Important in the diet are animals from trochus and cat-eye shells. These are mostly caught by women and children while wading on the reefs at low tide during the day. Spiny lobsters are also used in large quantity, but are caught by men and boys at night by torching. They use a three-pronged spear without barbs on the points. The torch was not observed elsewhere. It consists of a section of bamboo approximately four feet long and two to three inches in diameter. One end is open and the internodal space is stuffed with rags soaked in kerosene. The kerosene capacity is sufficient to burn for two to three hours.

A specialized type of net was developed in the Marianas for gill netting at night. In order to prevent phosphorescence in the water from showing the position of the net and frightening away the fish, the netting and floats were dipped in pig's blood. Instead of ordinary leads to hold the net down, the tops were cut off of one of the cypraea shells (C. caputserpentis), which were then tied to the lead line at intervals of 15 to 18 inches. The net was a mile in length, six feet deep, with a one inch square mesh. The floats were of pago wood and were eight to ten inches by two inches in diameter.

D. GUAM ISLAND (Population 22,783 - 1946)
(June 19-27)

The fisheries of Guam are under the jurisdiction of the agricultural division of Military Government. In order to encourage production of sea foods several steps were undertaken. One was to remove ceiling prices from seafoods. A second was to designate certain men in each village as fishermen thus relieving them of other employment. A third was to give exclusive trap fishing rights along certain areas of the coast to single individuals. Finally, several vessels belonging to Military Government were offered on a rental basis to fishermen with the hope of stimulating production of off-shore species, such as bonito. These measures have been largely unsuccessful. Removing ceiling prices can be effective only in cases where production is sufficient to increase income appreciably. The general shortage of manpower on Guam has made it more profitable for wage earners to work for the armed services rather than to go fishing. Consequently very few of the men designated as village fishermen are actually so employed. Examination of the traps in the vicinity of Merizo show a catch of only a few pounds per day, entirely insufficient to warrant this type of fishing as a primary source of income. The rental of fishing vessels has not resulted in the development of off-shore fishing for a number of reasons. In the first place, there is no back log of experienced fishermen to undertake this type of work. In the second place, shore facilities are not available in the event of a large catch. In particular, it is necessary to have ample refrigeration space to handle the catch. It is also necessary to have transportation facilities in order to distribute the catch to consumers. Very few fishermen can afford to pay a thousand dollars for a surplus weapons carrier or similar type of vehicle.

The limited reef and inshore areas are not sufficiently large to warrant any expectation of an increased catch from this area. In the case of an off-shore fishery for tuna and bonito it seems probable that it would be necessary to bring in experienced fishing crews from other islands, such as Saipan, and to subsidize them heavily over a period of possibly six months by furnishing vessels, equipment and refrigeration space at no cost in order to develop the fishery. Unfortunately, one of the limiting factors in the establishment of an off-shore fishery for tuna and bonito is the availability of live bait. Our limited observations can throw no conclusive light on the abundance of bait fish around Guam and if a successful off-shore fishery is to be established, a thorough investigation must be made of this supply. However, our impression is that there is not an ample supply of bait fish around Guam which would warrant the encouragement of a large off-shore fishery.

The most common type of fishing gear is the throw net. The usual size is seven feet in length and there are two common sizes of mesh, one of 1/2 inch bar or one inch stretch mesh and the other about half that size, approximately 1/4 inch bar of 1/2 inch stretched

mesh. Both are made of cotton twine. Diving and spearing of fish are negligible. There are quite a number of small seines which are used in multiples of 30 feet by tying sections together. These seines are straight, about three feet deep and of one inch stretched mesh of cotton twine. There are only a few scattered places where seines can be used because of the rough bottom. Spiny lobsters are fairly abundant and a good many are taken at night by torching. Octopi are also very common up to three feet in total spread. Both the spiny lobster and the octopus are regarded very highly as food by the Guamanians and they also eat the small black tipped sand shark (Eulamia melanopterus).

Although there are a few small outrigger canoes 12 to 14 feet in length, these are very roughly constructed and have relatively little carrying capacity. The Guamanians prefer United States manufactured small boats, both power and sail.

The most promising locality for increasing production is at Umatac. There are a number of good fishermen here who are experienced in going off-shore and who have in the past operated gill nets for mackerel with good success. It is reported that their catch amounted to 40 to 50 thousand pounds of mackerel a week during the season. Here again increased production would be dependent on establishing refrigeration and transportation facilities.

Because of its partial isolation there are more fish around Cocos Island than around the shore of Guam itself. On the lee side of the island there were schools of large mullet 14 to 16 inches long, large crevalle of 10 to 15 pounds and blue wrasse (Cheilinus sp.) (Fig. 36) up to 30 pounds were observed on the seaward side. Goat-fish up to ten inches in length also were common. For further recommendations concerning fisheries on Guam, see Part III Summary and Recommendations (IV D).

Fig. 36... Guam. Blue wrasse (Cheilinus undulatus), taken with surround net. June 1946.

## PART II DESCRIPTION OF THE FISHERIES

### INTRODUCTION

Although the number of economic species of fish, reptiles, and marine invertebrates is certainly in excess of 2,000, the day to day subsistence of the Native people is dependent on a comparatively few groups. Of the reef and inshore fish it will be found that throughout the mandated area the most important are the angel fish, the barracuda, the crevalle, the wrasse, the goat-fish, the parrot fish, the squirrel fish, and the surgeon fish. Among invertebrates, the more important ones are a type of cockle called anadara, conch, crab, octopi, the rock oyster, spiny lobster, giant clam, trochus, and turbo or cat-eye. Although a number of species of sea cucumbers are abundantly distributed over the entire area, they were not found to be an important item in the native diet.

On the various kinds of fish found in the open ocean outside the barrier reefs, the tuna, mackerel, and sword fish are of general importance. A few of these offshore fish are taken by the natives, usually by trolling just outside the breakers on the barrier reef. The natives fish depths of as much as 20 fathoms, where they sometimes take swordfish weighing over 200 pounds, and yellow fin tuna weighing up to 80 pounds.

Occasionally a dugong or sea cow was taken, particularly in the Palaus, but the total number evidently never amounted to more than a few a year.

The failure of the natives to develop more of an offshore fishery was not due to their inability to catch the tuna and other species, but simply resulted from the fact that they had no need to. From a practical standpoint it was easier for them to obtain their fish from the constant fish population on the reefs and in the lagoons. Their offshore fishing was more in the nature of what we would call "sport fishing". The taking of an extra large tuna or swordfish is described by the natives with as much enthusiasm as though it were to be entered into the records of the International Game Fish Association.

Since fishing between the shore and the reef provided most of the food for the table, there was a customary division of labor between the sexes. Usually women and girls fished the reefs and flats close inshore, which are either exposed at low tide or nearly so. The men did the spear fishing, diving, and hand-lining, either around the reefs or in favorable spots in the lagoons. Boys begin going fishing with their fathers when about six years of age, and by the time they are ten they frequently go fishing with groups of others of their own age. Fishing with beach seine or from canoes is usually entirely in the hands of men. The women either collect their fish by hand or, in some cases, use a small hand net to collect small fish around rocks in the shallow waters of the flats. Most of the diving done by the men is in less than four fathoms.

The above statements should not be construed to mean that the fishery resources of the former Japanese Mandate are only sufficient for native subsistence. Succeeding sections will show that the Japanese actually took 75 million pounds of bonito from the area in one year, using shore based fleets of small fishing vessels under 50 tons. In addition, several factory ships produced an unknown, but certainly sizeable quantity which did not appear in the Mandate statistics. There is no doubt that offshore supplies of bonito and tuna are ample to support a fishery approaching 200 million pounds annually.

The present state of our knowledge of the tunas does not answer the question of whether or not the tunas of the mandated area are seasonally a part of the population which supports the Japanese home fishery, and if so to what extent. If this should be the case, it is possible that a catch of 200 million pounds in the former Mandate would cause some reduction in catch off Japan proper.

# I. BONITO INDUSTRY

## A. STATISTICE OF THE BONITO FISHERY

Maximum production of bonito was reached 1937 (Table I) with a catch of 74,983,780 pounds valued at $958,476 (¥4.00 to $1.00), or 1.3 cents per pound average to the fishermen. The price of fresh bonito varied from place to place (Table 2), and fluctuated according to local abundance, but basically it was a percentage of the market price for bonito sticks in Japan. The 1937 price of fresh bonito was 9 percent of the market price of bonito sticks in Tokyo. The local price in the Palaus, for example, was established monthly, calculated at 9 percent of the price which Palauan bonito sticks sold for in Tokyo the preceding month.

In 1938 the catch dropped to 32,703,981 pounds, and to 25,411,466 pounds in 1941. This the last year for which statistics are available from the South Seas Government records, but it is known that the catch declined abruptly in subsequent years.

The extra heavy catch in 1937 seems to have resulted from the operations of an unusually large number of fishing vessels, some of which were withdrawn the following year. Table 4 lists the number of fishing vessels at bases in the mandated area in 1937. Figures for the following years are not available, but the number is known to be less.

Japanese recommendations are that the number of vessels in the bonito fishery should be 25 at Koror in the Palaus; 20 at Truk; and 10 at Ponape. In addition, 40 vessels of 50 to 60 tons could be used for tuna, 20 each at Koror and Truk.

Table 5, from South Seas Government figures for 1941, shows the production from the more important marine fisheries at centers in the Mandated Islands. In the case of white pearl shells (Gold-lip pearl oyster), it is believed that most of the catch was taken in the Arafura Sea. In using this table, note that bonito and tuna sticks are processed from the fresh fish, consequently the vertical column totals for weight are incorrect. Also, the figures for shark fin production in the Palaus are confusing. It is obvious that 42,858 kg of sharks would not yield anything like 22,028 kg of fins. Quite probably fins were removed from captured sharks, and the carcasses discarded. This, however, is mere speculation. In any event, the figures are the only ones available for the last pre-war year, and are sufficiently valuable to be included in this report.

No figures could be found on the extent of the canning industry. The only information is that the Palau cannery at Koror, with a capacity of 500 cases a day, was completed in 1939, and operated at capacity for a short time in 1940. It packed tuna in oil, and was the only operating cannery on a commercial scale in the Mandated Islands.

TABLE 4

Number of Fishing Vessels in the Mandated Islands, 1937

| Port | Below 20 tons | Above 20 tons | Total | No. Crew |
|---|---|---|---|---|
| Saipan | 34 | 3 | 37 | 630 |
| Yap | 4 | — | 4 | 96 |
| Palau | 89 | 160 | 249 | 3154 |
| Truk | 47 | 3 | 50 | 817 |
| Ponape | 18 | 1 | 19 | 586 |
| Jaluit | 1 | - | 1 | 21 |
| TOTAL | 193 | 167 | 360 | 5304 |

TABLE 5

1941 Catch And Production — Mandated Islands (From South Seas Government)

Weight In Kilograms — Value In Yen
2.2 pounds 4 yen to a dollar

| | | SAIPAN | YAP | PALAUS | TRUK | PONAPE | JALUIT | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Bonito Fresh | KG | 1,297,354 | | 3,308,160 | 4,346,259 | 2,424,260 | 169,020 | 11,545,053 |
| | ¥ | 358,996 | | 827,040 | 1,118,166 | 509,094 | 105,638 | 2,918,934 |
| Bonito Sticks | KG | 182,152 | | 370,290 | 724,800 | 332,266 | 24,332 | 1,333,840 |
| | ¥ | 491,227 | | 907,210 | 2,011,718 | 774,384 | 65,895 | 4,250,434 |
| Tuna Fresh | KG | 33,669 | | 906,150 | 24,150 | 12,768 | 46,356 | 1,023,093 |
| | ¥ | 19,913 | | 253,722 | 5,847 | 9,150 | 27,073 | 315,705 |
| Tuna Sticks | KG | | | 54,533 | 3,956 | 2,730 | 5,500 | 66,719 |
| | ¥ | | | 97,069 | 11,373 | 6,552 | 14,888 | 129,882 |
| Horse Mackerel | KG | 4,014 | 1,896 | 1,613 | 7,559 | 14,830 | | 29,932 |
| | ¥ | 2,302 | 1,251 | 1,290 | 4,031 | 7,425 | | 16,299 |
| King Mackerel | KG | 5,767 | | 14,092 | | | | |
| | ¥ | 3,356 | | 11,555 | | | | |
| Mullet | KG | 75 | | | | 6,075 | | 6,150 |
| | ¥ | 40 | | | | 3,037 | | 3,077 |
| Sharks | KG | 10,705 | | 42,858 | | 2,665 | | 56,228 |
| | ¥ | 3,012 | | 214 | | 527 | | 3,753 |

TABLE 1

Bonito Catch — Japanese Mandated Islands 1934-1941
Catch in Millions of Pounds, 000 omitted [1]

| PLACE | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 |
|---|---|---|---|---|---|---|---|---|
| SAIPAN | 5,535 | 3,929 | 3,721 | 8,134 | 5,702 | 4,591 | Data | 2,854 |
| YAP | 9 | ....[2] | .... | .... | 123 | 79 | not | 12 |
| PALAU | 8,313 | 11,860 | 8,439 | 30,304 | 11,924 | 12,207 | available | 7,277 |
| TRUK | 2,639 | 6,605 | 12,914 | 27,353 | 11,648 | 16,807 | ____ | 9,561 |
| PONAPE | 2,645 | 2,888 | 5,930 | 8,940 | 3,290 | 8,157 | ____ | 5,333 |
| JALUIT | 561 | 505 | 369 | 200 | 14,770 | .... | ____ | 372 |
| TOTALS | 19,702 | 25,787 | 31,373 | 74,931 | 32,701 | 41,841 | ____ | 25,409 |

[1] Original data given in kilograms. Conversion to pounds x 2.2.

[2] No commercial production at Yap, 1935-1939, incl.

TABLE 2

Prices of Fresh Bonito — Dockside
Cents Per Pound

| | 1934 | 1937 | 1941 |
|---|---|---|---|
| Saipan | 02.5 | 01.25 | 03.25 |
| Yap | 03.5 | N.A. [1] | N.A. [1] |
| Palau | 03 | 01.25 | 02.5 |
| Truk | 03.75 | 0.75 | 02.5 |
| Ponape | 02.5 | 01.25 | 02.5 |
| Jaluit | 02.5 | 01.25 | 07.5 |

[1] N.A. — Not Available

TABLE 3

Weight Relation of Bonito Sticks To Fresh Bonito

| | Fresh Bonito | Bonito Sticks | % |
|---|---|---|---|
| 1936 | 14,265,772 | 2,422,856 | 17. |
| 1937 | 34,060,809 | 5,812,745 | 17. |
| 1938 | 14,958,592 | 2,501,222 | 17. |
| 1941 | 11,545,053 | 1,333,840 | 11.6 [1] |

[1] Authors note: This low figure may be due in part to increased use of fresh bonito to feed augmented garrisons of Japanese troops.

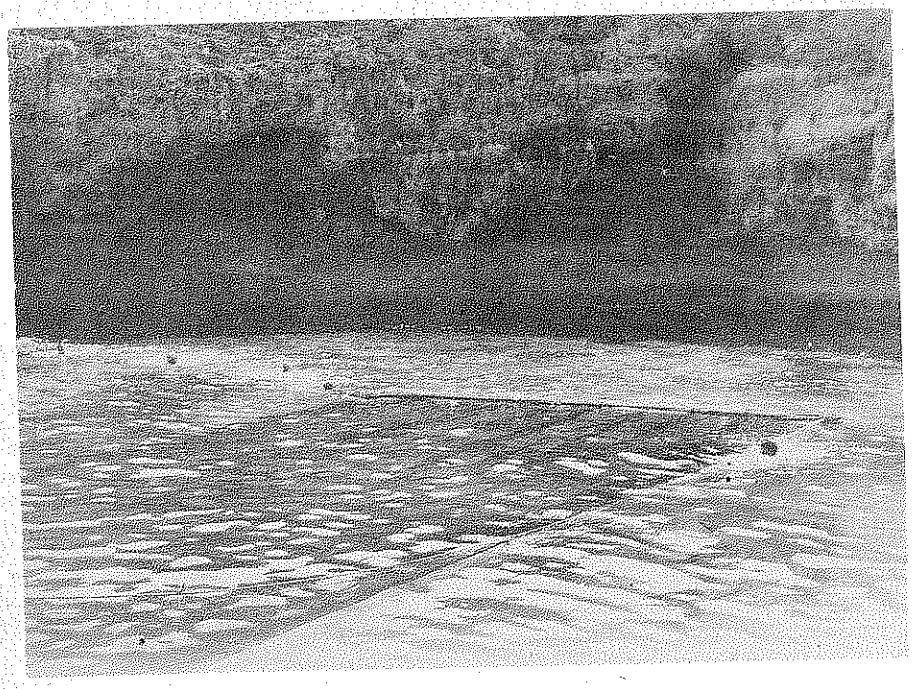

Figure 38... Saipan. Bonito Fishing No. 1.
Laying out live-bait net. June 1946.

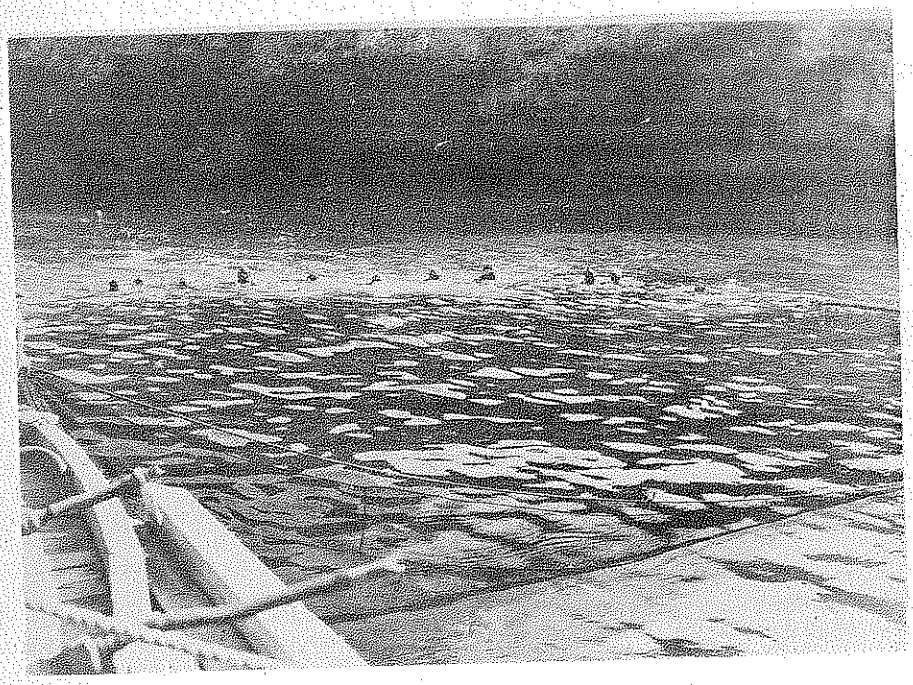

Figure 39... Saipan. Bonito Fishing No. 2.
Driving live-bait into net. June 1946.

TABLE 5 (Continued)

1941 Catch And Production -- Mandated Islands (From South Seas Government)

Weight In Kilograms — Value In Yen
2.2 pounds 4 yen to a dollar

| | | SAIPAN | YAP | PALAUS | TRUK | PONAPE | JALUIT | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Shark | KG | 150 | | 22,028 | | | | 22,178 |
| Fins | ¥ | 500 | | 44,056 | | | | 44,556 |
| Other | KG | 288,688 | 46,742 | 334,877 | 56,419 | 134,973 | 26,724 | 828,405 |
| Fish | ¥ | 105,033 | 24,779 | 174,137 | 22,765 | 67,486 | 13,362 | 407,556 |
| Trochus | KG | | 21,080 | | [1] 48,835 | | | 69,875 |
| Shells | ¥ | | 2,524 | | 6,479 | | | 9,003 |
| White | KG | | | 212,688 | [2] | | | 212,688 |
| Pearl Shell | ¥ | | | 183,430 | | | | 183,430 |
| Black | KG | | | 559 | | | | 559 |
| Pearl Shell | ¥ | | | 50 | | | | 50 |
| Sea Cucumbers | KG | 2,117 | 3,136 | 9,556 | 14,486 | 9,172 | | 38,477 |
| (Trepang) | ¥ | 4,437 | 4,892 | 12,723 | 22,227 | 15,317 | | 59,596 |
| Coral | KG | | | 18,236 | | | | 18,236 |
| | ¥ | | | 261,305 | | | | 261,305 |
| Other | KG | 53,555 | | 206,875 | 135,131 | 12,075 | | 407,576 |
| Shells | ¥ | 12,179 | | 35,758 | 30,269 | 2,415 | | 80,621 |
| TOTALS | KG | 1,878,236 | 72,854 | 5,502,515 | 5,361,595 | 2,951,814 | 271,932 | |
| | ¥ | 1,000,995 | 33,446 | 2,809,559 | 3,232,875 | 1,395,387 | 226,856 | 8,699,118 |

[1] No open season for trochus in Palaus, 1941 (So stated in Japanese report)
[2] Pearling fleet based at Koror, but shells taken elsewhere (Author's note)

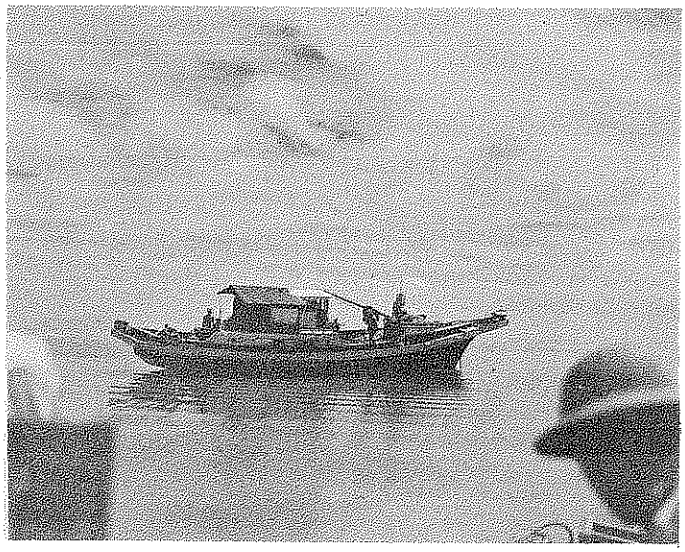

Figure 37. Truk. Japanese Fishing Sampan.

## B. THE JAPANESE BONITO FISHERY

The length of time required to establish a new fishery is well illustrated by Japanese experience in attempting to exploit the bonito in the former Mandated Islands. Although they were in control from 1914 on, it was not until the middle twenties that sufficient information had been gathered to indicate the possibilities of a large fishery. Their first attempts were made in the vicinity of Saipan, but because of the shortage of live bait the results were not encouraging. Further search showed that a much greater supply existed in the Palaus and special attention was given to this area.

In the late 1920's bait fish were also found at Truk and development here was started. Realizing that some form of subsidy would be required to get commercial production started, the Japanese Ministry of Agriculture and Commerce offered special inducements to Okinawan fishermen who would migrate to the new centers. These inducements were in the nature of cash awards for the construction and outfitting of fishing vessels and for shore installations. As production increased and the fishery got on a more stable basis, a number of fishermen organized cooperative fishery companies, while others operated their own vessels independently. By the early 1930's operations had been extended from the original localities around Palau and Truk to Ponape and, to a lesser extent, to Yap and Kusaie. Because of the long distances involved (approximately two thousand miles from Tokyo to the Palaus), the catch was processed for export in the form of dried bonito sticks. It is interesting to note that producers of this item in the Japanese homeland were not pleased to have competition from a new direction and at first adopted customary methods of attempting to freeze out competitive products.

The method of fishing now in use at Saipan is described below. It is similar in all respects to the methods developed and used by the Okinawans. The latter sometimes obtained their live bait in a different manner. Apparently the Okinawans were extremely hardy fishermen, for, as soon as their catch was unloaded, they immediately refueled and left to catch live bait during the night. Schools of bait fish were attracted by lights and when a large school had been assembled it was led, by moving the light, to the bait net. At daylight the necessary quantity of live bait was put into the ship's tanks, the balance remaining in the bait net until needed. The vessel then started hunting for bonito and fishing began as soon as a school of fish could be brought alongside. Ordinarily the Okinawans did not stay out overnight, even if no fish were caught.

## C. NATIVE BONITO FISHERY ON SAIPAN (June, 1946)

In addition to two sampans, (Fig. 37) the facilities on Saipan consist of a dock capable of handling three or four sampans and a shed where weighing, washing, and gutting can be carried on. These sampans were owned by, and the operations are carried out under, Military Government. The fishermen were paid only the regular daily wage established by Military Government and the fish were distributed free to the native population. In view of the high degree of skill shown by the native fishermen, it is believed that the fishery could be placed entirely in their hands to be operated on a cooperative basis and the fish sold. It is recommended that the vessels and their equipment either be given to the natives, or appraised at only a nominal value of around $500.00 each.

It must be remembered that these Japanese sampans were sunk at Saipan and were subsequently re-floated and repaired. It should not be expected that the natives would bear the cost of salvage and repair. Since the dock and shore facilities are essential to the fishing operations, and are in a large measure of public benefit, they could be leased to the fishing cooperative at some rental such as $1.00 a year, but in any case a definite guarantee should be given of occupancy for a period of at least five years. Such an arrangement would not only assure to the fishermen a more adequate compensation for their labors, but would also greatly increase, possibly double, the production of the fishery.

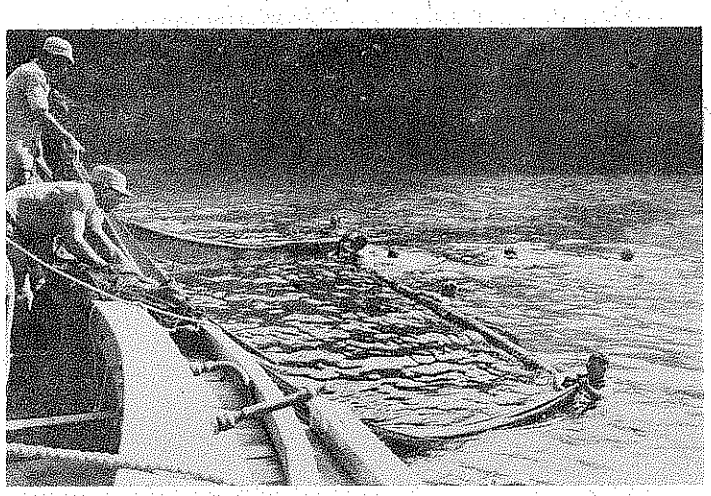

Figure 40... Saipan. Bonito Fishing No. 3.
Drying-up live-bait net.
June 1946.

Figure 41... Saipan. Bonito Fishing No. 4.
Bailing live-bait from net to tanks.
June 1946.

Figure 42... Saipan. Bonito Fishing No. 5.
Detail of live-bait and tanks.
June 1946.

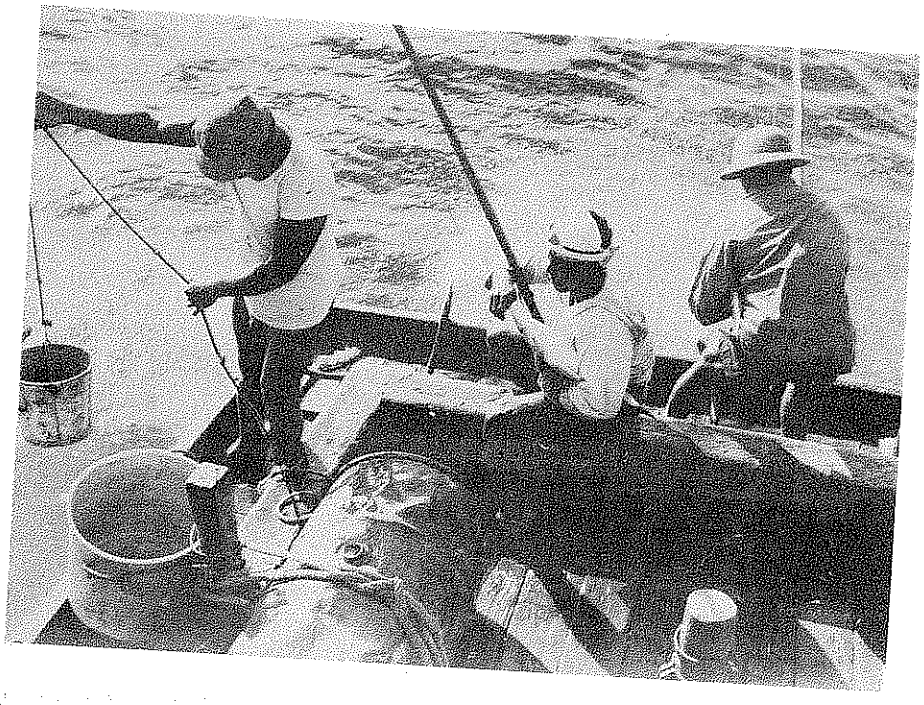

Figure 43... Saipan. Bonito Fishing No. 6. Salt water sprayer. June 1946.

Figure 44... Saipan. Bonito Fishing No. 7. Method of fishing. June 1946.

At the time of our survey, refrigeration was not required in the dock area. All except a small portion of the catch was merely weighed, washed, and distributed to the native population in the round. This is a satisfactory arrangement as long as the demand exceeds the supply, since all of the fish immediately go into the consumers' hands and are eaten within twenty-four hours. However, refrigeration facilities should be made readily available to handle any excess of production over immediate consumption.

All of our information leads to the conclusion that the fishery could be considerably increased and that both the supply of bonito and bait fish will stand a considerably larger production. It should be possible, using the present experienced crews as teachers, to interest a larger number of the natives in becoming expert fishermen, with the hope that eventually possibly as many as ten fishing sampans could operate from the docks at Saipan. Since the increased production would not be required to feed the local population, it would be the aim of this expansion to prepare dried bonito for export to Japan or China. Since the method of processing is important in preparing a type of product desired by the Japanese and Chinese, it would be the best policy to bring in from Japan one or more persons experienced in the preparation of dried bonito to teach the natives the Japanese process. The need for technical assistance would probably not extend over a longer period than six months.

The importance of the bonito fishery, not only at Saipan but at other places throughout the former mandated area, warrants a full description of the method of fishing, since it will become a pattern for future operations. The sequence of operations is taken from an actual day of fishing.

Departure from the dock was at 4:00 a.m. and by 5:45 the vessel was standing close inshore along the cliffs of Tinian to search for live bait. As soon as it was light enough to see, the vessel moved slowly along the cliffs and a diver was sent over about every 100 feet until one of them located a school of the small anchovies (Anchoviella purpureus), used for bait. The sampan then took up a position about 100 yards from the school of bait fish and was quickly anchored by bow and stern parallel to shore and less than 100 feet from the cliff. Then two or three lines with a hook at the end were carried ashore by swimmers and fastened to the rocks at water level to hold the ship from drifting away from shore. They were now ready to set the bait net, which is approximately 30 by 60 feet and made of very heavy bobbinet. This net is stretched between the ship and cliffs with one short edge inshore and the other on the ship (Fig. 38). The short edge which is carried ashore is held at the surface by a large bundle of bamboo, which acts as a float. The leading edge of the net which is toward the school of fish is then weighted down at or near the bottom. The trailing edge away from the fish is held at the surface. Ten or twelve fishermen then go over the side and form a semi-circle around the school of fish and by swimming slowly, drive the school into the net (Fig. 39). As soon as the school is within the leading edge of the net, this edge is brought up to the surface, forming a trap. Some of the net is then drawn aboard the ship and some is wrapped around the bamboo float on the shore end until the school of fish is in a small pocket alongside the ship (Fig. 40). From this pocket they are bailed into the two large bait tanks located amidships (Fig. 41). The bait tanks are formed by two watertight bulkheads, which make a watertight compartment in the center of the ship. This compartment is further subdivided to form two tanks (Fig. 42). In this section two-inch holes are bored through the bottom of the hull in the way of the tanks to provide salt water circulation. This circulation is dependent on the motion of the vessel and is only sufficient to keep the bait alive during several hours. It is not enough to keep the bait alive over-night.

On the trip in question, approximately an hour was required to catch a small school of bait fish. The ship then moved offshore and the captain began looking for flocks of sea gulls feeding at the surface, which are used as indicators of schools of bonito below. When a school was located, the captain brought the ship across the head of the school and approximately 100 yards away. The engines were then stopped and small quantities of live

bait were thrown over. As the vessel drifted slowly, the bonito followed the live bait to the stern of the ship. As soon as a school has been brought to the ship there is a definite division of labor among the fishermen and each man has a task to perform. In this case 17 men did the actual fishing. There were four men across the stern and 13 men along the port rail from bow to stern. No fishing was done from the starboard side. One man on the starboard quarter threw live bait over the stern to keep the fish coming to the four men who were fishing there. Amidships on the port side one man threw live bait both fore and aft to keep the fish coming to the fishermen on that side. Two men got bait out of the tanks while two others kept the bait throwers supplied with fresh live bait. Throughout the fishing, salt water is sprayed over the side from nozzles located about every four feet (Fig. 43). In this case there were eleven nozzles operating on the port side and three on the stern. The purpose of this spraying is twofold: first, it tends to prevent the fish from being frightened by sight of the fishermen; and second, the action of the spray on the water is somewhat similar to a school of small bait trying to escape. Each fisherman has a heavy bamboo pole about ten feet in length to which is attached a line of the same length. At the end of the line is a barbless hook, which may be one of two types. In one case it has a few white feathers attached to it, similar to a feather jig, and in the other case it is plain and a live minnow is put on the hook by inserting the point through both lips. The feather jig is used when the fish first come alongside the ship and is worked back and forth near the surface. After a few minutes the fish seem to become aware of the fact that the feather jig is not alive and cease striking on it. This jig is then removed and the plain barbless hook is put on with live bait attached through both lips. Fishing continues until the school of bonito sounds or the live bait is exhausted.

The actual catching of the fish requires considerable skill and dexterity. As soon as a fish strikes, the fisherman leans back and down, heaving the fish quickly out of the water and toward the ship (Fig. 44). The amount of power put into lifting the fish is gauged carefully so that the fish will come aboardship at about the height of the fisherman's waist. He grabs the fish under his left arm, removes the hook (if it has not already come out of its own accord), and in practically one motion throws the fish behind him on deck and drops the hook again into the water. Some of the fishermen are so skillful that they can with one heave bring the fish up and on deck, disengage the hook without touching the fish, and be fishing again while the fish is flapping on the deck. Expert fishermen will catch from ten to twelve fish per minute. All of the fish caught were ocean bonito or skipjack (Katsuwonus (Euthynnus) pelamis), and 4,017 pounds were taken in an hour and five minutes. The average weight per fish was nine and a half pounds.

In addition to the bonito there are heavy runs of mackerel, particularly during the month of March. In March of 1946 large schools came inside the reef, and during one week a total of 68,000 pounds were taken. If facilities were available, it is reasonable to expect that several hundred thousand pounds could be taken annually.

It must be remembered that here, as elsewhere, the Japanese did not allow the Chamorros to go outside the reef and consequently they were unfamiliar with offshore fishing methods. Their progress in becoming expert fishermen since the American occupation has been most encouraging. With proper support there is every reason to expect that they can develop a very flourishing fishery for bonito (skipjack), tuna, and mackerel.

It is suggested that it might be worthwhile to undertake experiments with some type of purse seine or lampara net for the taking of bonito. It is realized that there are many difficulties involved, especially the rapidity with which the schools of fish travel, the transparency of the water, and the fact that there is no smooth bottom in shallow water. Quite possibly the operations would have to be carried on at night. Such a method would, however, make possible the establishment of fisheries in areas where bait fish are not abundant. Recognizing the limitations imposed by the supply of bait fish, the Japanese experimented with purse seines during the 1920's but were unsuccessful in developing a suitable method.

It might also be possible to extend fishing operations to new localities by developing the methods of obtaining sufficient supplies of other types of live bait than the anchovy, which is the mainstay of the industry in the Palaus and at Saipan, small goat-fish should be especially good for this purpose.

There are several recommendations in regard to bonito fishing. First, it is believed that the sampans could be operated efficiently with a crew of 14 to 16 men instead of the 26 to 28 now used, thus providing an extra crew for an additional boat. Second, if it is found necessary, the sampans should be allowed to remain out overnight when they have found no fish during the day.

This would permit them to replenish their bait supply before dark so that they could begin searching for fish at dawn the following day, it being well known that the best fishing time is early morning. This would serve the additional purpose of getting the catch back to the dock in a fresher condition, as they would be caught during the coolest part of the day. Consideration should also be given to the desirability of the sampans carrying at least half a ton of ice for the preservation of the catch which is made earlier in the day, especially since in many cases it is the middle of the afternoon before the boats return from fishing. A half ton of ice would be sufficient to preserve up to 1,000 pounds of fish for twenty-four hours if the hold is properly insulated.

D. DRIED BONITO STICKS--JAPANESE METHOD

The bonito sticks, as prepared originally in Japan and subsequently in some of the former mandated areas have many advantages. Chief among them is durability. When the process is finally completed, the sticks may be kept without refrigeration for months. Packaging is simple, as it is only necessary to wrap the individual sticks in paper and ship them in wooden boxes or barrels. The process is a simple one and requires only facilities for cooking, although, in order to take advantage of large runs of fish, some type of refrigeration is essential. It takes about two weeks to finish the various steps involved.

A number of women were employed in butchering, skinning, scraping, trimming, and packing. In some cases they were paid a flat monthly wage, of around ¥40 to ¥60, but ordinarily they were paid a basic wage, plus a bonus for piece work. In addition to their salaries, they obtained discarded parts of the fresh fish for their own use. Native women were employed as well as Japanese and Okinawans. Native men were not commonly employed.

From the fishing vessels the bonito are brought in to the butchering tables, where the head is cut off and the guts removed. Gutting is generally accomplished by cutting off the entire abdominal section of the fish. Two fillets are then cut from the backbone and these strips again cut lengthwise, making four pieces from each fish, unless they are quite small, in which case there may be only two pieces; or, if the fish is extra large, they may again be cut across. The strips are then placed in a single layer in steel trays, which are stacked in the boiling kettles. The temperature of the water is below boiling when the fish are put in. Usually it is between 170° and 190° F. It is then slowly raised to boiling point and cooking is continued for about an hour. Cooking is done at as low a temperature as possible to prevent the flesh from splitting. Fresh fish requires somewhat lower temperature than stale fish. When the cooking is completed, the fish are allowed to cool slowly and then the skin and small bones are removed and, in order to maintain the original shape of the individual pieces, any cracks in the flesh or broken-off pieces are carefully replaced with a paste of cooked flesh. After these repairs are made the fish are ready for drying.

The ovens were made of brick, six feet in height, of which four feet was underground, and other dimensions convenient to take the drying trays. The latter were of wood with a

bamboo screen across the bottom and were triangular in shape, approximately three feet on two sides, two feet on the third side, with a depth of three inches. Ten of these trays were stacked on top of each other in the oven above a wood fire. The maximum temperature at the top tray was held to approximately 175° F. The strips were dried for only one hour a day and during this period the trays were interchanged in position so as to give even temperatures from top to bottom. Altogether, from 10 to 15 heatings were necessary. The purpose of this slow drying was to prevent the outer flesh from drying while the inner parts still contained large amounts of moisture.

After the sticks are thoroughly dry they are carefully scraped in order to bring them all to a uniform size and shape. The next step is to allow the sticks to mildew. They are packed in wooden boxes holding approximately 70 pounds, covered, sealed, and stored in a warm room for about two weeks. When the green mold has developed over the entire surface of the sticks they are removed from the warm room and dried in the sun. This treatment removes the fat which otherwise by decomposition would give a bad flavor and taste to the meat. After removal from the warm room and sun drying the sticks are brushed, repacked in boxes, and placed in a sterilization room where carbon bisulfide is evaporated and also steam sterilization is used. Following this, the mildew process is repeated twice and between treatments sterilization is given. After the final sterilization the sticks are packed 70 pounds to a box for shipment to Japan.

## II. THE JAPANESE TUNA FISHERY

Although the natives had occasionally taken tuna and comparatively large supplies were known to be present, the Japanese did not develop the tuna fishing until around 1940. Probably the reason for this delay was due to the need for larger and better equipped vessels and additional facilities ashore, particularly refrigeration. The establishment of a cannery in the Palaus did much to stimulate this industry. Experienced tuna fishermen from Japan with vessels ranging in size up to 60 net tons were just getting into production at the beginning of the war. The Palau cannery had a capacity of 500 cases per day, but it is doubtful if it operated at capacity for more than a short period in 1940. There was also limited production at Truk. In contrast to the bonito fishery, where pole fishing was employed, the tuna industry was based solely on long line fishing. The depth at which the lines were fished and the total number of hooks which could be handled from each vessel, are unknown. Information obtained at Truk was to the effect that tuna vessels were frequently away from port two weeks or more, but the exact location of the areas fished was not determined. Although tuna production was only in the neighborhood of two million pounds in 1941, there is every reason to believe that this industry would have expanded rapidly and perhaps reached as high a level as that for bonito in the course of another four or five years.

## III. SPONGE CULTURE

### A. NATIVE SPONGES

Native sponges of several types (yet unidentified) occur throughout the former mandated area. At Ponape, Kusaie, and Likiep, they are abundant enough to be used commonly in place of a towel after bathing, and for scouring cooking utensils.

They occur in depths less than two fathoms, but no investigation was possible to determine if there were additional resources at greater depths.

Since sponging was not a separate industry, the supply was obtained by fishermen who found them while engaged in regular fishing activities. They were pulled by hand, no special implements being used. In preparing them for use, the only treatment was to let the flesh rot in sea or fresh water for several days, then wash thoroughly in fresh water and dry.

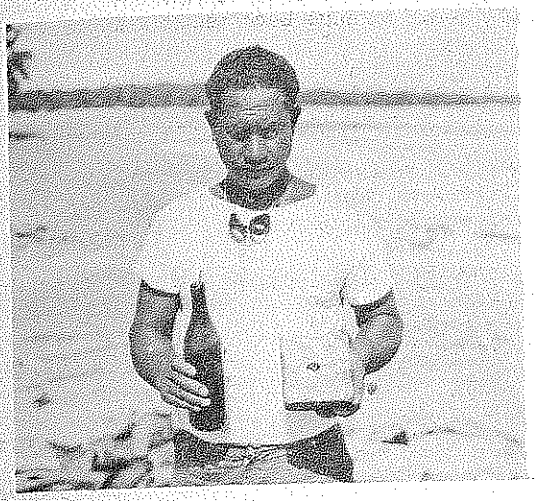

Figure 45...
Ailinglaplap.
Anchor and float for sponge culture.
August 1946.

B. JAPANESE SPONGE CULTURE AT AILINGLAPLAP (Marshalls)

On 26 August, 1946, an examination was made of the experimental sponge beds planted at Ailinglaplap by the Japanese in June and July of both 1939 and 1940. The planted area covers approximately two acres located just west of South Passage channel on the lagoon side. Depth is three to five fathoms with a white coral sand bottom. The area is well protected from rough water on the east by the channel reef, which is exposed at low tide. There are also protective reefs on the north and partly on the west. On the south, Bigatyelang Island prevents high winds from reaching the area.

The method of planting was very simple and was done by natives under Japanese supervision. Cement blocks 5 by 5 by 2 inches were used as anchors. From this block a piece of solid aluminum wire, about #12, stretched upward to a float made of a tightly corked and sealed Japanese one liter beer bottle (Fig. 45). The length of the wire varied somewhat depending on the depth, but was long enough so that 24 sponge cuttings could be strung on it four inches apart. A few wires had as many as 30 sponges on them. Not all of the cuttings survived, but mortality was not excessive, for almost all wires had 20 to 24 sponges on them. The bottle float was from a fathom and a half to two fathoms below the surface. The lowest sponge was 12 to 18 inches above the bottom. Anchors were spaced 10 feet apart on the bottom, sufficient to prevent fouling the wires in case of a storm, for we saw no wires which had become tangled.

According to a native informant, samples were sent to Japan, but no commercial harvest was made. The best time for taking up as well as planting is June and July, as that is the season of least wind and calmest water. A few sponges are taken by natives for washing babies. Their method of cleaning sponges is to bury them under water and sand on the lagoon reef for three days, then wash them in salt water followed with fresh (rain) water, then dry them in the sun.

Although it was impossible to make an exact count, there are several hundred sponges remaining. The aluminum wire is becoming brittle, and unless the sponges are either removed or restrung, it will not be more than another six months until some become detached. Because of the fine sand bottom, it is probable that sponges falling to the bottom would be silted over and killed by the first heavy wind.

The sponges are a very dark blue color when alive, but after cleaning are very nearly white without bleaching. The size varied from four to six and a half inches in largest dimension. Shape was rather irregular, almost all individuals having one or more short

protruberances which prevented them from having a circular shape. It is not known what shape or size cuttings were planted, but growth seems to have been relatively slow, less than an inch a year.

Ownership of the sponges is in doubt. The native Chief claims them as his property, but Military Government officers have ordered that none be harvested until notified.

All of the sponges are of the same species. A small sample was supplied to Dr. Lewis Radcliffe, Executive Secretary of The Sponge Institute, Washington, who sent one to Dr. M. W. deLaubenfels for identification. Dr. deLaubenfels reported as follows:

"The specimen is Spongia officinalis, subspecies mollissima, known as Fine Levant or Turkey Solid. One expects to find this exclusively in the eastern Mediterranean, and it is absent or rare elsewhere in the world. The specimen is one of the finest I have ever seen. Its fibers are a little bit weak, perhaps as a result of chemical bleaching, but in general it is worthy of enthusiasm."

Additional specimens will be sent Dr. deLaubenfels for checking. The weak fibers were not due to chemical bleaching, and it may be that this is due to differences in Mediterranean and Central Pacific conditions. In any event, it is evident that sponge culture has definite possibilities, and the sponges now at Ailinglapalap should be used mainly as cuttings to extend planting to other suitable places.

## IV. PEARL SHELLS

### A. DISTRIBUTION OF PEARL OYSTERS

The black lip pearl oyster (Pinctada margaratifera) is widely distributed throughout the former mandated area. Specimens were taken at Saipan, the Palaus, Ponape, Kapingamarangi, Nukuoro, and Likiep. They occur in abundance only in the Palaus. The Japanese figures for 1941 showed a production from the Palaus of approximately 2,500 tons, but an unknown percentage of these may have been taken in the Arafura Sea. It is believed that limited commercial production would be possible at Truk and Ponape and it would be well worthwhile to attempt increasing the abundance in a number of localities such as Kusaie, Kapingamarangi, Ailinglapalap, Majuro, and Eniwetok.

No specimens of the gold lip pearl oyster (Pinctada maxima) were seen at any place visited. However, it is known that the Japanese brought in some of this species to Palau for their experiments in pearl culture and it is quite likely that more thorough investigation would reveal some in the near vicinity of Koror.

Following the success of Mikimoto in commercializing the culture of pearls in Japan, numerous attempts were made to establish this industry in the former mandated area and also in the Philippines and the Dutch East Indies. The main experiments were carried on in the Palaus, where plantings were made as early as 1930 and at the time the war began four companies were engaged there in pearl culture. There was also a planting on a smaller scale at Ebon in the Marshall Islands. The work at both of these localities is described more in detail below. The actual number of pearls produced and their quality, either in the Palaus or at Ebon, is unknown to us. For one thing, it was not customary to ship the pearls back to Japan annually. They were exported whenever what they thought to be a sufficient number had been collected. Japanese statistics show 17,783 pearls exported from the Palaus in 1941. However, these could have been produced in previous years as well as 1941.

The great advantage of culturing pearls in the Palaus and other islands of the former Japanese Mandate was the presence there of the larger species of pearl oyster, especially the black lip pearl oyster (Pinctada margaratifera), and the availability of the gold lip oyster (Pinctada maxima). Because of their large size they were not only easier to use as hosts for the mother of pearl blanks, but also the nacre was laid down at a more rapid rate, so that pearls could be produced in two years rather than the three to five which were required for the smaller native Japanese species of the pearl oyster (Pinctada martensi).

B. JAPANESE PEARL CULTURE AT EBON

Although we did not visit the island of Ebon, a native from that island was interviewed at Majuro in regard to experimental productions of culture pearls carried on by the Japanese. This native assisted the Japanese in their planting operations and was one of only three natives permitted to do so. The work was carried on from 1935 to 1942. Three species of oysters were planted: the first was the black lip (Pinctada margaritifera) of approximately six inches in diameter, brought from Namorik; the second species, was the gold lip (Pinctada maxima), approximately six inches in diameter or larger, which was brought from New Guinea; and the third a small white oyster, approximately three inches in diameter, which was brought from Japan. Planting was done inside the lagoon in depths of 3 to 12 fathoms. As at Koror in the Palaus, oysters were placed in wire baskets holding from 6 to 18 oysters each. Some baskets were placed on the bottom, others suspended by wood floats and gasoline drums at varying distances from the bottom to approximately three feet below the surface of the water. The effect of various locations was not known to our informant. He was told that in Japan it took five years to produce cultured pearls, but only three years at Ebon. The informant also did not know which species of oyster proved best for pearl culture. Pearl shell slugs of graduated sizes were put into oysters to form the pearls, as was done at Koror. None of the natives was permitted to watch the process of inserting the pearl slug into the oysters. The Japanese told the natives that it would cost them 1,000 yen to watch the process. Our informant thought that the Japanese must have planted thousands of these oysters. Three Japanese were engaged in this work, and the man in charge was Kosuka Kyoshi. The operating company was the Marshalls Sinsyu Kabushiki Kaisha of Tokyo and Maiken. The plantings were abandoned in 1942, and the informant did not know the present status of the plantings, but thinks it probable (with which I agree) that the natives took up most of the baskets to get the pearls.

## V. SEA CUCUMBERS (TREPANG)

Approximately a dozen species (not yet identified) are very abundant throughout the area. The commercial types are shown in Fig. 31. When dried they are known as trepang or beche-de-mer, and are a prized addition to the diet of many Orientals.

A small (4-6 inches) smooth, black species occurs in tremendous quantities on the flats, just offshore in 6 to 12 inches of water. It is sometimes difficult to walk there without stepping on them. Most of the larger species are to be found in deeper water, down to several fathoms, and usually are to be seen in greater abundance at night.

Chief centers of trepang production were Saipan, Palaus, Yap, Truk, and Ponape. This was due, not only to the local abundance of sea cucumbers, but also to the availability of shipping. Trepang cannot be kept indefinitely without protection against spoilage, and remote islands and atolls do not have frequent trading vessels to take a semi-perishable product.

According to Japanese reports, overfishing had reduced the numbers in many places, as no conservation regulations applied to these animals. Our own observations tended to confirm the Japanese statements, as the larger and more desirable commercial species were not very abundant compared with the unutilized species. No information is available on the numbers spawned, or rates of survival or growth. The limited amount of trepang fishing now (summer, 1946) done by the natives gives no indication of the probable need for protection. However, trepang is a cash crop to the natives, and sufficient information should be obtained to protect their interests.

Japanese figures on export of dried sea cucumbers where between 20 to 30 tons per year. Their 1941 figures of production, presumably net weight, were as follows (weight in pounds):

| Saipan | Yap | Palau | Truk | Ponape | Total |
|---|---|---|---|---|---|
| 119,673 | 68,952 | 341,244 | 1,142,779 | 201,784 | 1,874,432 |

At truk, Ponape, and Palaus fishing for sea cucumbers was done by men, as the valuable and large specimens had to be taken mostly by diving, in which the women did not engage. (See also VIIB Trepang Fishing of Truk.)

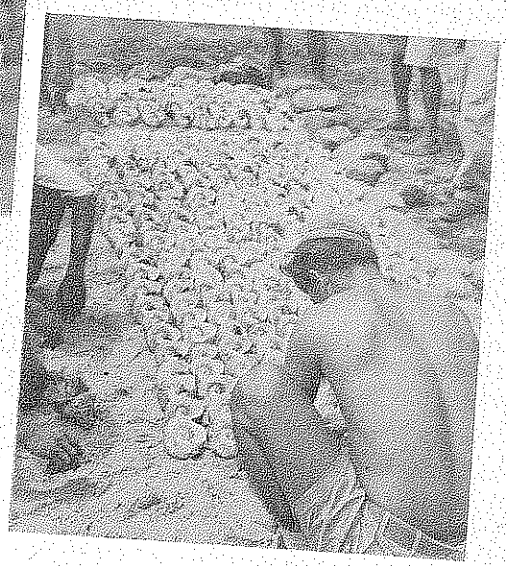

Figure 46 (Above)
Truk.
Native produced Trepang
(dried sea-cucumber).

Figure 47 (Right)
Truk.
Trochus Shells.
May 1946.

## VI. FISHERIES - TROCHUS SHELLS

Several species of trochus are found throughout the former mandated area, but the commercial species, Trochus niloticus, was originally taken only in the Palaus and at Yap. Under the direction of the South Seas Government transplantings of this trochus were made from the Palaus to a number of other localities. The latest transplantings were around 1936. Most of these transplantings seem to have been successful since at present the animals are found in commercial abundance at Saipan, Truk, Ponape, Kuop, Jaluit, Ailinglapalap, and Kapingamarangi.

Trochus are found chiefly on the outside edge of the barrier or fringing reefs at depths to two fathoms. It is stated that they prefer areas where seaweed is present. The collection of trochus shells was given over to the natives. The Japanese bought them for from 10 to 15 sen (¥.10 - ¥.15) each and the total production was sent back to Japan for the making of pearl buttons. Such statistics as are available seem to show that approximately 125 tons were taken per year. However, since considerable planting was done in 1936, and it requires several years for the trochus to become established, there was no harvesting from Saipan, Ailinglapalap, or Kapingamarangi. In addition, the exigencies of war prevented harvesting at any point from 1942 to 1946. In the latter year only a limited amount of harvesting was done under the direction of the U. S. Commercial Company at Yap, Saipan, the Palaus, Truk, and Ponape. There is every reason to expect that during the next few years the production of trochus should amount to as much as 50 percent higher than the tonnage taken by the Japanese prior to the war. However, this will depend to a large extent on the number of shells rejected. (See also VIIC Trochus Shell Fishery of Truk.)

## VII. FISHERIES OF TRUK

### A. INFORMATION ON PREWAR FISHERY

The following information was secured from Chief Artie Moses who is Chief of the whole Truk Group and owner of Kuop Atoll. He stated that the Japanese brought in the commercial trochus shell from the Palaus and planted them around the reefs at Truk, beginning 20 years ago. The most recent planting was in 1936. Plantings were apparently fairly widespread and included Kuop Atoll. None was planted at Hall Islands. (Author's note: The native trochus is a small species with a rough shell and seldom gets over two and a half inches in diameter. It has no commercial value.) During the war, especially near the end, many trochus shells were taken by the Japanese and by the natives for food. The natives were not allowed to have trochus in their possession before the war as the taking of them was strictly controlled and done by Okinawan divers for the Japanese. There were a few Japanese divers also.

The natives formerly had five and six man canoes both paddling and sailing. These were taken away by the Japanese and the natives were forbidden to go outside the passes. Before the war the natives did a little trolling for bonito with feather jigs outside the reefs, but only for subsistence. They were not employed by the Japanese to get fish for the industry. The main fishery was carried on by the Japanese and Okinawans. Five Japanese sampans came into Dublon Island one day with 500 fish each which was considered a good day's fishing. Each sampan carried a crew of 12 men. Sometimes the catch was as low as 100 to 300 fish per day and occasionally a sampan would get 1,000 fish. The fish averaged five to eight pounds each. The Japanese had a large drying shed on Dublon Island for bonito (Katsuwonis pelamis). No canning or salting was done by the Japanese. They had refrigeration sufficient to hold surplus fish over-night in case of a large catch. Bonito

were sold fresh to the natives for ¥3.00 to ¥4.00 each. The heads, backbones and other by-products of the drying industry were sold for three to four sen each. The price depended on size of catch, as the Japanese reduced the price to get rid of a surplus, and raised it when fishing was light. Toward the end of the war when food was scarce fresh bonitos sold as high as ¥100 each.

The natives themselves dried some bonito partly following the Japanese method after cooking and removing the bones. The flesh was dried in the sun. The natives also salted some bonito although salt had to be imported from Japan. The main native centers of drying and salting were on Tol, Uman, and Pis Islands. There are still some Japanese fish hooks used for off-shore fishing but no fishing line and they have lost the art of using local fibres to make lines strong enough for bonito fishing.

Under the Japanese, in order to fish off-shore or for certain other types of fishing, such as turtle and for shell fish, the natives had to go to the nearest Japanese office and get a license. The native told the Japanese where he wanted to fish, what species he expected to take and the season of the year for each species. If approved by the Japanese, a license written on a wood paddle was issued free and was good for three years. Any native found fishing without a license was subject to fine or work on the roads.

Just before the Japanese surrendered they ordered the natives to destroy all Japanese papers, books, and photographs and the only thing the natives were able to retain were their bibles and hymn books. We were unable to locate any Japanese licenses and none is believed to exist now as native houses were searched by the Japanese to be sure that the order was complied with.

B. TREPANG FISHERY AT TRUK

On Dublon Island of the Truk group there is a Korean merchant who, before the war, handled trepang. He is, therefore, familiar with the Japanese requirements, and it is believed that this industry could be revived in the Truk area with considerable profit to the natives. Yellow, black, and brown trepang were abundant and are present the year round. The process itself is a simple one, requires little investment or equipment, and should be easily within the means of any natives who wish to go into it. During the Japanese occupation the natives collected many thousands of pounds of sea cucumbers for making trepang. Specimens range in size from four to 18 inches in length (Fig. 46). Most of the fishing was formerly done at night, using torches made of dry coconut leaves to locate the sea cucumbers on the shallow reefs. Sea cucumbers were apparently found in greatest abundance at Tol Island, but we found them to be comparatively abundant in the vicinity of practically all islands. In preparation, the sea cucumbers are first boiled, then eviscerated, then dried under cover over a fire. In some cases they are simply dried at comparatively low temperature; in other cases they are smoked. About six grades were produced formerly in the Truk area. Yellow specimens were the most sought after. Apparently, small sizes were used, as it was stated that 50 pieces of dried trepang weighed only one kilogram. A kilogram of the dried product was sold for ¥5.00 at Truk, and for ¥8.00 on arrival at Japan. This presumably was the price to the primary producer. We could not get the price to fishermen. The Korean thought he could prepare approximately ten kilograms of dried trepang per week.

C. TROCHUS SHELL FISHERY AT TRUK (Fig. 47)

In view of the reported planting of trochus shells during 1936 by the Japanese, it seemed desirable to look into the present abundance of these shell fish. Arrangements were made by Mr. G. G. Wheeler, USCC Senior Representative, to obtain the services of three Okinawan divers and a small navy patrol craft to visit the reefs in the vicinity of Otta Pass. This was done on May 25th. A small reef, approximately 3/8 of a mile in circumference, was selected for search. Four divers worked around this reef and in an hour and a half obtained 27 trochus shells over three inches in diameter. The trochus were found along the face of the reef in one to two fathoms. The production of four shells per man per hour is extremely low. It is believed that this was not due to an actual scarcity of trochus shells, but to inexperience in locating them.

Fig. 48... Saipan. Beach Seining No. 1. Setting net. June 1946.

Fig. 49. Saipan. Beach Seining No. 2. Hauling net. June 1946.

## VIII. SAIPAN BEACH SEINING

(June 1946)

The seine crew which operates inshore between the beach and the barrier reef is very expert. There are 12 to 15 men in the crew. Their seine is in sections approximately 200 yards long in each section, eight feet deep, and of 1/4 inch bar, or 1/2 inch stretched mesh. The cotton twine is somewhat heavier than #9. The net is set from a 16 foot, narrow beam skiff of the Okinawan type. Three or four fishermen go in the seine boat and the net is laid out in a half-circle from shore (Fig. 48). The fishermen propel the seine boat with bamboo poles and by a single long sculling oar at the stern. The water in this section is not over three feet deep. The net is set only after a school of fish has been observed from shore. As the net is laid out, fishermen follow it into the water and see that it doesn't foul and is tight on the bottom (Fig. 49). Most fishermen wear goggles and dive down in the water to see that the net is clear. These goggles are of Japanese make and are of wood and plastic construction. If the net is not long enough to reach back to shore, some of the seine crew wade out between the end of the net and shore to keep the fish from breaking out along the open side. Sometimes several hundred pounds of fish are taken on one set of the net. In general, however, this type of fishing is very low in production. Several hauls which we observed did not bring in more than 40 or 50 pounds of fish, most of which were small goat fish from four to six inches in length (Fig. 50). These small fish should not be taken, but, due to the shortage of protein food, it seems too much of a hardship on the population to recommend stopping this type of fishing. However, as soon as production from the sampans is sufficient to supply the daily needs of the native population, it is recommended that the use of seines along shore between Mutcho Point and Susupe Point be prohibited during the months of June, July, and August. The results of this regulation, when put into effect, should be observed carefully and if it does not result in an increased catch of fish - both in number and size - seining along shore should be prohibited in that area throughout the entire year. This regulation should not prevent the catching of fish by means of a throw net.

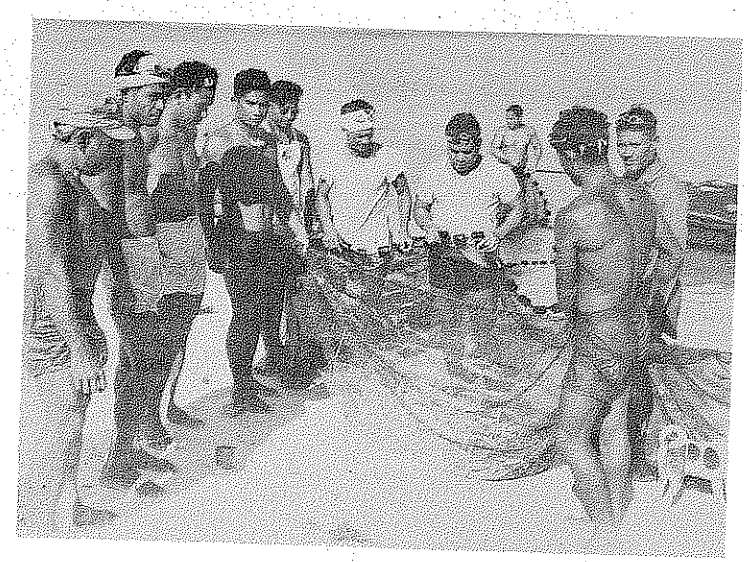

Figure 50... Saipan. Beach Seining No. 3.
Catch (mostly 4-5 inch goatfish). June 1946.

## IX. SEA TURTLES

Sea turtles, both the Hawksbill (Chelonia imbricata) and the Green turtle (Chelonia mydas or japonica) are found throughout the area, but more abundantly in the Carolines, less so in the Marshalls and Marianas. Females come ashore on sandy beaches during late spring and early summer to deposit their eggs, numbering up to 150. A hole is dug in the sand above high water mark, the eggs laid in it buried, and left to be incubated by the sun. The young hatch out at the end of 60 days and immediately take to the water.

The Hawksbill, being carnivorous, is not highly regarded as food. The 13 large plates or scutes on the back constitute the "tortoise shell" of commerce. Market value of the plates depends largely on their coloration, the plain dark plates having less value than ones with a greater proportion of light area.

According to Japanese reports, about 200 turtles were taken annually, mostly from Palaus, Truk, and Ponape. This small production reflects the rigid Japanese measures protecting the Hawksbill. No turtles or their eggs could be taken on shore, at which time they are very easy to capture, and no individual could be taken measuring less than 60 centimeters (24 inches) in length. The catch was made offshore, either by spearing or with special large mesh nets made of sennit.

The Green turtle does not have the overlapping plates like the Hawksbill, and has no commercial value. It is herbivorous, and excellent eating. The most common native method of cooking is to bake the animal in its shell.

The Japanese identified the Green turtles as Chelonia japonica (Thunberg). It is quite probably identical with the Philippine species, Chelonia mydas (Linn).

## X. POISON FISH

Of the approximately 2000 species of fish and other marine animals in Central Pacific waters, at least 125 are said to be poisonous when eaten. Others, such as cone shells and sea snakes, have a venomous bite, and a third group including corals, sea-urchins and moray eels, cause wounds which frequently become infected and are difficult to heal.

Reasonable precautions can be taken to avoid injury from organisms of the last two groups. Cone shells and sea snakes should not be handled. Wearing shoes (tabis) and gloves when wading or diving, and care in avoiding abrasive contact with corals or stepping on sea-urchins will minimize the danger of wounds from them. Moray eels are found in holes in reefs, so it is inadvisable to reach into such places with bare hands.

But the problem of poisoning from eating fish is a more baffling one. Only the puffers (family Tetrodontidae), and their spiny relatives, the porcupine fish (family Diodontidae) seem to be universally regarded as dangerous. Other species are poisonous in one locality but harmless elsewhere. Even the virulence of the poison varies from place to place, and with season of the year. As far as could be determined, there are no poisonous species in the Palaus. Elsewhere, it is good judgment to follow the recommendations of the native people, who from long experience have come to know the harmful local varieties. The only other generalization is that surface feeding fish, taken by trolling offshore, are not known to be harmful. The poison evidently originates in the food of reef and lagoon fish.

The death of over a score of persons annually, stimulated research by Japanese investigators at the Imperial Naval Hospital, Saipan (Reference 8). It has not been possible to obtain a translation of the reference publication, but according to a translator their conclusions were that the substance responsible was an alkaloid in the blood, and that some measure of protection could be obtained by thorough bleeding, skinning, and washing the flesh of the fish before cooking.

It is believed that additional research is necessary. Certainly the publication cited should be given a careful translation, and the conclusions checked by a competent pharmacologist.

There follows a list of the poisonous species of fish from the Japanese report.

SCIENTIFIC AND COMMON NAMES OF FISHES LISTED AS BEING POISONOUS IN REPORT OF THE INVESTIGATION ON POISONOUS FISHES OF THE SOUTH SEAS, EDITED BY Y. HIYAMA, AND PUBLISHED BY NISSAN FISHERIES RESEARCH LABORATORY

| SCIENTIFIC NAME (1) | FAMILY NAME | COMMON NAME English | COMMON NAME Native (Marshalls) | DEGREE POISONOUS |
|---|---|---|---|---|
| 1. Lycodontis flavimarginata (Ruppell) | Muraenidae | Moray Eel | Dreb | Deadly |
| 2. Lycodontis meleagris (Shaw) | " | " | " | " |
| 3. Lycodontis undulata (Lacepede) | " | " | " | " |
| 4. Lycodontis undulata var. isingleenoides (Richardson) | " | " | Maj | Harmless |
| 5. Lycondontis picta (Ahl) | " | " | Dreb | Moderately |
| 6. Lycondontis thyrsoidea (Richardson) | " | " | Maj | Harmless |
| 7. Sphyraena piscuda (Bloch & Schneider) | Sphyraenidae | Barracuda | Jujukob | Deadly |
| 8. Sphyraena forsteri (Cuvier & Valenciennes) | " | " | Jure | Slightly |
| 9. Caranx ascensionis (Cuvier & Valenciennes) | Carangidae | Crevalle | Lane | Small: slightly; Grown: Deadly |
| 10. Caranx sexfasciatus (Cuvier & Valenciennes) | " | " | Ikubuj | Small: slightly; Grown: Deadly |
| 11. Lutjanus vaigiensis (Quoy & Gaimard) | Lutjanidae | Snapper | | Slightly |
| 12. Lutjanus bohar (Forskal) | " | " | Baan, Pan | " |
| 13. Lutjanus (Loxolutjanus) sp. | " | " | Jab | Deadly |
| 14. Lutjanus fulviflamma (Forskal) | " | " | Jeblo | Slightly |
| 15. Lutjanus flavipes (Valenciennes) | " | " | Jaj | " |
| 16. Lutjanus semicinctus (Quoy & Gaimard) | " | " | Elikinwi | " |
| 17. Aprion virescens (Valenciennes) | " | " | | " |
| 18. Lethrinus miniatus (Schneider) | Lethrinidae | Porgy | Jallia | " |
| " | " | | Ronet | Deadly |
| 19. Lethrinus sp. | " | " | Mameni | Slightly |
| 20. Lethrinus variegatus (Valenciennes) | " | " | Net | Deadly |
| 21. Monotaxis grandoculis (Forskal) | Denticidae | NCN (2) | Kie | " |
| 22. Pentapus aurolineatus Lacepede | " | NCN | Tunal | " |

(1) After Fowler - Fishes of Oceania.
(2) No common name

SCIENTIFIC AND COMMON NAMES OF FISHES LISTED AS BEING POISONOUS IN REPORT OF THE INVESTIGATION ON POISONOUS FISHES OF THE SOUTH SEAS, EDITED BY Y. HIYAMA, AND PUBLISHED BY NISSAN FISHERIES RESEARCH LABORATORY

| SCIENTIFIC NAME (1) | FAMILY NAME | COMMON NAME English | COMMON NAME Native (Marshalls) | DEGREE POISONOUS |
|---|---|---|---|---|
| 23. Callyodon microrhinos (Bleeker) | Callyodontidae | Parrot Fish | Alwor | Slightly |
| 24. Cheilinus sp. | Labridae | Wrasse | Labbo | " |
| 25. Cheilinus fasciatus (Bloch) | " | " | Jollol | " |
| 26. Coris gaimard (Quoy & Gaimard) | " | " | Lukobinatat | Deadly |
| 27. Epibulus insidiator (Pallas) | " | " | Mo | Slightly |
| 28. Cephalopholis argus (Schneider) | Serranidae | Sea-Bass | Kalemej | " |
| 29. Plectropomus truncatus (Fowler) | " | " | | " |
| 30. Plectropomus oligacanthus (Bleeker) | " | " | Jule | Deadly |
| 31. Variola louti (Forskal) | " | " | Kaikbet | " |
| 32. Serranus fuscoguttatus (Forskal) | " | " | Kuro | " |
| 33. Serranus sp. | " | " | | Slightly |
| 34. Serranus microdon (Bleeker) | " | " | Illino | Deadly |
| 35. Ctenochaetus strigosus (Bennett) | Hepatidae | Surgeon-Fish | Diebdro | Slightly |
| 36. Ctenochaetus sp. | " | " | Teo | " |
| 37. Hepatus olivaceus (Schneider) | " | " | Ael | Moderately (?) |
| 38. Hepatus nigrofuscus (Forskal) | " | " | Diebdro | Slightly (?) |
| 39. Zebrasoma veliferum (Bloch) | " | " | Laid | " |
| 40. Odonus niger (Ruppel) | Balistidae | Trigger-Fish | Bubor bubmej | Deadly |
| 41. Balistes conspicillium (Bloch & Schneider) | " | " | Bub | Moderately |
| 42. Alutera scripta (Osbeck) | Monacanthidae | File-Fish | | Deadly (Internal organs only) |
| 43. Holacanthus discanthus (Gunther) | Chaetodontidae | Butterfly-Fish | Jorur | Slightly |
| 44. Abudebduf sexfasciatus (Lacepede) | Pomacentridae | Damsel-Fish | Bakej | Slightly or Harmless |

(1) After Fowler - Fishes of Oceania.