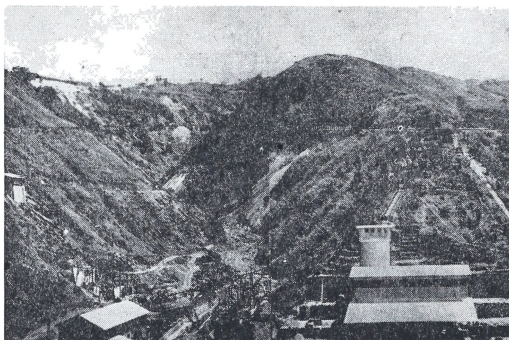


placed on the opposite side of the valley. The latter was placed at approximately the same elevation as the Fine Grinding and Flotation Plant to secure ease of supervision and control. The present mill is designed for 500 tons daily grinding-capacity.

Ore from the mine will be reduced to 3/4 inch size in the Coarse Crushing Plant and will then be transferred by conveyor across the creek to the Fine Ore Bin.

From this bin it will pass through a rod mill and be reduced to 20-mesh size, and then it will go to two ball mills and be reduced to "minus 250-mesh." Water is used as a carrier of the ore from the time it enters the rod mill, and classifiers keep the ore circulating through the ball mills again and again until it is reduced to the desired fineness.

Chemical reagents are added to condition the pulp for flotation and the flotation machines then accomplish the seeming miracle of making the heavier concentrate float to the surface and overflow into the desired channels to be collected, and making the lighter gangue stay down to be finally discharged from the mill, stripped of its valuable content. The remaining part of the milling process is merely one of dewatering the concentrate and preparing it for shipment.



Reproduction of a photograph of the new Lepanto Mill taken about the end of February of this year, looking in the opposite direction. The conveyor truss, the course crushing plant, and the machine shop are on the left. Note both the old and the new mill sites and both the old and the new haulage levels.

use local supplies whenever they are suitable. The Lepanto operation will, therefore, bring prosperity to a large number of employees directly; and indirectly to another large group in the surrounding area, from the supplying of necessary commodities and services both to the employees and their families as well as to the company.

Stock-certificate holdings in Lepanto are very widely disseminated among the general public. Out of some 500 stockholders of record at the end of 1947, only 22 were owners of 100,000 or more shares. Of these 22 shareholders, the Alien Property Custodian is the largest single shareholder and it is expected that his block will eventually revert to the Government of the Philippines.

The officers of the company are: Messrs. E. A. Perkins, President, V. E. Lednický, Vice-President, T. W. Farnell, Treasurer, and C. B. Foster, General Superintendent.

Opportunity in Philippine Fisheries

By DR. ALBERT W. C. T. HERRE

FISH and fisheries have an importance in the economy of rice-eating populations that is difficult for people in the United States, Canada, and most of Europe to comprehend. Rice is the most important item in the life of such countries. Though not important in bank clearings or financial statistics, fish are the second item in national economy. Although these two keep the common people going and are of primary importance, they have been neglected by politicians and officials, and ignored by western economists and writers. It is therefore no wonder that examination of the fisheries of any part of southwestern

Asia or Insulinde shows unsatisfactory conditions in the quantity, quality, and market price of fish during much of the year. Prolonged field studies of the factors involved, especially in the Philippines, show that these conditions are unnecessary.

Though unfortunately separated politically, the Philippines are an integral part of the East Indies, the greatest center of fish life. More than 2100 kinds of fishes are thus far known from Philippine waters, with additions being discovered every time intensive field work is done. Most of these are edible, and several hundred kinds occur in

the markets, some of them in large quantities in season. It would seem that the fishing industry would be a well developed business, properly organized and able to supply the markets with an abundance of excellent fish at moderate prices throughout the year. It is true that at certain seasons and in some localities fish are often taken in such quantities as to glut the market. At such times they are usually ruinously cheap, but much of the time good fish are scarce and expensive. That is particularly true now during these post-war years, when first-class fish are fabulously expensive and priced far beyond the means of the vast bulk of the people.

This is partly due to conditions inherent to a tropical monsoon climate, and in part due to other factors which cannot be detailed here. Some of the important factors are the following:—

(1) Native fishing methods. Some of these methods are excellent and cannot be improved upon, but in general the ancient native methods are only for fishing along shore in shallow water. The great increase in population has thrown a burden on the shore-fisheries that in many places they cannot sustain without marked depletion. This is well illustrated in Manila Bay, where the sizes and quantities of certain fishes taken are in marked and unfavorable contrast to what were taken a generation ago.

(2) Fishing boats. Most of the native fishing boats, even the largest, are only dugout canoes, no matter how modified. They have neither deck nor cargo-space, are helpless in rough weather, and cannot be used for deep-sea fishing, the chief dependence of modern fisheries. This condition is being slowly remedied. Under the leadership of Mr. P. R. Manacop, vessels using otter trawls have been in use by Filipino fishermen for more than two years. Most fishermen have no money for keel-built ocean-going fishing boats, diesel engines, and modern fishing gear. It would be possible for them to acquire fishing gear and modern boats through cooperative association, but under Philippine conditions such organizations must be started by the Government. Deep-sea fishing, as an integral part of the Philippine fisheries, may have to be subsidized or assisted in some manner until it becomes an established industry.

(3) The ignorance and poverty of the fishermen. Only the slow process of education can remove their ignorance. Let us note what may be done in this respect. By 1938 Japan was first in fisheries, with an output reaching 778,000,000 yen in annual value. By 1940 Japanese fisheries were much more valuable. Yet within my own lifetime Japan's fisheries were at first hardly more advanced than those of the Philippines and had been little changed for centuries. The astonishing improvement was due to several factors, but the most important one was the system of education introduced. This included village fishery-schools, a fishery high school in every prefecture, and the Imperial Fisheries Institute, an integral part of the Imperial Tokyo University, as well as other institutes of lesser importance. Space will not permit an elaboration of the functions of each of these types of school.

Here it is in order to note that a school of fisheries has been started by the Director of Fisheries, Dr. D. V. Villadolid, Mr. A. F. Umali, and others of the Philippine Bureau of Fisheries. It is not the function of such a school to enter upon a research program, but to train leaders who can go out to work in the fishing barrios. Here their work can be three-fold; (a) to demonstrate improved techniques to the fishermen, (b) to educate the sons of fishermen in modern ways and improve upon the methods of their fathers without discarding those of proved value, (c) to help educate the people in developing and properly conserving their fishery resources.

(4) The diffuse character of the industry. There are thousands of farmer-fishermen scattered along the vast reaches of the Philippine coasts, who naturally lack unity

or organization. It is thus practically impossible for the industry as a whole to raise funds for the founding of experiment stations, set standards for its products, or improve conditions in general.

In the winter of 1919-20, fishermen from the Riu Kiu Islands introduced the *muro ami* or caesio-net method and soon supplied large quantities of cheap and wholesome food fishes not taken by native fishermen supplying the Manila market. Their motor launches went to sea at all times except during an actual typhoon, bringing fish from the remotest reefs to Manila. Twelve years ago they began beam trawling, further augmenting the supply of low-cost food fish. These Japanese fishermen filled a public need, while the native fishermen were urged in vain to follow their example. Poverty, ignorance, and the inability to form cooperatives were obstacles too great to overcome at that time.

When the last war was over, fish of all kinds commanded fantastic prices. Lured by the prospects suggested, various Filipinos and Americans, either individually or as companies, went into the fishing business. Few of them were hampered by either knowledge or experience. Naturally, a number of them have failed. However, some of them have done well, and one Filipino company began the use of the otter trawl more than two years ago, as already stated. It is common knowledge that Filipinos have planned to adapt other boats to otter trawl fishing, and we may confidently expect an expansion of the use of other types of gear such as improved purse seines, the Danish seine, and the more extended use of refrigeration.

The Philippine Bureau of Fisheries in 1941 was an ably administered organization with well qualified men in the key positions, and had a well planned program for gradually modernizing Philippine fisheries. The Bureau of Fisheries is again functioning and should be given ample support by the Government. The development of a better quality and a greater supply of protein food for the people, is not a pursuit in which to economize.

Few realize the extent of Philippine aquatic resources and only prolonged personal observation in all parts of the Islands can give an idea of the quantity and kinds of fish that live in and about Philippine waters.

The following is for theorists who "prove" that tropical waters contain few fish. Going eastward in Surigao Strait, a ship I once was on moved for two and a half hours through porpoise traveling westward. This school was more than twenty miles long and from one to two miles wide, and contained an incredible number of these large, voracious, fish-eating mammals, hundreds of whom were leaping high in the air at any given moment. Visualize the productivity of waters that support so many million porpoise! The number of edible fish eaten by them daily would soon run into astronomical figures. Tunas and bonitos are large migratory fishes of the open sea, with eight species in the Philippines. I have seen schools of the oceanic bonito, *Katsuwonis pelamis*, the yellowfin tuna, *Neothunnus macropterus*, and the yaito tuna, *Euthunnus yaito*, any one of which would have fed several hundred thousand people. In fact, part of a school that entered a fish corral at Cabadbaran, Agusan Province, Mindanao, would have given 250,000 people over a pound apiece of clear meat; these were medium-sized yellowfin tuna running about 80 pounds each. These migratory fish are caught only when they come inshore, and are eaten fresh or dried. With the advent of deep-sea fishing the great schools of tuna, bonito, mackerel, Spanish mackerel, scads, and other migratory Carangidae, and swordfish and their allies, could be caught in huge quantities in the Kuro Siwo and the open Pacific further eastward and northward. For more than twenty years mother ships of about 3000 tons capacity poached north-east and north of Luzon, especially among the Babuyan islands.

At present the most important Philippine method of catching fishes of the tulinagan or tuna group, is by the use of deep-water *baklad* or fish corrals. In Balayan Bay, Batangas Province, baklad are set in water up to a depth of 205 feet. The shores of Balayan and Batangas Bays, Luzon, Antique Province, Panay, Butuan Bay, Agusan Province, and Zamboanga Province, Mindanao, and the islands of Sulu Province, are lined with fish corrals that catch many fish. This catch could be increased in some localities if the fishermen had a satisfactory method of disposing of their catch. When a baklad in Siohan Bay, Zamboanga Province, takes 20,000 tuna at one time, it shows that the Sulu Sea does have fish in it and that they can be taken. Another mode of taking tuna is by long line fishing. This method is followed particularly about the Lubang Islands and the Gulf of Davao.

The most important Island fishes are sardines (18 species) and their allies. Several kinds are resident, but migratory species enter the Islands with the southwest monsoon and occur in large schools, sometimes miles in extent. Sardines are mostly dried, or salted and smoked; none are canned, though several million pesos worth of canned sardines are imported annually. Philippine sardines make a superior canned product. The most important fish is bangos, *Chanos chanos*. The fry of this large vegetarian pelagic fish are caught in enormous quantities on shallow, sandy shores, and are reared in salt-water ponds, especially about Manila Bay. They are harvested after six to nine months; their annual value runs to about P30,000,000. Ten years ago the assessed valuation of the ponds was more than P60,000,000.

Groupers, snappers, grunts, lethrins, therapons, porgies and their allies, are all valuable reef fishes of good to superb quality, and are mostly eaten fresh. There is need for further exploration of our waters in the hope of finding new fishing banks. The caesios and surgeon fishes are of very diverse families, but both occur in large schools on the reefs. Only Riu Kiu islanders have taken them in quantity, but Filipino fishermen must learn to take them by the *muro ami* method. I have known a crew to take 2000 kilos of fish at a haul. This is a profitable fishery, furnishing cheap and excellent food, but requires sea-going launches, icing or some kind of refrigeration, and a change in methods.

Mullet, hairtails, pampano or talakitok, siganids, catfishes, flying-fish, and many others are important. Shrimp are much sought for and are one of the best-paying products taken by the trawlers.

There is a demand for fish-oils and the vitamins produced from their livers. Publicity has been given the vitamins from shark livers, but no one in the Philippines is investigating the livers of large groupers, snappers, lethrins or kutambak, parrotfish, maming, and other good-sized fishes common in the markets of Zamboanga,

Jolo, Davao, and other southern ports. For several years livers of these fishes were collected by Capt. A. D. Lee and shipped to the Parke Davis Company of Detroit, Michigan. Since the close of the war, nothing further has been done along this line. Recently the *M. V. Gill*, working around Basilan and the Zamboanga peninsula, had good catches of sharks, mostly tiger sharks. One weighed 1080 pounds, the liver alone weighing 212 pounds. Another shark nearly as large also had a liver of the same weight. All the livers were rich in oil but low in vitamin A.

The production of plenty of first-class dried fish, ranks next in importance to an ample supply of fresh fish. These two are much more important in the economy of the Philippines and the daily life of the Filipino people than any canning industry. Every energy should be bent toward increasing the quantity and quality of both fresh fish and dried fish.

Dried fish of good to excellent quality is produced in the Islands, but much of the product is poor to even half-spoiled. To get good dried fish it is necessary to devote chemical and technical skill to the basic problem,—the production of first-class salt at a price the industry can afford. This is probably the greatest need of the fishing industry at present. Better boats and better methods should follow, with the establishment of canneries later on.

There are valuable freshwater fisheries, but their depletion has been rapid in recent years, so that some no longer yield abundantly. The introduction of Chinese carp has greatly increased the food supply in certain rivers and lakes, and a judicious selection from some of the rapidly growing river carps of China, which cannot breed in ponds, would greatly increase it in the large rivers of Luzon and Mindanao. The greatest benefit to interior regions was my introduction of gurami in 1927. By 1938 their pond culture had spread to three-fourths of all the provinces, and was a rapidly expanding, profitable industry. Some gurami should be grown in every inland region up to 3000 feet, as this would provide excellent, cheap food regardless of typhoons.

In 1939 Dr. Eduardo Quisumbing, noted Philippine botanist, introduced a small gurami, the "sipat Siam", from Bangkok, Siam. Owing to its rapid growth and the speed with which it reaches maturity, it increased with remarkable rapidity in the provinces of central Luzon about Manila. Not only private ponds, but Laguna de Bay and numerous rivers soon abounded with it. During the war it was the chief fish available to the Filipinos of central Luzon.

It is vitally necessary to develop Philippine fisheries further, (1) to obtain a plentiful supply of fundamental food, (2) to reduce the importation of food, (3) to add to Philippine financial strength by producing valuable export products.

“... Taxes upon the necessities of life have nearly the same effect upon the circumstances of the people as a poor soil and a bad climate. Provisions are thereby rendered dearer in the same manner as if it required extraordinary labor and expense to raise them. As in the natural scarcity arising from soil and climate, it would be absurd to direct the people in what manner they ought to employ their capital and industry, so it is likewise in the artificial scarcity arising from such taxes.”

—ADAM SMITH