property or belonged to people not on the island were cleared of rubbish and vegetation. The territorial government helped by lending public works personnel and making available a truck to haul refuse away.

As a part of the village improvement programme, the old refuse dump had been cleared and covered, and a new refuse site opened some distance from the village. While the operation is still not wholly satisfactory, at least the new site is far enough removed from the village to eliminate most of the trouble caused at the former dumping site by rats, flies, etc.

"New Look" Of Cleanliness

As the community sanitation improvement programme drew to a close after several weeks of work there was a "new look" of cleanliness about the village. More important perhaps was the "new look" of satisfaction and community pride shared by the people of the village. They had pooled their energies and time, and worked towards a common goal.

There had been mistakes in the timing of certain phases of activities, and minor misunderstandings had occurred, but these faults were negligible compared with the general improvement of the village and in the morale of its people.

The sanitation reports on the 208 homes visited showed that definite progress had taken place in 200. There was not a single case of enforcement; none was necessary, as the people of Yona understood why recommendations were made by the sanitarian.

After the sanitation programme got

under way, hospital admissions of gastro-enteritis cases decreased. As well, there was a reduction in the number of cases of scabies, impetigo, and intestinal parasites seen at the dispensary. It is too early to determine whether this lowering of the incidence of gastro-enteritis will continue, but careful observations are still being made.

The people of Yona village, however, continue to be aware of the importance of good sanitation, and have kept up the work so well begun. As a result of this public awareness, both fly and rodent problems have definitely decreased.

Similar accounts of other village sanitation improvement programmes on Guam could be prepared, but basically they resemble that described for Yona village. In some instances the public health sanitation programmes were called "rodent control projects" or "home refuse improvement programmes", to stress those items which the community felt were important to them. These points of importance were discovered through talks at village meetings and with the Commissioner and civic religious groups, and through discussion with key leaders in the community.

In the case of community sanitation programmes which stressed rodent control, the Sanitation Section carried out trapping and made Warfarin rat poison available to home owners, who also cleaned their premises to eliminate food supply and harborage for rodents. While providing such services increases the cost of a village programme, it is also a goodwill gesture that helps to show the sincerity of the agency working with the village.

Village improvement programmes, whether in sanitation or in any other public health field, are not easy to carry out. They all require hard work, patience, technical "know how," and a good sense of humour. However, the public health improvements that can be achieved by using the dynamic force of a group of people in a village are simply astonishing, and the results of a well-planned programme can go far beyond expectations. The sanitarian, by using locally-suitable health educational techniques and media, and allowing ample time for his programme, can stimulate good public health practices which will greatly benefit his people.

The future work plan of the Sanitation Section provides for the continuation of these village sanitation programmes, in co-ordination with the Public Health Division, throughout the rest of the island of Guam. Special efforts will be made to increase the use of the public health nurse and sanitarian as a team working with various villages in their improvement programmes, and to enlist the aid of the various community forces to help, thus making Guam a healthier and more pleasant place in which to live.

PACIFIC READING

Material in this section is contributed by the South Pacific Commission Literature Bureau. Any enquiries relating thereto should be directed to Box 5254, G.P.O., Sydney, Australia.

Notes and News

Social Studies Books for Papua and New Guinea. Two new books have recently been published by the Jacaranda Press, Brisbane. They are:

A Teacher's Book of Social Studies for Standards III to VI by David Powys, B.Ec., Dip.Ed., Dip.Auth. Price A.17/-. 158 pp.

Social Studies for Standard VII by G. T. Roscoe, M.A., Dip.Ed., F.C.P. Price A.18/-. 179 pp.

Both books, which are intended as source material for teachers in Papua and New Guinea, would also be useful in other territories.

The first book deals with Papua & New Guinea. A geography section covers land formation, climate and fauna, while sections on the history, government, and economics of the territory follow. Six of the chief primary industries are described in detail. The book concludes with a chapter devoted to each of the fourteen districts. Several photographic illustrations portraying native life are included.

An astounding variety of information has been collected for this teachers' book, and an earnest attempt has been made to weave a human story into its pages. An alphabetical index would surely have enhanced its value.

Social Studies for Standard VII deals with the geography, history and development of Australia as well as New Guinea, while New Zealand also occupies a section. The book is well illustrated with line drawings and photographs. Here again an index would have been useful, especially to indigenous teachers.

Both books are most informative, and young teachers especially would find them valuable as source material. However, it is felt that indigenous teachers would need to be above average to use them without considerable assistance.

New Fisheries Booklets. In co-operation with the Commission's fisheries officers, the Literature Bureau is preparing for publication two new booklets entitled *How to Look After a Fishpond* and *How to Look After Fishnets.*

The first describes the construction, stocking, management, and maintenance of a fishpond suitable for the raising of tilapia, a species of edible fish introduced to the Pacific several years ago to provide a new source of protein for islanders. *How to Look After Fishnets* deals with the cleaning, drying and storing of nets. It then describes a method of preserving a net by using a tanning solution. In each book the text is simply written and well illustrated with clear line drawings, and should be suitable for either adult reading or school use.

These books will be companion volumes to the already widely-known *Fish Preservation Simplified,* and will be published in both English and French editions. Single inspection copies, together with details of costs, will be available shortly from the Literature Bureau.

Hygiene Book Reprinted. *A First Hygiene Book,* mentioned in "Notes and News" in the last issue, has now been reprinted, and copies of both the New Hebrides and Papua & New Guinea versions can be purchased from the Literature Bureau.

Since it was first published some eighteen months ago this book has been well received in most Pacific areas, and has already been reprinted twice. Written in simple English and well illustrated with clear black and white line drawings, it provides a simple introduction to sound hygiene principles and should be found very useful for either school use or village level work.

Orders should be addressed to the Literature Bureau, Box 5254, G.P.O., Sydney, price for single copies being A.3/-, plus postage. If 12 or more copies are purchased at the one time a special discount is granted.

Handbook of Papua and New Guinea. The second edition of this book, which is edited by R. W. Robson, F.R.G.S., was published recently by Pacific Publications Pty. Ltd., 29 Alberta Street, Sydney, price A.10/-.

The first part covers a general geographical and historical survey as well as descriptions of the political and social organizations. (The UN Trusteeship and the South Pacific Commission are mentioned here.)

The whole territory is then divided into fifteen districts, each being treated in a separate, clearly-indexed section. A map of the district prefaces each section, which deals with such topics as area and geography, list of principal administrative officers, communications, industries, business establishments, and other general information covering education, mission activities and similar matters of interest.

Finally, about 120 pages are devoted to matters relating to the economic and commercial life, communications, education, health and social and mission activities.

Situated as it is in close proximity to Australia, Indonesia, Asia, and adjoining Netherlands New Guinea and other

OXFORD ENGLISH COURSES

FIRST READING BOOKS

The need for a new series of supplementary readers arises in changes of fashion no less than in methods of teaching English as a foreign language. Since one of the purposes of supplementary readers is to get students interested in reading, they need to be attractively printed in a large type and with plenty of illustration. *The New Oxford Supplementary Readers* will satisfy these new conditions, but at the same time retain the important principles of existing series.

TOWN RAT AND COUNTRY RAT	1/-
A PRESENT FOR MOTHER	1/-
THE OLD WOMAN AND HER COCK	1/-
SHALL WE MEET THE LION?	1/-

A new series of supplementary readers is now being produced for use in conjunction with the *Oxford English Course for Papua and New Guinea*. The first two books in this series are:

WHY COCKS CROW	3/-
TUI LIKU AND THE GIANTS	3/-

The vocabulary of these 48-page books is based on the words learnt in the *First Book, Second Book,* and *Third Book* of *Oxford English Course for Papua and New Guinea,* and the stories in them have been chosen from various regions of the southern Pacific area.

UNDER THE MANGO TREES	2/-

This is the story of Dinah Frank of Rogea, the first of a series of short lives of outstanding men and women from Papua and New Guinea. They are being produced in close collaboration with the area Director of Education.

All prices are quoted in Australian currency

OXFORD UNIVERSITY PRESS

346 LITTLE COLLINS STREET MELBOURNE

WHERE THE WHITE SAMBHUR ROAMS

R. L. Spittel

This simplified version of a great adventure story in seventeenth-century Ceylon has been written within a limited vocabulary of 2,000 words, primarily for those studying English as a second language. *Many lively black-and-white illustrations.* *2s. 6d.*

STORIES TO REMEMBER

E. F. Dodd

The books in this series of classics are retold and simplified to a limited vocabulary for students of English. A prospectus is available on application. Recently published: ROUND THE WORLD IN EIGHTY DAYS (Jules Verne), THE CORAL ISLAND (R. M. Ballantyne) and SIX SHORT STORIES. *2s. 3d.* each

Far and Wide Stories: 12

MYSTERY IN MAORILAND

John Hornby

An adventure story of life in New Zealand, in a series of readers suitable for the younger pupils in Secondary Schools. Excellent supplementary reading material for geography. *Illustrated.* *2s.*

QUESTION TIME SERIES

Ethel M. Phillips

The subject matter of this well-known series takes the form of talks, in the course of which two children are given, in simple language, information about everyday articles. 16 pp. *Coloured illustrations.* *8d.* each

Prospectus available on application

MACMILLAN & CO LTD

St Martin's Street London WC2

Pacific territories, this great area and its people must be reckoned as a powerful potential influence on the future history of the region. A comprehensive knowledge of it is contained in the 288 pages comprising this book.

Nature Study. This handbook for Pacific island teachers from the Islands Education Division, Department of Education, N.Z., provides an invaluable aid to all classes of islands teachers of all grades. The author, Ray Blanc, has had many years of experience guiding teachers in the islands.

The book emphasises throughout that nature study is a study of nature, and that the closer our place of study is to real nature the better.

Both in his introduction and later in the book the author outlines methods, and gives suggestions, designed to stimulate the interest and activity of pupils in the study of nature. They then become the discoverers. The importance placed on team-work, co-operation and social training in the organization of nature study merits special attention.

Mr. Blanc has struck a very happy medium between a text book and a method book. Exclusively neither, it is yet both. All teachers can find sufficient information to put them at ease with their subject, sufficient to give them an assurance in further studies. At the same time if the methods recommended are followed, future lessons in nature study should hold both interest and incentive for the pupils.

Measuring 9½" x 6½", with a hard cover, the book has been attractively produced. It contains 261 pages. Price stg.25/-.

Land Tenure Report. A report dealing with the land tenure system in the British Solomon Islands was published recently by authority of the Western Pacific High Commission. Its 329 pages fully document the findings and recommendations of the Commissioner empowered to investigate the problem, and it should be of considerable interest to territorial administrations and research workers interested in the Pacific area.

Copies can be purchased from either the Western Pacific High Commission, Honiara, or the Literature Bureau, Sydney, price £A.1/5/-, plus postage.

SPC Tuberculosis Conference In November

FROM November 3-14, about eighteen tuberculosis and public health officers from almost all the South Pacific territories, together with four metropolitan specialists, will attend a conference on tuberculosis arranged by the South Pacific Commission. It will be held in Pago Pago by kind invitation of the Government of American Samoa, which is co-operating with the Commission in the undertaking.

The theme of the conference is the consideration of tuberculosis as a community disease in the island territories of the South Pacific. The purpose is essentially to consider the best means whereby, in the epidemiological environment existing in the area, the disease may be prevented from spreading in the community, and whether it is feasible to eliminate it entirely.

Four topics have been selected, as follows:

(i) *Aims and purposes of a community control programme in tuberculosis.*

(ii) *The epidemiology of tuberculosis, and its significance in community control.*

(iii) *Aspects of case management and contact control in the protection of the community against tuberculosis.*

(iv) *Methods and techniques in diagnosis, prevention (including inoculations) and treatment.*

Preliminary papers have been prepared and circulated on the present position of tuberculosis and its control in the South Pacific territories, and on the items on the agenda.

It is hoped to make the conference as informal as possible and to ensure that all participants will have the fullest opportunity of taking part in discussions and expressing their views freely.

Bibliography On Cycads

CYCADS are found in many islands of the Pacific, the most common being *Cycas rumphii* Mig. (*C. circinalis* Blanco, *C. riuminiana* Porte). These plants and their family are the remainder of the Mesozoic flora which covered the earth in that era.

In the past, fruits of Cycads were used as food in some islands such as Guam and New Caledonia. These fruits are nevertheless toxic and need to be cooked in a special way to make them edible. Poisoning due to their consumption was not infrequent; even recently, cases have been reported from Micronesia.

In the scope of a study on tropical plants used for food, and reported to have toxic properties, Mrs. Marjorie Grant Whiting of the Department of Nutrition, Harvard School of Public Health, has assembled a considerable amount of information on Cycads, their food value, toxicity and uses as food or as medicine. The South Pacific Commission assisted Mrs. Whiting in her work.

Today, research on Cycads still continues in the United States, Hawaii and Australia. Although this research is not completed, the valuable information assembled by Mrs. Whiting is of great importance and therefore should be made available to interested readers. Mrs. Whiting has prepared an Annotated Bibliography on Cycads which will soon be distributed by the South Pacific Commission. It contains very valuable information on the geographic distribution and vernacular names of these plants, the preparation of their starch for food use, the uses other than food for various parts of the plants, the Cycads' toxicity, field and laboratory experimentation in that respect, the symptoms of cycad poisoning and, finally, the chemical analyses of these plants.

An index of authors and references completes this bibliography, which is a most valuable contribution to knowledge on economic botany of the Pacific.

—*Jacques Barrau.*

Health Education Training Course On Guam

At the conclusion of the health education training course, held under SPC-WHO auspices at Commission headquarters from July 1 to August 21 of last year, instructors from Pacific territories who had taken part agreed they would endeavour to promote similar courses in their own areas.

The first of such courses will be held on Guam from October 27 to November 21. Thirty-five health and educational personnel will attend from Guam and the United States Trust Territory of the Pacific Islands.

Director of the course will be Mr. L. T. Cowper, a sanitation specialist of the Guam Department of Medical Services, who was an instructor at last year's SPC-WHO course in Noumea.

The World Health Organization will be represented by Mr. Lynford L. Keyes, Western Pacific regional adviser for health education of the public, who also attended last year's course.

PICTURE CREDITS

Acknowledgement is made for illustrations reproduced in this issue as follows: Front cover, and pages 20, 21 (bottom), 37 (left), 41-45 incl., 46, 47 (top), Fiji Official; 22, 58, 59, Australian Official; 25-28 incl., Michel Angot; 31, 32, 33, 56, 57, Netherlands Information Service; 34, 35, 36, D. R. A. Eden; 39, 40, H. A. P. C. Oomen; 50, 51, 52, René Catala; 53 (top), Y. M. Lau; 53 (bottom), F. A. McClure; 54 (right) and 55, after Gamble.

South Pacific Commission Technical Papers

Copies of Technical Papers, which are published both in English and French editions, may be procured from the South Pacific Commission, Nouméa, New Caledonia, or G.P.O. Box 5254, Sydney, Australia. Except where otherwise stated, price per copy, post free by surface mail, is 2/- stg. (2/6 Aust., 2/3 Fijian, 30 cents U.S., 1 New Guinea guilder)*.

NUTRITION

18. **Report on Nutrition Investigations by the South Pacific Commission in 1950.** November 1951.
22. **Chemical Composition of the Milk of New Hebridean Mothers.** F. E. Peters, biochemist, South Pacific Commission. February 1952.
23. **Nutrition Research Conducted in New Hebrides during 1951.** Sheila Malcolm, nutritionist, South Pacific Commission. April 1952.
50. **Nutrition Investigation in New Caledonia.** Sheila Malcolm. October 1953.
63. **Diet and Nutrition in American Samoa.** Sheila Malcolm. August 1954.
83. **Diet and Nutrition in the Trust Territory of the Pacific Islands.** Sheila Malcolm. July 1955.
85. **Etudes sur la Nutrition et l'Alimentation dans les Etablissements Francais de l'Oceanie** (Summary and Conclusion in English). Sheila Malcolm. April 1955.
95. **Bibliography of the Nutritional Aspects of the Coconut** (revised edition of T.P. 58). F. E. Peters. September 1956.
100. **Chemical Composition of South Pacific Foods**—An Annotated Bibliography. F. E. Peters. January 1957. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
106. **Some Food Problems In The Pacific Islands.** H. S. McKee. May 1957.
113. **The Diet of Mothers and Children on the Island of Guam.** Sheila Malcolm. January 1958.
115. **The Chemical Composition of South Pacific Foods.** F. E. Peters. January 1958.
118. **Nutrition and the Papuan Child.** H. A. P. C. Oomen and S. H. Malcolm. April 1958. (8/- stg., 10/-A., 9/-F., $1.20, 4G.)

PUBLIC HEALTH

12. **Tuberculosis Investigations by the South Pacific Commission in 1950.** May 1951.
24. **A Survey of Leprosy on the Island of Nauru.** Dr. C. J. Austin, Director, Makogai Leprosy Hospital, Fiji. April 1952.
27. **A Survey of Leprosy in the British Solomon Islands Protectorate.** Dr. C. J. Austin. July 1952.
56. **Leprosy in Netherlands New Guinea.** Dr. Norman R. Sloan. April 1954.
57. **Leprosy in the Trust Territory of the Pacific Islands.** Dr. Norman R. Sloan. April 1954.
62. **Leprosy in American Samoa.** Dr. Norman R. Sloan. July 1954.
64. **Dental Conditions in School Children of American Samoa.** Dr. Raymond G. Neubarth. August 1954.
67. **Ophthalmological Survey of the Trust Territory.** Dr. H. E. Crawford. September 1954.
69. **Leprosy in Western Samoa and the Cook Islands.** Dr. Norman R. Sloan. October, 1954.
96. **Health Education In The South Pacific.** G. Loison and L. L. Keyes. September 1956.

MOSQUITO-BORNE DISEASES

17. **Conference of Experts on Filariasis and Elephantiasis, Tahiti: Summary of Proceedings.** September 1951.
33. **A Survey of Malaria in the British Solomon Islands Protectorate.** Dr. R. H. Black, School of Public Health and Tropical Medicine, University of Sydney. November 1952.
60. **Some Aspects of Malaria in the New Hebrides.** Dr. R. H. Black. May 1954.
61. **Malaria in the Trobriand Islands.** Dr. R. H. Black. May 1954.
65. **Annotated Bibliography of Filariasis and Elephantiasis.** September 1954. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)
66. **Distribution of Filariasis in the South Pacific Region.** Dr. M. O. T. Iyengar. September 1954. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)
68. **Malaria in the Torres Straits Islands.** M. Josephine Mackerras and Dorothea F. Sandars. October 1954.
80. **Malaria Control and Research in Netherlands New Guinea.** Dr. R. H. Black. March 1955.
81. **Malaria in the South-West Pacific.** Dr. R. H. Black. March 1955.
86. **Distribution of Mosquitoes in the South Pacific Region.** Dr. M. O. T. Iyengar. 1955. (8/- stg., 10/-A., 9/-F., $1.20, 4G.)
88. **Annotated Bibliography of Filariasis and Elephantiasis. Part 2.** Dr. M. O. T. Iyengar. Jan. 1956. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
104. **Developmental Stages Of Filariae In Mosquitoes.** Dr. M. O. T. Iyengar. May 1957.
105. **An Investigation On Filariasis In The Berau Region.** H. de Rook. May 1957.
109. **Annotated Bibliography of Filariasis and Elephantiasis. Part 3.** Dr. M. O. T. Iyengar. July 1957. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
110. **Enquete epidemiologique et entomologique sur la Filariose de Bancroft en Nouvelle-Caledonie et dependances.** M. Lacour et J. Rageau. (With Summary in English). August 1957.
117. **La repartition geographique des moustiques en Nouvelle-Caledonie et dependances.** J. Rageau. Mars 1958. (Available in French only).

TROPICAL CROPS

19. **Report on Copra Grading.** November 1951.
21. **Note on the Mycoflora of Rice Seed in the Territories of the South Pacific.** Dr. F. Bugnicourt, Director, Institut Francais d'Oceanie. January 1952.
31. **Cocoa Plantation Management in Western Samoa.** D. R. A. Eden, General Manager, New Zealand Reparation Estates, and W. L. Edwards, Assistant General Manager. October 1952.
36. **Cocoa Growing in Fiji Islands.** D. H. Urquhart, former Director of Agriculture, Gold Coast. December 1952.
37. **Cocoa Growing in Netherlands New Guinea.** D. H. Urquhart. January 1953.
38. **Coffee Growing in New Caledonia.** D. H. Urquhart. January 1953.
39. **Cocoa Growing in Western Samoa.** D. H. Urquhart. January 1953.
40. **Cocoa Growing in New Hebrides.** D. H. Urquhart. January 1953.
48. **The Management of Coconut Plantations in Western Samoa.** D. R. A. Eden. September 1953.
82. **The Manufacture of Copra in the Pacific Islands.** W. V. D. Pieris. July 1955. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
87. **L'agriculture vivriere autochtone de la Nouvelle-Caledonie,** par Jacques Barrau; precedee de l'organisation sociale et coutumiere de la population autochtone, par Jean Guiart. Janvier 1956. Available in French only. (20/- stg., 25/-A., 22/6F., $3.00, 10G.)
94. **Food Plants of the South Sea Islands.** Dr. E. Massal and Jacques Barrau. September 1956. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
97. **Rice Production In The South Pacific Region.** R. Watson. October 1956.

PESTS AND DISEASES OF PLANTS AND ANIMALS

8. **Insect Pests in the Wallis Islands and Futuna.** From report by F. Cohic, Entomologist, Institut Francais d'Oceanie. December 1950.
9. **Report of Plant and Animal Quarantine Conference, Suva.** April 1951.
34. **Rhinoceros Beetle Control in the Kingdom of Tonga.** L. J. Dumbleton, Plant and Animal Quarantine Officer, South Pacific Commission. November 1952.
77. **A List of Diseases and Parasites of Animals Recorded in the South Pacific Territories.** Bilingual. December 1954.
78. **A List of Plant Diseases Recorded in South Pacific Territories.** Bilingual. December 1954.
79. **A List of Insect Pests Recorded in South Pacific Territories.** Bilingual. August 1955. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
101. **Parasites And Predators Introduced Into The Pacific Islands For The Biological Control Of Insects And Other Pests.** L. J. Dumbleton. March 1957.
107. **The Rhinoceros Beetle In Western Samoa.** R. A. Cumber. June 1957. (4/- stg., 5/-A., 4/6F., $0.60, 2G.)
116. **Contribution a l'Etude des Cochenilles d'Interet Economique de Nouvelle-Caledonie et Dependances, par F. Cohic.** Fevrier 1958. Available in French only.

ECONOMIC CONDITIONS

54. **The Pacific Islander and Modern Commerce.** V. D. Stace, Assistant Economist, Reserve Bank of New Zealand. March 1954.
89. **Small-Scale Industry for the South Pacific—Preliminary Papers.** Cyril S. Belshaw. March 1956. (4/- stg., 5/-A., 4/6F., $0.60, 2G.)
90. **Industrial Activity in Selected Areas of the South Pacific.** K. H. Danks. March 1956. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)
91. **Western Samoa—An Economic Survey.** V. D. Stace. June 1956. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
92. **Economic Aspects of the Coconut Industry in the South Pacific.** E. J. E. Lefort. September 1956. (4/- stg., 5/-A., 4/6F., $0.60, 2G.)

CURRENT RESEARCH

5. **Fisheries and Animal Health Research Projects of Significance for the South Pacific Region,** conducted under the authority of the C.S.I.R.O., Australia. May 1950.
29. **Current Research in the South Pacific in the Field of Economic Development.** July 1952.

* **Abbreviations used in the above list for the currencies quoted are: stg. (sterling): A (Australian): F (Fijian): $ (United States dollars): G (New Guinea guilders).**

43. **Research in Queensland in Tropical Plant and Animal Industries.** Jacques Barrau, Technical Officer, South Pacific Commission. May 1953.
98. **Social Science Research In The Pacific Islands.** November 1956. (4/- stg., 5/-A., 4/6F., $0.60, 2G.)
102. **Index Of Social Science Research Theses On The South Pacific.** April 1957. (4/- stg., 5/-A., 4/6F., $0.60, 2G.)

CO-OPERATIVES

1. **The Co-operative Movement in the Gilbert and Ellice Islands.** H. E. Maude. February 1949.
42. **The Co-operative Movement in Papua and New Guinea.** Prepared by the Registry of Co-operative Societies, Port Moresby. February 1953.
51. **A Bibliography of Co-operation in the South Pacific.** December 1953.
75. **Catalogue of the Commission's Co-operative Library** (Bibliography of Co-operation). January 1955. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)

COMMUNITY DEVELOPMENT

2. **Community Development.** March 1950.
11. **Interim Reports on the Moturiki (Fiji) Community Development Project.** Howard Hayden, Director of Education, Fiji. May 1951.
26. **Further Education in the Cook Islands.** P. F. Henderson, Officer for Further Education, Cook Islands. July 1952.
35. **The Purari Delta—Background and Progress of Community Development.** November 1952.
45. **The Nimboran Community Development Project.** Dr. J. van Baal, Director of the Bureau of Native Affairs, Netherlands New Guinea. June 1953.
46. **The Koror Community Centre.** Reports supplied by the High Commissioner, Trust Territory of the Pacific Islands. August 1953.
74. **Educational Aspects of Community Development.** R. Thomson. January 1955. (4/- stg., 5/- A., 4/6F., $0.60, 2G.)
84. **The Communities Project Approach to Economic Development.** H. Belshaw. July 1955.

EDUCATION

3. **The Village Library.** April 1950.
4. **Visual Aids in Education in the South Pacific.** A. L. Moore, Visual Aids Consultant. April 1950.
14. **Educational Broadcasts to Samoan Village Schools.** Department of Education, Western Samoa. May 1951.
15. **Libraries for Beginners.** Dr. and Mrs. Kenneth Todd, Kwato Mission, Eastern Papua. July 1951.
32. **Types of Organization in Adult and Mass Literacy Work.** D. B. Roberts, Organizer of Island Literature, South Pacific Commission. August 1952.
44. **The Use of the Vernacular in Teaching in the South Pacific.** G. J. Platten. June 1953.
47. **Central Vocational Training Institution.** F. J. Harlow. August 1953. 5/- stg.; plans available sep. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)
72. **Literacy Teaching for Adults.** Karel Neijs. November 1954. (5/- stg.)
73. **Educational Evaluation—A Documentary Survey.** J. C. Nield. December 1954.
99. **Education In The Pacific Islands—A Selective Bibliography.** C. Wedgwood. November 1956. (6/- stg., 7/6A., 6/9F., $0.90, 3G.)
114. **An Experimental Course in Adult Literacy.** Karel Neijs. January 1958.

OTHER SUBJECTS

6. **A Preliminary List of Economic Plants of New Caledonia.** J. Barrau, Director of Agriculture, New Caledonia. July 1950.
7. **A Preliminary List of Plants Introduced into Tahiti.** July 1950.
16. **Some Notes and Suggestions Regarding Conservation of Important Archaeological Sites and Archives in South Pacific Territories.** F. M. Keesing. August 1951. (5/- stg., 6/3A., 5/6F., $0.75, 2.50G.)
25. **Report of Fisheries Conference, Noumea.** May 1952.
28. **Coral as a Building Material.** July 1952.
30. **Bibliography of Cargo Cults and other Nativistic Movements in the South Pacific.** Ida Leeson. July 1952.
41. **Social Problems of Non-Maori Polynesians in New Zealand.** Rev R. L. Challis, Pastor of the Pacific islanders' Congregational Church in New Zealand. February 1953.
49. **The Social and Cultural Position of Micronesian Minorities on Guam.** R. R. Solenberger. October 1953.
53. **Reclamation of Tidal Mud Flats in Tonga.** W. Straatmans, Head of the Department of Agriculture, Nuku'alofa, Tonga. March 1954.
70. **A Linguistic Survey of the South-Western Pacific.** Dr. A. Capell. November 1954. (20/- stg., 25/-A., 22/6F., $3.00, 10G.)
76. **A Bibliography of Tropical Housing.** January 1955.
93. **Clearing House Service for Broadcast Recordings—Information and Catalogue.** July 1956.
103. **How to Make Your Own Posters.** Nancy Phelan. May 1957. (2/6 stg., 3/3A., 2/9F., $0.40, 1.25G.)
108. **Practical Aspects Of Weed-Killing By Chemicals In Tropical Crops.** E. J. E. Lefort. July 1957.
111. **A Selected Annotated Bibliography of Trochus.** R. Gail and L. Devambez. January 1958.
112. **Film and Filmstrip Catalogue.** (Revised edition of T.P. 71). January 1958. (3/- stg., 3/9A., 3/6F., $0.45, 1.50G.)

PRINCIPAL COMMISSION PUBLICATIONS

- The *SPC QUARTERLY BULLETIN* features articles on activities in the Commission's three main fields of operation: economic development, health and social development. Articles are also contributed by specialists working in these and related fields, in the territories within the Commission area.

SUBSCRIPTION RATES

PRICE	*STG.*	*AUST.*	*FIJI*	*U.S.$*	*N.G. GUILDERS*
Single copy	2/–	2/6	2/3	0.30	1.00
One year	8/–	10/–	9/–	1.15	4.00
Three years	20/–	25/–	22/6	2.80	10.00

- *TECHNICAL PAPERS:* These are technical reports on a wide range of subjects in the economic, social and health fields (list above).
- *OFFICIAL RECORDS: Proceedings of Sessions of the South Pacific Commission* (First to Seventeenth); *Annual Reports of the South Pacific Commission* (1948 *to* 1957); *Reports on the First and Second South Pacific Conferences; Progress Reports on Action Taken on the Resolutions of the First and Second South Pacific Conferences.*
- *EXPERT REPORTS:* The Oxford University Press is publishing a series of Expert Reports in book form for the Commission. Four have been issued to date:

VOCATIONAL TRAINING IN THE SOUTH PACIFIC. By R. A. Derrick, M.B.E., A.M.I.S.E., F.R.G.S. Mr. Derrick's report consists of a survey of the facilities for professional and technical training in the whole of the South Pacific, and of recommendations for future development.
Price in Australia ..... *30/-A.*

MOTURIKI: A PILOT PROJECT IN COMMUNITY DEVELOPMENT. By Howard Hayden. A fully documented, copiously illustrated report on a pilot project in community development carried out under Commission sponsorship on the island of Moturiki by the Government of Fiji.
Price in Australia ..... *42/-A.*

SOCIAL ANTHROPOLOGY IN MELANESIA: A Review of Research by Dr. A. P. Elkin, Professor of Anthropology in the University of Sydney. In this report Dr. Elkin reviews past, present and future anthropological research in Melanesia, designed to advance native welfare.
Price in Australia ..... *27/6A.*

SOCIAL ANTHROPOLOGY IN POLYNESIA: A Review of Research by Dr. Felix M. Keesing, Professor of Anthropology, Stanford University. This is a parallel study to Professor Elkin's report on anthropological research in Melanesia.
Price in Australia ..... *27/6A.*

- *BIBLIOGRAPHY:* The following bibliography has been published for the Commission by Oxford University Press:

A BIBLIOGRAPHY OF BIBLIOGRAPHIES OF THE SOUTH PACIFIC: Compiled by Miss Ida Leeson, former Mitcheli Librarian. A basic catalogue arranged by area and subject.
Price in Australia ..... *15/-A.*

- *OTHER PUBLICATIONS:*

The Construction of Literacy Primers for Adults: By Dr. K. Neijs ..... *5/-Stg.*
How to Make Your Own Filmstrips: By Nancy Phelan. *2/6Stg.*

The above volumes are obtainable through leading booksellers.

INQUIRIES REGARDING COMMISSION PUBLICATIONS MAY BE DIRECTED TO THE SECRETARY-GENERAL, SOUTH PACIFIC COMMISSION, NOUMEA, NEW CALEDONIA, OR TO G.P.O. BOX 5254, SYDNEY, AUSTRALIA.

Printed by Bridge Printery Pty. Ltd., 117 Reservoir St., Sydney

Malaria. . . . an effective treatment

The outstanding advantage of CAMOQUIN is the ease with which the control of malaria can be achieved. A single dose can usually be relied upon to produce an effective clinical cure, while one dose every week gives a high degree of protection.

CAMOQUIN has met with considerable success in all forms of malaria in Africa, India, the Philippines and South America and has been suggested as the product of choice*.

Supplied in bottles of 25, 100 and 1000.

A specially flavoured infant tablet is also available in bottles of 25 and 100.

PARKE-DAVIS **CAMOQUIN**

* *"The superiority of 'Camoquin' over other antimalarials", Singh, I. & Kalyanum, T. S.* Brit. Med. Jnl. 1952: 2: 312

PARKE, DAVIS & COMPANY, LIMITED *(Inc. U.S.A.)* SYDNEY, N.S.W.