The utilization of such fish poses difficult problems. It can be converted into fish meal, a product used mainly as fertilizer or as stock food rather than for human consumption. The large-scale manufacture of fish meal also needs complex and expensive equipment, which can only be used profitably if regular supplies of fish are available for a large part of the year. For similar reasons canning and the manufacture of fish oils require steady supplies of fish, and are of little use in handling sudden gluts.

Drying in the sun involves less equipment than the methods already mentioned, but is in many regions hindered by weather conditions for part or all of the year. Small-scale artificial drying of cooked fish is practicable, but the product requires moisture-proof containers, preferably metal, if it is to be kept for more than a few weeks in warm damp climates. Mr. H. van Pel, fisheries officer of the Pacific Commission, has recently shown that dried fish flakes of good quality can be made from cooked fish by very simple means.

The manufacture of fish sauces from sea or fresh-water fish requires only simple equipment and can, if necessary, handle large amounts of raw material at a time. The essential piece of equipment is a vat in which the salted fish is left to be reduced by bacteria and by its own digestive enzymes to a semi-liquid state. On the domestic scale, earthenware jars of a few gallons capacity (20 to 50 litres) can be used. Commercial production in Indochina uses wooden vats which hold up to about 1,000 gallons (5 cubic metres) and the National Institute of Fisheries Research of Cambodia (Institut National des Recherches Piscicoles au Cambodge) has used reinforced concrete vats with a capacity of 3,300 gallons (15 cubic metres). Concrete vats must be coated internally with some salt-resistant material.

The salted fish is put whole in the vats; it is neither cleansed nor scaled. Very little labour is therefore needed, the main operation being transport between the fishing vessel and the vat. The fish remains untouched in the vat for several months; the solid residue is then washed with brine to extract breakdown products of protein and other substances of nutritive value. The residue (nuoc-salt) can be used as a fertilizer. The washing can be done with a motor-driven pump made of a salt-resistant alloy.

The capacity of a fish sauce plant is limited only by the size of the vats. It can therefore receive its raw material in large batches, even taking a year's requirements in a few days. Fish to which one-fifth of its weight of salt has been added soon after catching can be held for several days before going into the vats. Fish sauces, if correctly prepared, keep for several years; they are more stable than any other fish product except canned fish.

Fermented Fish Pastes in S.E. Asia

These products include bagoong in the Philippines, prahoc in Indo-China and trassi in Indonesia. They are widely used as condiments for rice. The quantities eaten in a single meal are rather small, but taken regularly they must help to supplement the rice diet in essential amino-acids, together with calcium, phosphorus and other minerals.

Bagoong is made from small fish, intimately mixed with one part of salt to three parts of fish, or two parts of salt to seven parts of fish. The salted fish is left undisturbed for three months in earthenware jars and is then ready for use. The bagoong contains about 32% of solids; half of this is protein or amino-acids, the rest being largely salt.

The manufacture of prahoc is more complicated. The heads are cut off the fish, which is cleaned and scaled before being mixed with coarse salt (one part of salt to five parts of fish). The salted fish is put on mats to dry in the sun for two days. The sun-dried material is then mixed with a liquid mount. The paste is put in earthenware jars, which are not sealed but are covered to keep out flies, and are exposed in the sun. The paste remains in the jars for a month or more. During this time a salty liquid separates from the paste, and is used as nuoc-mam. The prahoc is considered to be ready for use when no more liquid appears.

The main centre for the manufacture of trassi in Indonesia is the fishing port of Bagan Si Api Api on the east coast of Sumatra, from which substantial quantities are exported to Java.

Trassi can be made either from fish (trassi ikan) or shrimp shells (trassi udang). The fish is salted (one part of salt to ten parts of fish) in the boats and is spread out to dry in the sun for a few days when they return to port; it usually has at this stage a very strong unpleasant smell which disappears later. The sun-dried material is pounded into a paste, often with the addition of more salt. The process of making trassi from shrimps at Bagan Si Api Api is generally similar to that used with fish. Indonesian trassi is usually bright red; the colour is due to synthetic dyes. The final product is often mixed with spices. Tapioca (cassava) flour may also be added. Small red shrimp are used in the preparation of trassi udang in the Merauke District on the south coast of Netherlands New Guinea. Production reached 269,000 kg. (263 long tons) in 1949, a considerable increase over the best pre-war year, but fell to 7,000 kg. (7 long tons) in 1953. Almost all the production was exported to Indonesia until this market was closed for political reasons. Only small amounts of trassi have been sold in New Guinea, though if used within the territory it would be a useful supplement, especially for protein and calcium, in the diet of the people.

The shrimps are spread on sacks in the sun until half dry. They are then mixed with one-sixth their weight of salt, and the mixture broken up as finely as possible in a vessel made from a hollowed-out tree trunk or a pot. Sometimes feet (carefully cleaned) are used in this process. The resulting mass is left to ferment for two or three days in a large heap, and then spread out again to dry. Rice meal is probably added before the final drying. Trassi is prepared at Merauke only by Javanese and Chinese. Papuans are involved only as hired labour.

Conclusions

Fermented fish sauces and fish pastes are used widely in South-East Asia, where they render rice diets both more palatable and more nourishing. They provide a cheap and relatively simple means of preserving most of the food value of fresh fish without expensive equipment.

These have been made at Merauke in Netherlands New Guinea and on a very small scale at Arama in New Caledonia. Their manufacture should also be possible in other places of the South Pacific, especially those where an Asiatic population would provide a ready market. If these fish products should prove acceptable to the indigenous peoples, they would be a nutritionally valuable supplement to diets based either on rice, bread or starchy roots.

FISH SAUCES PROVE POPULAR IN AFRICA

Encouraging Results From Acceptability Trials

In the foregoing article describing the preparation and use of fish sauces in South-East Asia, it is suggested that they might well be used in other parts of the world where the people's diet supplies little animal protein.

In Africa, the average diet in many parts appears deficient in protein, especially animal protein. Fish sauces are not used, but offer an obvious possibility of improving the position. Recently the Food and Agriculture Organization of the United Nations requested the Food and Nutrition section of the Research Institute of the French Cameroons to study the acceptability of such products by Africans. The results of this study have been described by Masseyeff, Cambon and Bergeret in the issue for April 1955 of the French journal Encyclopédie Mensuelle d'Outre-Mer.

The products used were prepared
in France by the fermentation of surplus whole fish and fish guts. They differed from the nuoc-mam of Indo-China only in being more concentrated. Two forms were available: a paste with 55% of protein and powder which was still more concentrated. Both had the high content of essential amino-acids and of vitamins (especially vitamin B₁₂) characteristic of this type of food.

**Details Of Trials**

The trial was carried out in the towns of Douala and Yaoundé, and also in tribes varying in their racial origin and degree of social and economic development. At Douala the test was made in municipal restaurants. These are used by workers in the town, who are often bachelors with little opportunity to prepare meals themselves. The meals supplied consist always of a plate of rice flavoured with a sauce containing meat, peanuts, tomatoes, pimento and palm oil. The restaurants charge low prices, a meal costing 20 African francs (about 12.5 Australian pence), or half this sum if the meat is omitted.

The paste was added to the sauce at the rate of either 6 grams (0.22 ounce) or 9 grams (0.33 ounce) per plate. The trial lasted three days, during which 775 persons were asked their opinion of the sauce, which was favourable in 95% of the cases, regardless of the amount of paste used. Those whose dishes contained meat considered that its flavour was strengthened, and those who ate a sauce without meat reported a wide variety of flavours with fish predominating.

In the villages 10 grams of paste, or the corresponding amount of the more concentrated powder, were distributed for each adult, and one-half, one-third or one-quarter as much for children, according to their age. It was explained to the housewives that the paste or powder should be added to the sauce when it was cooked.

In one village the people were Mohammedans and refused to try the paste which, they thought might be contaminated with some product of the pig, an animal considered impure by their religion.

In three other villages the number of people whose opinion was obtained ranged from 555 to 1,425, and the percentage of favourable opinions from 62 to 95. Over the whole trial 88% of the people who tried the sauce or powder approved of the effect on their dishes.

The results of this trial show that the nutritionally-valuable products from fish sauces are acceptable to African peoples, both those who still live in primitive conditions in the villages and the more advanced town dwellers. If such products can be supplied at a low price they may well make a significant improvement in the African diet.

The authors of the article consider that the essential requirement of cheapness may be met in commercial production, as the surplus fish or fish waste used as raw material has little value unless processed. The importance of attractive presentation of a new food is stressed. In Africa as elsewhere a product presented in neat, clean, brightly-coloured containers is likely to be well received.

This work might well serve as a model for studies of acceptability of unfamiliar products by native peoples. It shows that a new product can be welcome even in the allegedly conservative African villages. In the Pacific islands, imported foods are already familiar in many territories, and the chance of acceptance of new items probably depends largely on the ease or difficulty with which they fit into the accepted ways of cooking.

Fish sauces are obviously most easily used by people whose food consists largely, as in the African villages studied, of a cereal (rice or millet) flavoured with a tasty sauce. They can also be added to all sorts of soups and stews.

—H. S. McKee.

**New Species Of Fig Tree Named After S.P.C. Officer**

A SPECIES of fig tree that grows in the forest near Atéou, a village in New Caledonia, has recently been named Ficus barrau, in honour of M. Jacques Barrau, subsistence agriculture officer to the South Pacific Commission. He collected a specimen and sent it for identification to the Muséum National d'Histoire Naturelle, Paris. It was found to be a species previously unknown to science, and was accordingly described and named by Professor Guillaumin, the noted authority on the plants of New Caledonia.

Most villages in New Caledonia are either near the coast or in deep valleys at low elevations; a few only are high on the mountains. Atéou, which is inland from Koné, is built at about 2,000 feet on a shelf at the base of a steep, forested mountain. It is an isolated village, far from any road, and reached only by rough tracks on which goods are carried in and out by pack horses.

The village has extensive plantations of arabica coffee, grown in the shade of natural forest. This practice has often been found unsatisfactory in New Caledonia, but seems successful here, last year's coffee harvest for the village being 18 tons. Taros are also grown in clearings in the forest, and in ingeniously-irrigated beds perched on steep slopes below the village.

The forest contains several species of trees with edible fruits and nuts, which when in season add variety to the diet of the people.

—H. S. McKee.

**Price Increases For Copra From Papua And New Guinea**

INCREASES in the shipping freight rates for copra from Papua and New Guinea to Australia have necessitated an increase in the prices of copra supplied to Australia. The new prices are:

<table>
<thead>
<tr>
<th>Type of Copra</th>
<th>New Price</th>
</tr>
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<tbody>
<tr>
<td>Hot-air dried</td>
<td>£83 10 0</td>
</tr>
<tr>
<td>Fair merchantable sun-dried</td>
<td>£83 0 0</td>
</tr>
<tr>
<td>Smoke-dried</td>
<td>£82 7 6</td>
</tr>
</tbody>
</table>

The new prices took effect as from 1st September 1956, on shipments ordered after that date.