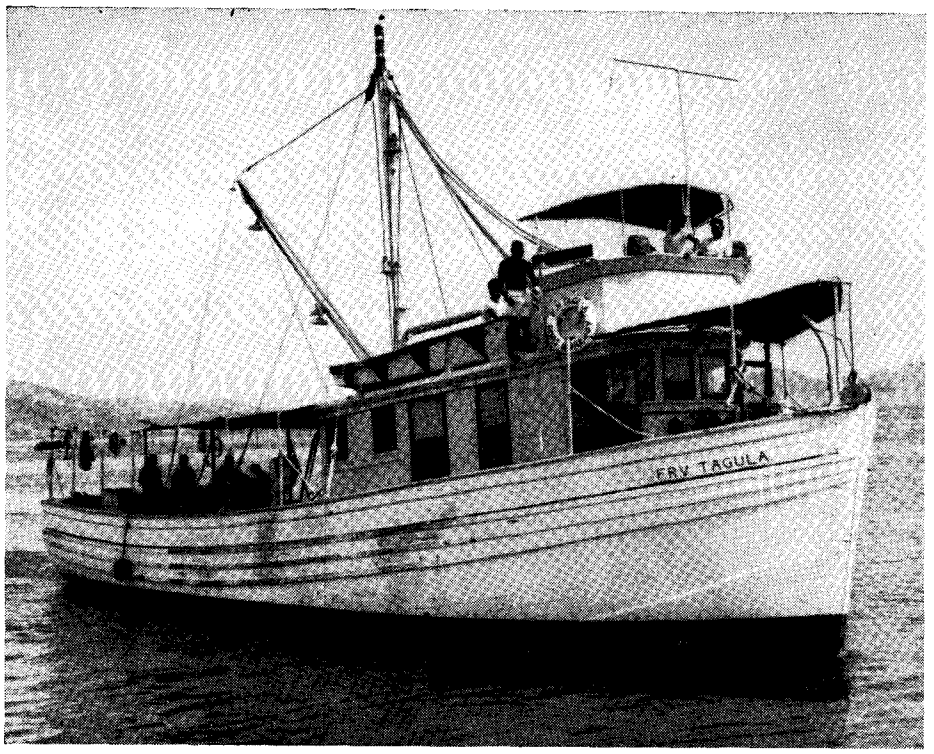
Fisheries Development In Papua And New Guinea



The work being carried out in Papua and New Guinea in freshwater, estuarine, and sea fisheries, and in pond culture, as part of a development programme approved in 1955, is reviewed in the article below.

By A. M. RAPSON*

The Administration's fisheries research vessel "Tagula", which has carried out extensive investigations in Papuan waters. Designed in Scotland and built in Brisbane, she is 60′ long with a beam of 18′ and draft of 7′. She has accommodation for a European master-engineer, three technical staff and a crew of ten Papuans. Her cruising speed is 8½ knots, and cruising range, 1,200 miles.

THE Division of Fisheries in Port Moresby is carrying out, with a small staff of technical officers, a programme of fisheries development approved in 1955. It includes work on freshwater fisheries, pond culture, estuarine and sea fisheries.

Freshwater Fisheries

Four weed-eating species of fish have been introduced to the territory. Only *Tilapia mossambica* (Peters) has bred successfully, and is now distributed in some lowland areas and in parts of the Highlands. Tilapia are established in the Waigani Swamps, about 20 miles from Port Moresby, and some thousands of pounds are taken annually from this low-lying area, which is inundated at each wet season when the Laloki River floods. In the dry, when the water recedes, the swamp is reduced to isolated waterholes in which some river fish remain.

An important development in the introduction of this weed-eating fish is that quantities of better types of fish, bream (*Sparus*) and barramundi (*Lates*), also enter the swamps. Although it may not yet be economical to fish this water system as a commercial enterprise from Port Moresby, it is a highly-productive area, and is profitably fished by natives living near the swamps.

* Dr. Rapson is Chief of the Division of Fisheries, Department of Agriculture, Stock and Fisheries, Papua and New Guinea.

At altitudes of 1,500 to 3,000 feet, only moderate production of fish from tilapia ponds has been achieved. This is due in part to lack of suitable pond weeds, so that the fish feed mainly on small algae.

In the extensive Highlands plateau, altitude 5,500 feet, there is a similar lack of suitable weed. However, tilapia thrive in some localities, but yield is usually low.

The reason for the differences in production is related to fertilizing and to water temperature, which varies appreciably. Surface temperatures of ponds at this altitude on fine days exceed 80° F. Temperatures at the bottom of the ponds, where the fish spend a greater part of their time, often drops to 60° F., and does not change appreciably from day to day. This is caused in part by the long periods of windless days.

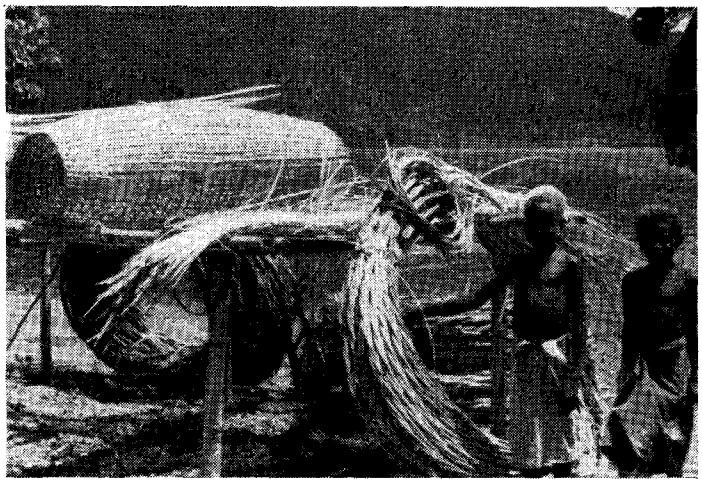
Greatest success in the Highlands has come from the feeding and fertilizing experiments associated with stock. A single, well-fertilized pond of one acre at Binden Plantation, Mt. Hagen, after being stocked for 18 months, produced, on draining, four tons of fish. Similar methods of cultivation and harvesting could, in good localities, produce comparable results. At an altitude of 6,500 feet, at Kutu Plantation, tilapia do not breed.

Although culture of tilapia has been considered undesirable by some writers (see Marshall Laird, *Studies of Mosquitoes and Freshwater Ecology in the Pacific*, Royal Society of New Zealand Bulletin No. 6, 1956), results obtained in Papua and New Guinea show that in well-managed ponds, tilapia effectively control mosquitoes. In natural waters, tilapia reduce the mosquito population considerably.

Ponds placed in strategic positions appear in some instances to attract breeding mosquitoes, with the result that the larvae are effectively controlled by tilapia. Where ponds have been constructed and left unstocked they have not altered the general pattern of mosquito population. At Dobel, Mt. Hagen, unstocked ponds after many months had no mosquito larvae, while at Kerowagi, an area with malarial mosquitoes, ponds left unstocked and under-stocked became breeding places for mosquitoes.

As a mosquito control, tilapia is more effective than *Gambusia*, and in addition it is edible. In some Highland areas many children have eaten tilapia. They have not eaten any other fish, and probably little meat.

Tilapia have recently been introduced to the Mortlock Islands in an attempt to produce more food and also to control mosquitoes in the gardens where swamp taro (*Cyrtosperma* sp.) is cultivated, and where mosquitoes sometimes develop on



Above: Catching fish with a lift-net in a backwater of the Jimmi River. Apogon and catfish are main species caught. Right: Small fish-trap at Rabaul. The coiled vines are used as mooring lines for larger traps.

such a scale as to limit work in gardens.

Osphronemus gouramy and snakeskin *Trichogaster pectoralis* introduced from Malaya in 1958 have not yet produced fry. They will be best for low—and medium—altitude ponds. Singapore carp fingerlings received from the Taronga Park aquarium, the last vegetable feeder introduced, will be better adapted for Highland waters.

Several rivers have been stocked with brown trout by private individuals, planters' associations and one large company. A few fish which have been caught show that trout will grow, and some reach a good size. The largest authenticated record is of a trout weighing 7 pounds 4 ounces. Some trout less than 8 ounces in weight have been captured with characteristics of old fish, with the hooked lower jaw. River temperatures at an altitude of 5,500 feet are about 64° to 68° F., rather above optimum requirements of trout.

In the Highland rivers, fish food—insects such as mayfly larvae, cadis larvae and other aquatic animals—are similar to those found in temperate zones. Quantities, however, are small, and the insects usually are much smaller than necessary to produce good stocks of large fish. The absence of wooded areas which contribute a large variety of food for many species of fishes is also a limiting factor in fish production. Eels are found in many Highland streams, and small numbers of these predators can seriously reduce stocks of more desirable species.

Estuarine Fisheries

In estuaries and lower reaches of the larger rivers several fish are important, for example: mullet (*Mugil*), bream (*Latus*), jewfish (*Scieana*), threadfin salmon (*Polynemus*) and milk fish (*Chanos*).

In Papua, barramundi (*Lates*), an important north Australian fish, is in considerable abundance, but up to the present time this species has not been recorded from New Guinea where, however, a species of cod (*Epinephelus*) is a valuable food fish.

Often fishing is limited to fish runs related to the wet and dry seasons, fish moving down stream in the flood seasons. When the rivers are in high flood, more fishing takes place outside the mouths of estuaries where some species spawn and the concentrated shoals of fish are more easily harvested. When the rivers are low and the waters clear, mullet, barramundi and other species travel up the rivers and these runs, which occur regularly at special phases of the moon, are important fisheries. New types of fishing gear being introduced offer promise of better harvest from these important migrations.

Recently-Introduced Fishing Gear

Distribution of machine-made nets and twines for making fishing nets offer very great development possibilities. With a growing cash economy, hand-made nets of local materials are costly.

The work of obtaining fibre materials and making nets from the hand-made twine is slow and laborious. In Manus Island the cost of a hand-made net 18 ft. long and 8 ft. deep, used to catch malambul (*Selar crumenophthalmus*) exceeds £10. The value of netting in synthetic material of similar thickness, but with better wearing qualities and strength, would cost less than £3.

Hauling nets of 3-in. mesh, by 100 meshes deep, 250 to 300 yards long, of

A family party of Papuans setting fish-traps in one of the many lagoons of the Balumo region in western Papua. Food is abundant in this area, as the swamps attract vast numbers of waterfowl and the lagoons teem with fish.

Papuans at a Milne Bay village making fishing nets from twine hand-woven from fibre obtained from jungle plants and trees. It is a slow and costly process, and efforts are being made to promote wider use of machine-made nets and twines.

12-thread cotton, have produced up to 800 pounds of fish per haul. Similar nets, 1-1¼-in. mesh, by 100 meshes deep, 200 to 250 yards long, of 9-thread cotton, have produced up to 500 pounds per haul. Methods of handling this type of small fish catch (bait fish) are being investigated.

Nylon nets have been used in estuaries for catfish, freshwater snapper (*Lutjanus argenteus*), and large bream, while barramundi have been taken up to 40 pounds in weight. Experiments with this type of net are continuing, to determine the minimum strength of twine which may be economically used to catch the largest size of fish. Preliminary experiments show, for example, that although barramundi of 20 to 40 pounds can cut a 2-in. or a 4-in. mesh of 90-pound breaking strain fibre, a 45-pound breaking strain net material in 7-in. mesh will hold 20-pound fish.

In clear water, small fish up to 500 pounds per haul have been successfully caught with a lift net. Shoals of sprats which come inshore in the south-east season have been caught with a net 40 feet by 80 feet, set on the bottom and lifted quickly when the fish move over it. Small bream over reefs have also been caught with this type of net.

Fisheries Research Vessel

A 60-foot vessel, the F.R.V. TAGULA, equipped for carrying out a wide range of fishing activities, operates in Papua. It is well equipped for trolling with motor boats, using the Queensland fishermen's methods—oceanic longline fishing and small mesh trawling—and is equipped to carry out a small amount of scientific research.

A 30-foot vessel is used for inshore work near Port Moresby, and experiments are continuing using outboard motors in sheltered waters. Several different types of small craft, in addition to double canoes, are being tested.

Although trolling for tuna and mackerel has been successfully carried out for centuries, the introduction of good lines with wire traces has greatly improved catches. The use of garfish (*Hemirhampus dussumierii*) for bait, as used by Queensland fishermen, has also given excellent results in fishing the mackerel runs.

In work carried out by the TAGULA, most satisfactory results have been obtained east of Samarai, where many catches exceeding 500 pounds per day have been obtained, while enough exceeded 1,000 pounds a day to warrant this method being adopted in commercial fishing. Considerable information on the Spanish mackerel migrations has been collected, and many important grounds for this species are now known. Greatest aid has been the use of echo-sounding equipment to locate reefs on dull and rainy days.

In hand-lining, a large proportion of the catch is of poor quality snapper (*Lutjanus waigiensis*), called red bass. Best results are obtained at night, usually on reefs some distance from sheltered anchorages, and navigational difficulties limit reef fishing to irregular intervals. Small motor boats and canoes, however, often bring in quantities of government bream (*L. sebae*) and Malabar snapper (*L. malabaricus*) from 35-fathom reefs.

Deep vertical lines fishing at depths of 75 fathoms in Rabaul Harbour are yielding considerable numbers of a large red fish (aprion?) up to 15 pounds in weight. This is not a first-quality fish, but it is meeting a considerable demand for fresh fish in the area (it is, however, not satisfactory in the "raw fish" dishes favoured by Chinese). Experiments are continuing using horizontal lines on the bottom.

A fourth method of fishing using horizontal longlines in the open sea is being tested. Garfish, fish strips, squid, mullet and silver biddies (*Gerres argyreus*) for bait have not yet given conclusive results. A variety of fish, including yellowfin tuna, ocean mackerel, sail fish, sharks and dolfins have been caught. However, using only five miles of longline has not proved economic because of the distances to be steamed to the fishing grounds—the 1,000 fathom line—and the wait between shooting and hauling to make an effective catch.

Garfish produced the best results east of Normanby Island and in the area south of Jomard Entrance to south of Suau. No fish were caught using squid (caught on beaches) south of Hood Point, although yellowfin tuna offshore feed largely on an oceanic squid. Yellowfin less than 20 pounds are often taken on troll lines close inshore. The yellowfin taken by longlining ranged from 60 to 140 pounds.

Preservation Of Fish

A small refrigerator installed at Loupom Island on the south coast of Papua by the Division of Fisheries for bait storage has been used by a fishing group under technical direction from the Division, to freeze fish for the Port Moresby market.

Results up to the present time would not warrant installation of a freezer specially for commercial fishing. However, with improved gear and better knowledge in handling fish, prospects for ultimate success in this method are fair.

Total sales of fish caught by the fishing group for 11 months amounted to £1,240, while costs, which included erection of freezer building, freight, engine operator's wages, and cost of fuel were £1,062. Although cash profit was small (£178), the project could be considered successful, as a considerably greater quantity of fish was caught and eaten than in previous years and most people in the islands benefited from this industry. A considerable part of the costs also was returned to the people in wages or in some other form.

The traditional method of preserving fish by smoking is widely practised, and

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Polynesia (the Marquesas and the Tuamotus were the only Archipelagos really investigated), tuna fishing with live bait is sound commercially. Results are not quite so conclusive with the long-line. Trolling on a small scale would probably supply the local market.

The data so far collected emphasizes the very great importance of the scientific research work carried out from the territories. Such results as are already available have indicated which are the best methods to be used according to the type of fishing intended, whether small-scale or commercial.

They also provide information concerning the species of fish and the yields, which will be useful for any eventual commercial use of pelagic fish. Finally, they have shown that non-specialized, locally-recruited crews can adapt themselves to new fishing techniques (the officers of the ORSOM III are European, and the five or six hands Melanesian or Polynesian).

All the elements which were listed in the introduction as being vital for the revival of fishing in the Pacific are, therefore, present, and the necessary effort should be made to foster it to the utmost.

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smoked fish are traded up to 50 miles from fishing grounds. The Division has assisted in developing an improved type of smoked fish product. Plans are available of a smokehouse designed in the territory before the War, as well as circulars describing the method of preparing fish for smoking. Assistance by technical officers is given to village people developing further trade.

Turtle And Dugong Fishing

In some villages turtles are fished for seasonal feasts and then left for several months until sufficient are again available for another feast. In other places, small turtles are hatched from eggs and the young kept in confinement until they reach edible size. Sometimes, too, in the Admiralty Islands, turtles are kept in pens in shallow water and regularly fed seaweeds, cut-up clam meat and coconut kernels, and may be considered domesticated animals.

Although turtle fishing is well regulated, it is probable that dugong, which have a very much smaller breeding rate and are eagerly sought, will become rare unless protection measures are taken soon.

Beche-De-Mer

The work involved in catching, cooking, cleaning and smoking requires organizing ability usually far above that of the village people. However, production has recently increased, and small quantities are sold to dealers at an average price of about 4/- a pound.

Experiments using dredges and traps in deep water where the best beche-de-mer are found have been only partially successful, and traditional skin diving methods, with the addition of goggles, produce most of the beche-de-mer marketed.

Prices for best quality deepwater black, white mama and mamateat have at times exceeded 10/- a pound, but the market is limited and only a high-quality product is sold.

Shell Fisheries

The export of shell from the territory is only a part of the trade in shell in Papua and New Guinea, and a part of the wealth of the territory peoples is in shells used in trade or barter. In times of war these shells have formed a sound, stable currency.

Cone shells and small gastropods, money cowries, pearl shell, green snail and clams are the principal shells used for barter.

The export of shell of all types reached a value of about £450,000 in 1956, but value has since declined to slightly more than half this value. During the period of high prices, fishing effort increased considerably, and production of trochus, the most important shell, reached 840 tons in 1955. However, decline in quantity had already started in 1956, and in 1957 only 530 tons of trochus were produced. Some of the shipments in the last years of high prices were reported to be more than 30% inferior grade.

The limited over-fishing during the period of good prices was not harmful to the beds. In most villages, fishing is restricted by periodic closure of reefs.

Investigations of the size of shell marketed have shown that increase in the legal size of trochus by ½ in. to 3 in. (minimum width across the base) would decrease the present production by 8%, but would make a more stable reserve stock. The principal factor to be considered against any increase in size is the number of small shellfish used as food in times of scarcity of other seafoods.

Greater shell trade may come from the marketing of a wider variety of shells for costume jewellery and brooches, and for shell collections. This type of trade developed during and immediately after the last war. However, no production figures in export quantities are available.

Most important shells in this category may be helmet shells, olives, cones, strombus, cowries, etc. A co-operative effort in producing shell for collectors in overseas trade may develop into a profitable industry.

Fish Production

An investigation in 1949 suggested that about 3,500 tons of fish were caught annually in Papua and New Guinea. Recent surveys suggest that the production is much higher, probably exceeding 10,000 tons per annum. This quantity is eaten mainly by coastal and river people. In upland areas the consumption is almost nil.

The high cost of ship maintenance in the territory combined with the relatively low rate of fish production makes sea fishing costs almost prohibitive. However, introduction of new fishing techniques promises the most rapid development of sea fishing.

The need for fish is greatest in the Highlands, and extensive areas of swamp land have a great potential for pond development, at a lower cost of production per pound than for sea fish.

Villagers Building Brick School In New Ireland

A cement-brick school building has been erected at Madina, on the east coast of New Ireland, through co-operative effort by the village communities, senior students, technical students, and the Administration.

The new structure is 50 ft. x 18 ft., and is the first of three to be constructed at the Nalik Administration Primary School in the Madina area. These will replace temporary buildings of bush materials.

At the request of village communities whose children attend Nalik School, a small brick-making machine was sent to Madina, and the villagers and older students made bricks for the new building in their spare time, using crushed coral rock. In constructing the school they were assisted by a technical instructor from the teaching staff of the Malaguna Administration Technical School, working with a team of Malaguna senior technical students receiving on-the-job training on construction projects in New Ireland.

The Administration met all out-of-pocket construction costs, which totalled £409 including the outlay for cement and a galvanised iron roof. The three buildings will cost approximately £1,250.