

COMMERCIAL FISHERIES REVIEW

March 1949

Washington 25, D. C.

Vol. 11, No. 3

FISHERY EXPLORATION IN THE WESTERN PACIFIC

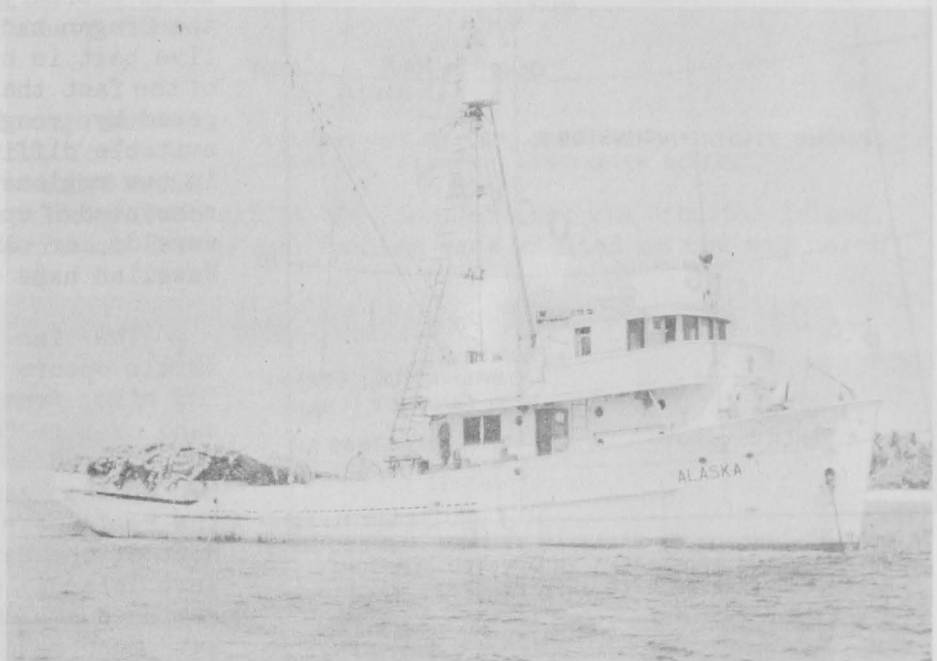
(JANUARY TO JUNE, 1948, BY VESSELS OF THE PACIFIC EXPLORATION COMPANY)

By O. R. Smith* and M. B. Schaefer**

INTRODUCTION

During the first six months of 1948, the Pacific Exploration Company, operating under contract with the Reconstruction Finance Corporation, dispatched the motor vessels Oregon and Alaska to prospect for tuna in the western Pacific, more particularly in the region of the Hawaiian Islands and southward through the Line Islands, and in the region of the Pacific Trust Territory (former Japanese Mandated Islands) which consists of the Marshall Islands, the Caroline Islands, and the Marianas Islands.

The contract between the R.F.C., a Government corporation, and the Pacific Exploration Company provided that observers of the Fish and Wildlife Service were to be accommodated on these vessels. The authors were detailed to accompany them to observe the results of the exploratory fishing and to collect biological and oceanographical data as practicable. The Alaska was fitted out as a tuna purse-seiner. The Oregon was equipped for live-bait fishing. These vessels are sister ships, being typical West Coast combination seiner-dragger type, of 100 feet in length. Both are the property of the R.F.C.



ALASKA ANCHORED IN SOUTH PASS, AILINGLAPLAP, MARSHALL ISLANDS.

During the course of the voyage, the observers submitted reports on the vessel's activities on the basis of which the South Pacific Investigations of the Fish and Wildlife Service issued reports to the industry in the Service's daily Fishery Products Reports published by the Market News Service and, also, in several trade journals. The present report summarizes the activities of the vessels and the immediate results of their exploration. Data gathered on the biology of the tunas

*Aquatic Biologist, South Pacific Fishery Investigations, Fish and Wildlife Service.

**Chief, Section of Biology and Oceanography, Pacific Oceanic Fishery Investigations, Fish and Wildlife Service.

and bait fishes and on the hydrography of the region will be published later after analysis has been completed.

The present report covers only the six-month period from the beginning of the explorations in January to June 1948. The vessels, after June 1948, were still engaged in continued exploratory work in the vicinity of the Hawaiian Islands.

EXPLORATIONS BY MV OREGON

French Frigate Shoals to Line Islands Cruise

OBSERVATIONS ON BAIT: The Oregon, after an uneventful trip from San Diego, left Honolulu on January 18, to prospect for bait at French Frigate Shoals in the

Hawaiian chain. The Oregon arrived at French Frigate Shoals on January 21, just as a storm was blowing up. Several days were lost riding at anchor during the blow, but the reefs and small sand islands were thoroughly explored for bait until February 1. On that date, the Oregon had 437 "scoops"^{1/} of live bait in her tanks, in spite of the fact that the work was hampered by rough seas and the inevitable difficulties of fishing in new regions. These bait fish consisted of species of small silverside or atherinid, with the Hawaiian name of "iao."

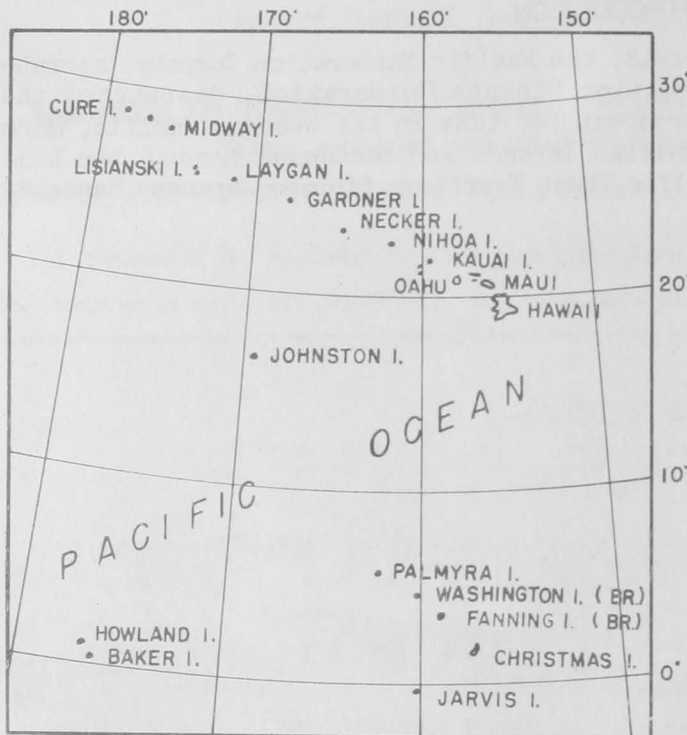


FIGURE 1 - REGION OF HAWAIIAN ISLANDS AND SOUTHWARD WHERE OREGON AND ALASKA PROSPECTED FOR TUNA. THE BALANCE OF THE AREA COVERED BY THESE VESSELS IS SHOWN IN FIGURE 2.

The iao at French Frigate Shoals occurs in schools of varying size, from a score to a thousand or more "scoops." They may be captured by means of a surround net on the sandy beaches inside the reefs near the small islands. Most of the bait was captured at East Island, although some was captured at Tern Island. A "blanket" mesh seine with square openings about a fifth of an inch on

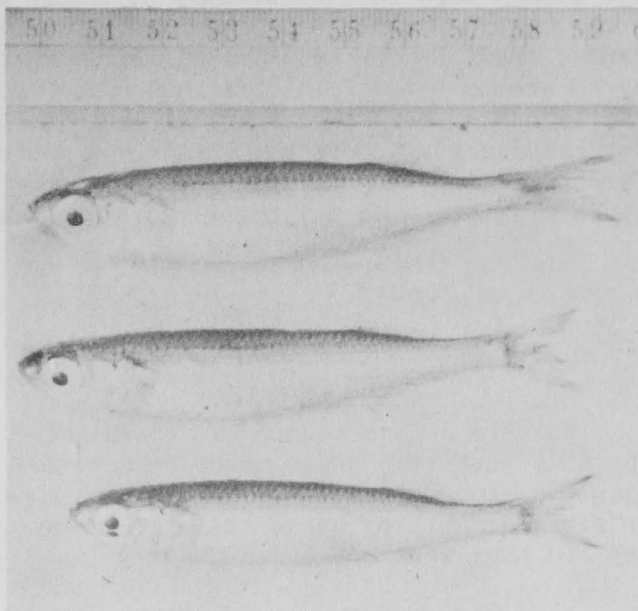
each side was used at first, but a net of half-inch stretched mesh, knotted, was found to be easier to handle and much more effective. Nets of the latter mesh, both 10 and 20 fathoms long and $2\frac{1}{2}$ fathoms deep, were used. The webbing was the same as that used in what the California fishermen commonly call a "Galapagos" net, so-called because of its special use in capturing bait at the Galapagos Islands. The lead line was very heavily weighted. It was set against the beach by two or three men, each carrying part of the net and walking in a half circle around the bait, while two other men kept the bait from going around the ends. The bait is quite tame and does not move much under ordinary circumstances. The net was closed by working the lead line over the bottom by hand, rather than by hauling the wings. A somewhat shallower net than $2\frac{1}{2}$ fathoms would have been just as efficient.

^{1/}A "scoop" is estimated to contain about 10 pounds of fish.

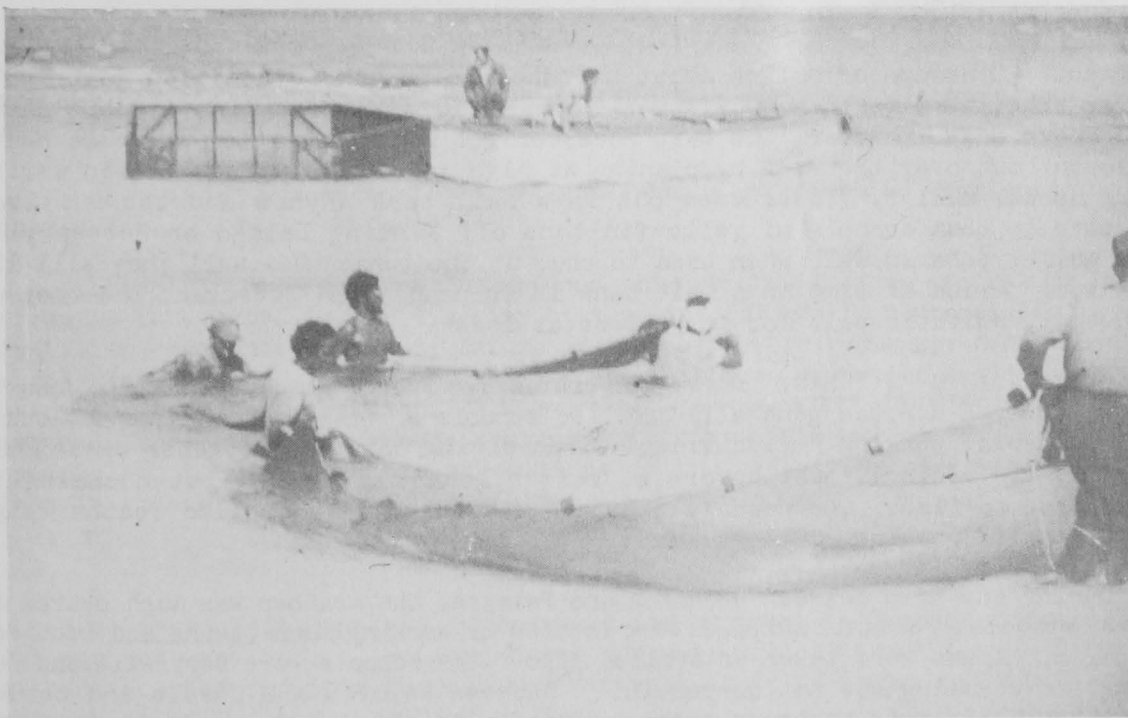
One difficulty encountered was with the receiver used to transport bait from the shore to the ship. The regular West Coast receiver is too deep for this shallow region. What is believed to be needed is a small-capacity receiver (about 50 to 100 scoops) of very shallow draft, not more than 18 inches, which can be towed rapidly. At Honolulu, this function is performed by a skiff having in the center a bait compartment which can be flooded by removing plugs.

It was evident that there are considerable quantities of iao at French Frigate Shoals, even in the winter season, and there are reported to be much greater quantities along the beaches during the summer months. It must be remembered, of course, that this standing crop of bait fish represents an almost virgin stock. How well this stock would stand up if heavily fished could only be ascertained from studying the changes which occur if and when heavy fishing takes place.

Because of continued rough weather, the Oregon did not scout for tuna northwest of Hawaii, but headed south with the bait from French Frigate Shoals to the Line Islands, via Johnston Island, Palmyra, and Jarvis. Christmas Island and Fanning were visited on the way north



SILVERSIDES OR IAO, FROM FRENCH FRIGATE SHOALS, HAWAIIAN ISLANDS. CENTIMETER SCALE.



SEINING BAIT AT FRENCH FRIGATE SHOALS, HAWAIIAN ISLANDS.

from Jarvis, and Honolulu was reached on February 21. At the outset of the trip, the bait was divided among two bait tanks on the afterdeck and a bait well on the port side amidships. Bait in the deck tanks suffered a fairly heavy mortality, but very few fish died in the well. Out of 340 scoops placed in the tanks, only 100 scoops were left on February 3. Though some had been used for chumming schools, a mortality of at least 50 percent was probably suffered by the bait in these tanks. Bait in the brine well, on the other hand, lived very well and some 30 or 40 scoops were still left when the ship reached Honolulu on February 21 (the others having been used to chum tuna schools). We do not know whether the differential mortality between the tanks and the well is to be attributed to a difference in handling during capture or to a difference in conditions in the two types of tanks. We may certainly conclude, however, that:

- (1) This species is suitable for long distance transportation if properly handled.
- (2) Careful studies of methods of handling and transporting are to be desired.

Palmyra Island lagoon was thoroughly prospected for bait on February 8 and 9. The only fish seen which might be used for bait was small mullet, which occurred in quantity along the beaches. There were apparently no fish of either the silverside or herring families here, at least in any quantity. They were not seen during the day and they were not taken under a light at night.

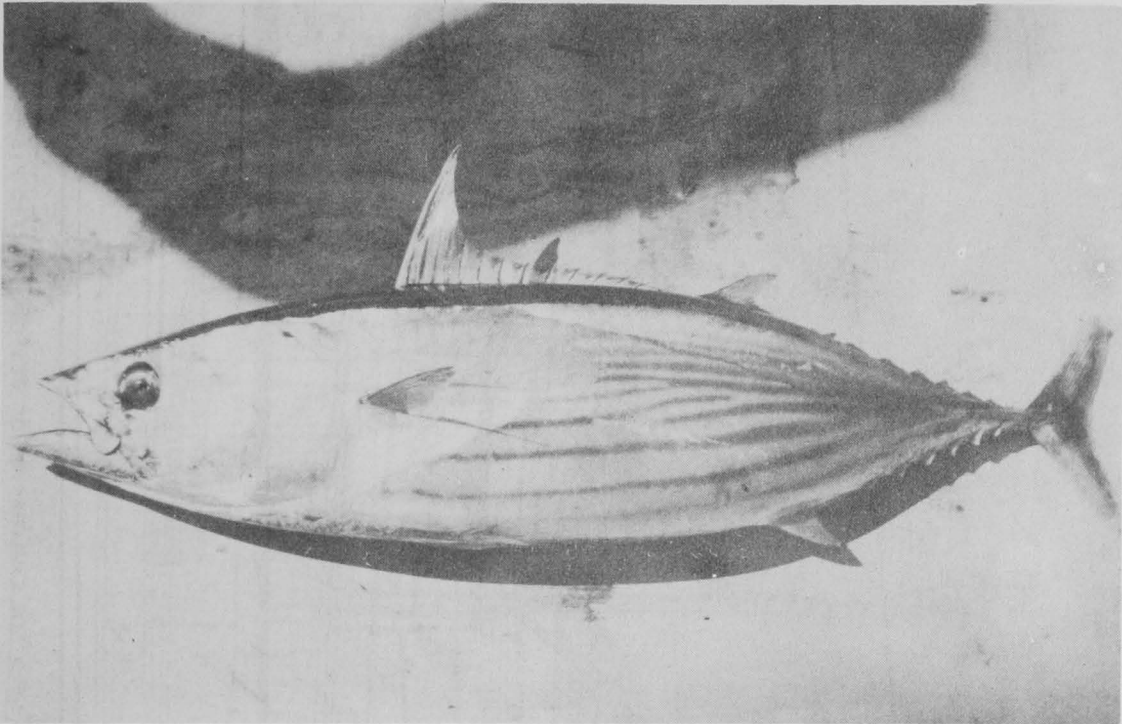
A part of the lagoon at Christmas Island was prospected for bait on February 14. Considerable quantities of mullet and goatfish were evident, but no fish of the silverside, anchovy, or herring families. It is reported, however, that there are quantities of iao and also "nehu" (a small anchovy) here at times. That there may be some truth to this, with respect to iao at least, is attested by the fact that a number were taken under a night light just offshore from the island. No nehu were seen at all.

About 30 scoops of mullet about 6 inches in length, with a few goatfish of similar size, were taken at Christmas Island. Because of engine trouble on the small power boat, however, the bait receiver got into a position where it had to be brought out over the reef by planing at high speed, which resulted in serious damage to the mullet. These were put in a bait tank anyhow and the survivors were used to chum schools of yellowfin tuna off Fanning Island on February 15. These mullet behaved well when used to chum up the tuna. How well they will live for a long period of time in a bait tank is an unanswered question, but they are undoubtedly suitable bait for large tuna, at least.

OBSERVATIONS ON TUNAS: During the cruise from French Frigate Shoals to Johnston Island, the weather was generally bad. No schools of fish were seen; one flock of birds was seen "working," (individual birds diving down to the water or skimming waves, as if feeding), just before we raised Johnston Island, but chumming the area raised no fish. One oceanic skipjack was taken on a trolled feather jig a few miles off Johnston.

During the trip between Johnston and Palmyra, the weather was much better and several schools of oceanic skipjack were located by working birds (terns and boobies). Several specimens were taken on trolled jigs. The schools were very wild and fast moving and chumming was not successful. Between Palmyra and Jarvis and between Jarvis and Christmas, numerous schools of oceanic skipjack were seen often with large flocks of birds working over them. Several oceanic skipjack and small yellowfin tuna were caught on troll lines. The schools were very wild and erratic in their behavior and the crew did not succeed in chumming them to the ship.

At Jarvis Island, a school of "two-pole"^{2/} yellowfin was raised and chummed up to the ship but they bit very indifferently and only 15 fish were caught. A large school of two-pole fish was sighted off Christmas Island, but it was not fished.



OCEANIC SKIPJACK, BONITO, OR AKU, KATSUWONUS PELAMIS FROM LINE ISLANDS.

Off Fanning Island, numerous flocks of working birds were observed, and, under two of these, schools of mixed one-pole and two-pole yellowfin tuna were raised by chumming. These fish took bait readily but stayed some distance out from the ship, and only a few fish were caught by the men in the racks.

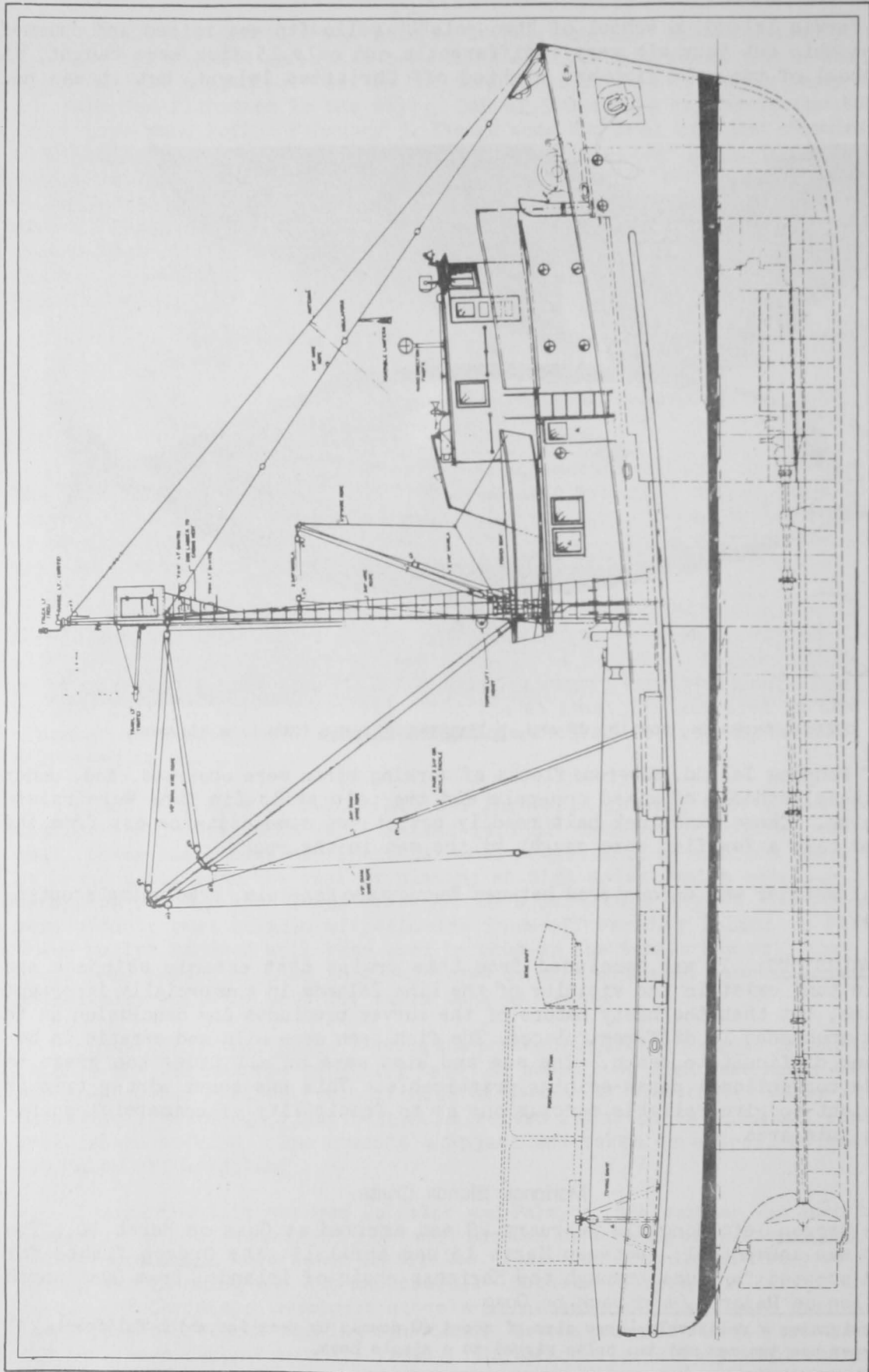
Foul weather was encountered between Fanning and Honolulu, precluding scouting for fish.

CONCLUSIONS: It was concluded from this cruise that oceanic skipjack and yellowfin tuna exist in the vicinity of the Line Islands in commercially important quantities, but that the hasty nature of the survey precludes any conclusion as to relative abundance in different places. The fish seen were wild and erratic in behavior and difficult to catch. The sea and wind were at all times too great to have made conventional purse-seining practicable. This one short winter trip is insufficient to give reliable conclusions as to feasibility of commercial operations in this area.

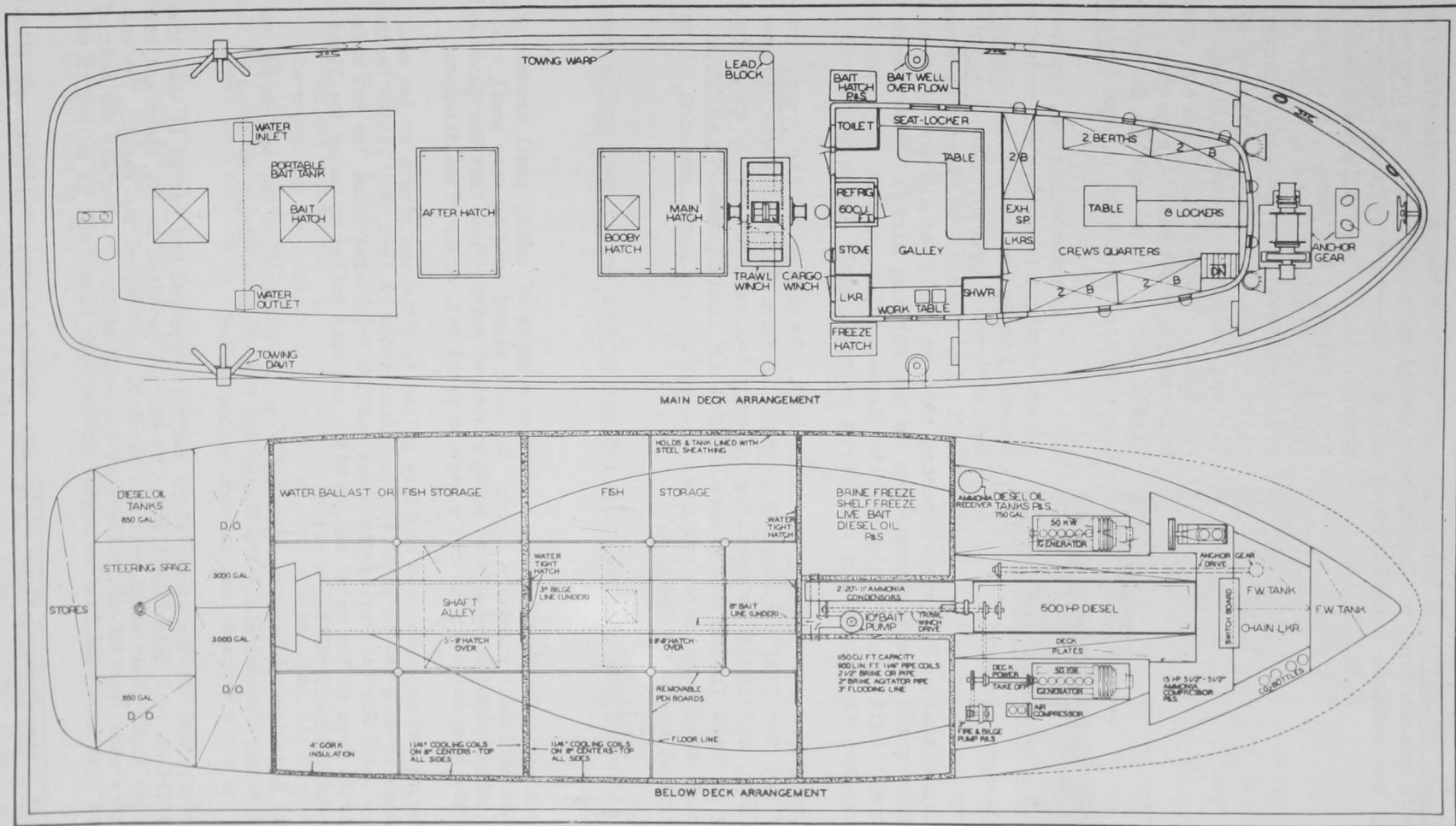
Marianas Islands Cruise

The Oregon left Honolulu February 28 and arrived at Guam on March 14. The trip out was uneventful. Between March 15 and April 19, the Oregon fished for bait and scouted for tuna through the Marianas chain of islands, from Guam north to Farallon de Pajoros, and back to Guam.

^{2/}This designates a relatively large size of about 40 pounds or over for which California fishermen use two men and two poles rigged to a single hook.

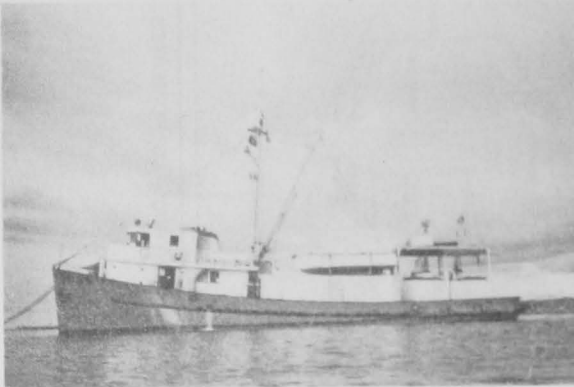


OUTBOARD PROFILE OF COMBINATION FISHING VESSEL USED FOR EXPLORATION OF WESTERN PACIFIC FISHERIES.



DECK AND BELOW DECK ARRANGEMENT OF COMBINATION FISHING VESSEL USED IN EXPLORATION OF WESTERN PACIFIC FISHERIES.

OBSERVATIONS ON BAIT: A great deal of time was spent prospecting for bait, for the obvious reason that a tuna clipper needs bait to fish. The Oregon's boats scouted along the beaches and cliffs of all the important islands in the Marianas group, and a few hauls were made with a beach seine, but very little bait was found. Fishing with a light was also tried wherever the Oregon anchored overnight, as she did at the islands of Guam, Tinian, Saipan, Alamegan, Pagon, Maug, and Rota. Three to fifteen pounds of bait could sometimes be netted under a light, but never enough to be worthwhile for a vessel the size of the Oregon.



OREGON MOORED AT GUAM.

There is some evidence, however, that more bait might be collected under a light in shallow water, where the Oregon could not anchor. One of the Oregon's crew left the vessel at Guam and spent some time on a local sampan. He later reported that he could get all the bait he needed under a light in shallow water even when he was working alone. This seems to indicate that small bait boats could operate successfully, and it might be feasible for a larger vessel to obtain its bait from several small bait catchers.

During the course of attempts to catch bait, the master of the Oregon developed a new type of net for fishing under a light. We have called this a "preset net." It was efficient, and could be operated by only two men. Hence, it could be hauled as frequently as bait formed a compact school or "ball" under the light. This effected a great saving in manpower³ over the prevalent local methods of catching bait, as described by R. O. Smith.³

A description of the construction and use of the preset net by the master of the Oregon follows:

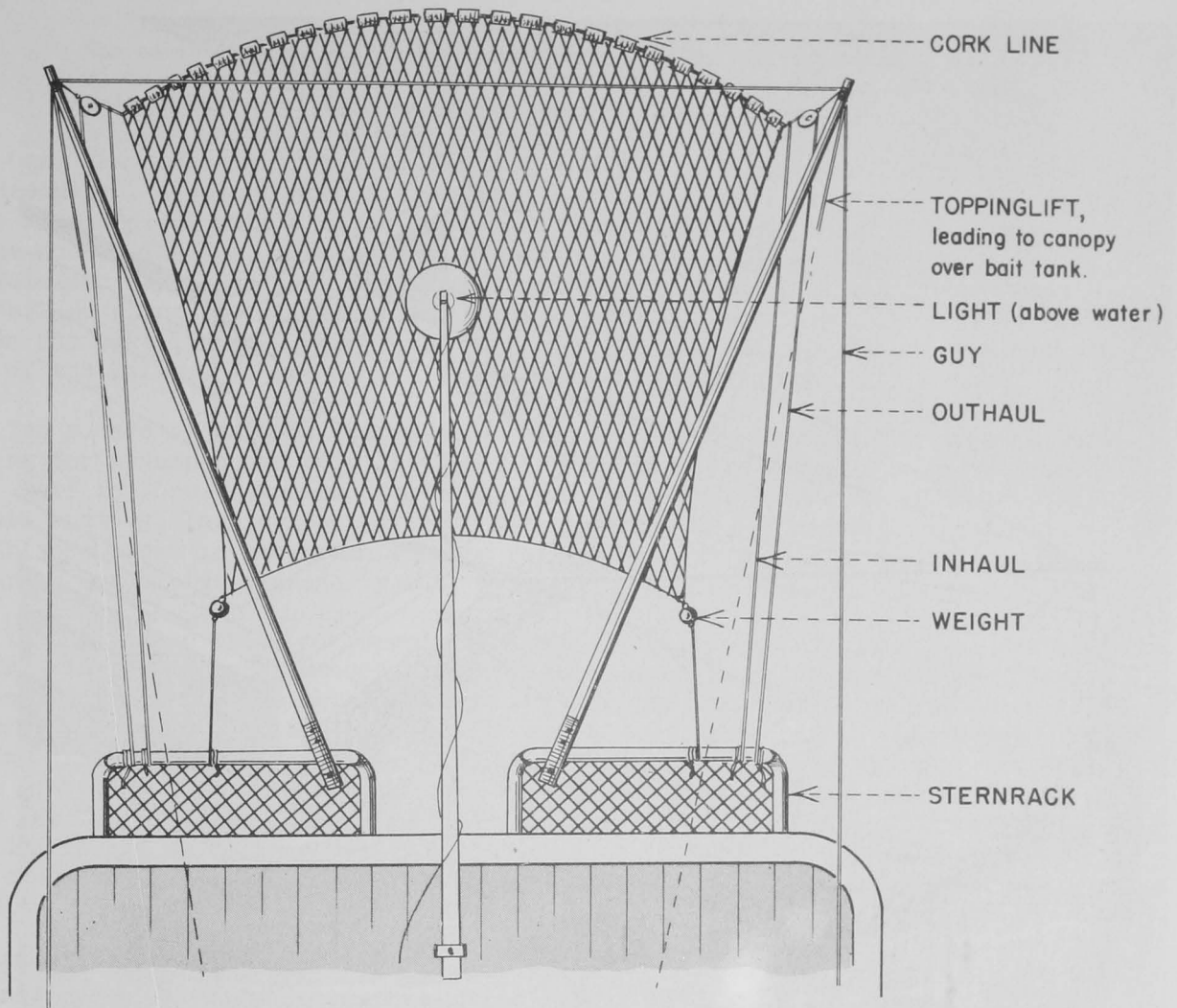
The problem in the Marianas was to develop a means of taking small amounts of wild bait efficiently under a light. The bait showed here in very small schools. A good school might have as much as 15 pounds of bait. This bait was quite wild and in the time necessary to set a regular night net, would often disappear.

The preset net we worked out could be pulled in about one minute by two men. Bait taken in this was in excellent condition since it took very little beating from the net. Any bait missed in a set was not frightened since the net made very little fuss in the water and we often saw bait balled up under the light before we finished brailing a set.

The net we used most was five fathoms along the corks, five fathoms pursed to two and a half fathoms along the leads, and four fathoms pursed to three on the sides. We put a 5-pound lead on each bottom corner.

We set this net off the stern before the bait appeared and pulled it when there was sufficient bait under the light. It was set parallel to the stern and held off by two light poles which extended about 20 feet beyond the racks. Two endless lines were rove through pulleys at the ends of these poles and the ends of the cork line were made fast to these, so the cork line could be pulled in and out.

³/Fisheries of Former Japanese Mandated Islands, Fishery Leaflet 273, Fish and Wildlife Service.



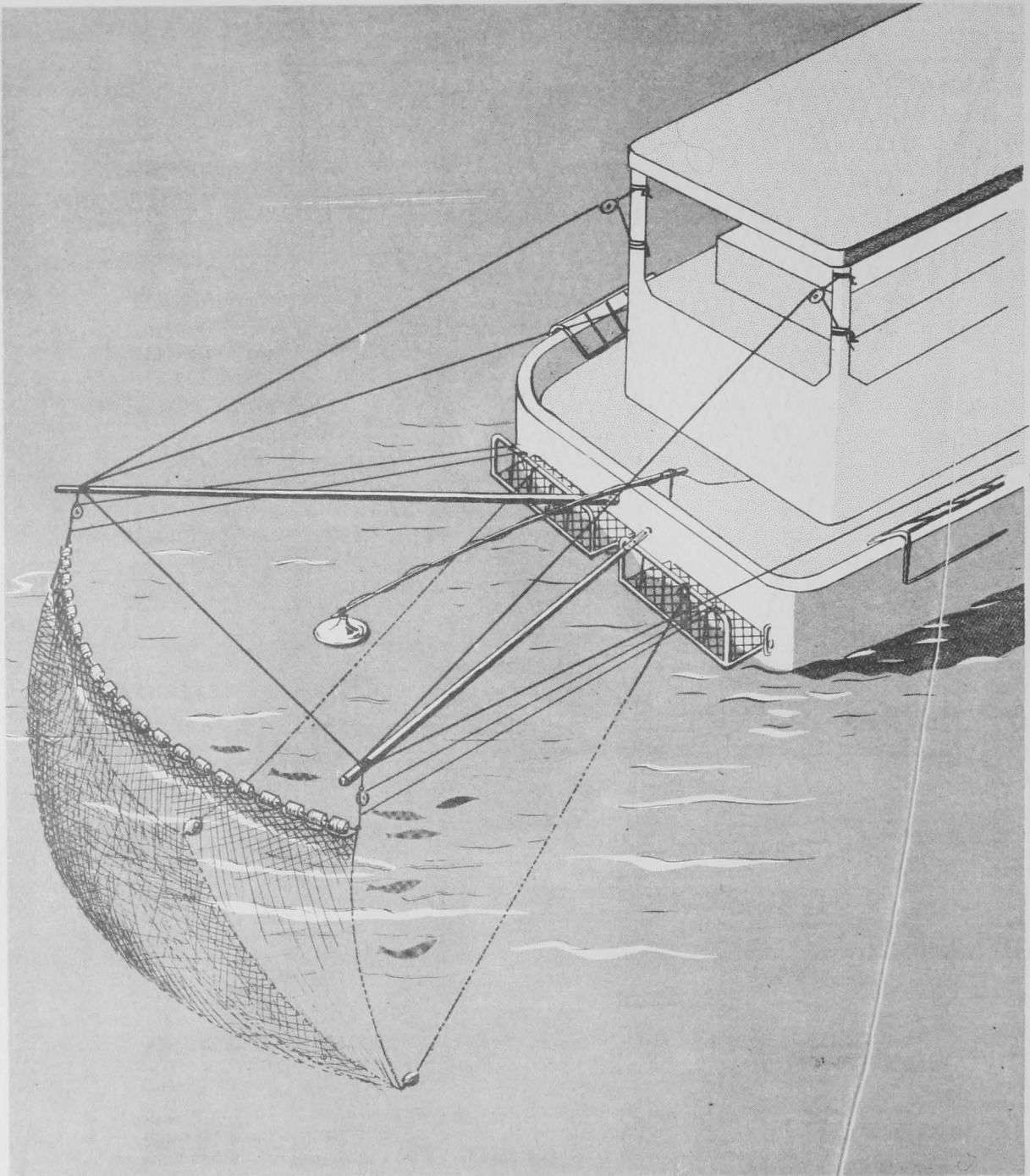
DETAILS OF "PRESET NET" DEVELOPED BY THE MASTER OF THE OREGON FOR BAIT FISHING UNDER A LIGHT.

Haul-in lines were attached to each of the 5-pound leads. A light was hung about a foot above the water and 15 feet back of the racks.

The net was placed in the water with the corks pulled out to the end of the poles and the haul-in lines slack so that the net hung straight down, parallel to the stern and about 20 feet out. The light was placed and when sufficient bait had balled, a set could be made by first pulling up the leads then hauling in the corks.

We were concerned about the effect the hanging net might have on bringing up bait to the light and tested it thoroughly. We were very surprised to find that the bait actually balled better with the net in the water and it was probably due to the fact that the net tends to discourage large fish from making passes at the bait near the surface. By keeping the large fish down, the bait is driven up.

We noticed one other definite advantage to leaving the net in the water. The bait became used to the hanging net, and when a set was made, ran away



"PRESET NET" RIGGED FOR FISHING.

from the moving leads and sides toward the stationary corks instead of running away from the bag. As a result we missed very little bait within the area of the net and we did not need scares at any time.

When we got used to the net, we found that it was very easy to pull without danger of forming pockets. So far we have had only small bait and have had to use the blanket mesh but we hope that the advantages will be increased when we can use the half inch mesh.

The advantages of being able to make sets with the two men on watch are obvious. Several nights we made five or six sets and caught ten or fifteen pounds of bait when there was no time to set a regular night net.

Guam was the best bait area found in the Marianas Islands. Using the preset net described, a vessel with a crew of 6 to 7 men would have no trouble taking 15 to 20 pounds of bait a night for the three weeks of the month during the dark of the moon. The best areas for night bait on Guam are Apra harbor, Port Merizo, and Talofofa Bay. Day bait can be found in smaller quantities along the protected beaches and along the cliffs on the leeward side. A sampan with a crew of 17 to 20 men can take 15 to 20 pounds of bait a day along the cliffs on the leeward side of the Island, by the method described below for Saipan.

Ten pounds of bait is estimated as the minimum requirement for a day's tuna fishing for a sampan and very little of this bait can be carried over from day to day. Half to three-quarters of the bait caught is round herring, the rest being a small anchovy. The largest bait ordinarily caught is two inches long; one-fourth inch blanket mesh is necessary for its capture. It is possible that bait appears in larger quantities seasonally but, from all local information, this is unlikely.

In the Saipan area, no dependable night bait sources were found, but day bait can be made by the local method along the windward side of Saipan and the leeward side of Tinian. In this method of taking bait, the boat is anchored about 40 feet off of and parallel to the cliffs. A square blanket mesh net is laid between the boat and the cliffs and one edge sunk by leads. From 7 to 12 divers then start about 30 to 40 yards from the net and, diving and splashing along the cliffs, they drive the bait into the net. One drive will net from 1 to 3 pounds of bait. Several drives are usually necessary to obtain a day's baiting for a sampan, although they can often be made from the same anchorage. This method requires a minimum of 15 men, but 17 to 20 is more common.

OBSERVATIONS ON TUNAS: The Oregon scouted around all the islands of the Marianas group for tuna or signs of tuna. Yellowfin tuna and oceanic skipjack appeared to be present in commercial quantities. Actual tuna scouting time was severely limited by the more pressing job of looking for bait, and also by unavoidable delays ashore, so that only 5 or 6 full days could properly be called scouting days. During this short time, eight schools of fish were sighted. In each case, fish were seen under flocks of birds, or tuna were caught by a trolled jig in the vicinity where birds were seen. Three schools were identified as oceanic skipjack, one as yellowfin. In addition, about 35 flocks of birds were sighted that appeared to be over tuna or skipjack. If the Oregon had had bait for chumming, more of the schools probably could have been positively identified.

CONCLUSIONS: It is yet premature to reach final conclusions regarding the Marianas area. However, from our short experience there from conversations with local sampan fishermen and observation of their fishing methods, and from the present available data on former Japanese operations, certain important considerations may be recorded regarding the commercial potentialities and means of production of oceanic skipjack. Data on other tunas are yet too scarce to permit similar appraisal.

It is evident that there are sufficient quantities of oceanic skipjack to support a commercial fishery at least large enough to supply all local demands and permit the production of an excess above this for export, either in the round or processed, whichever is the more economically desirable.

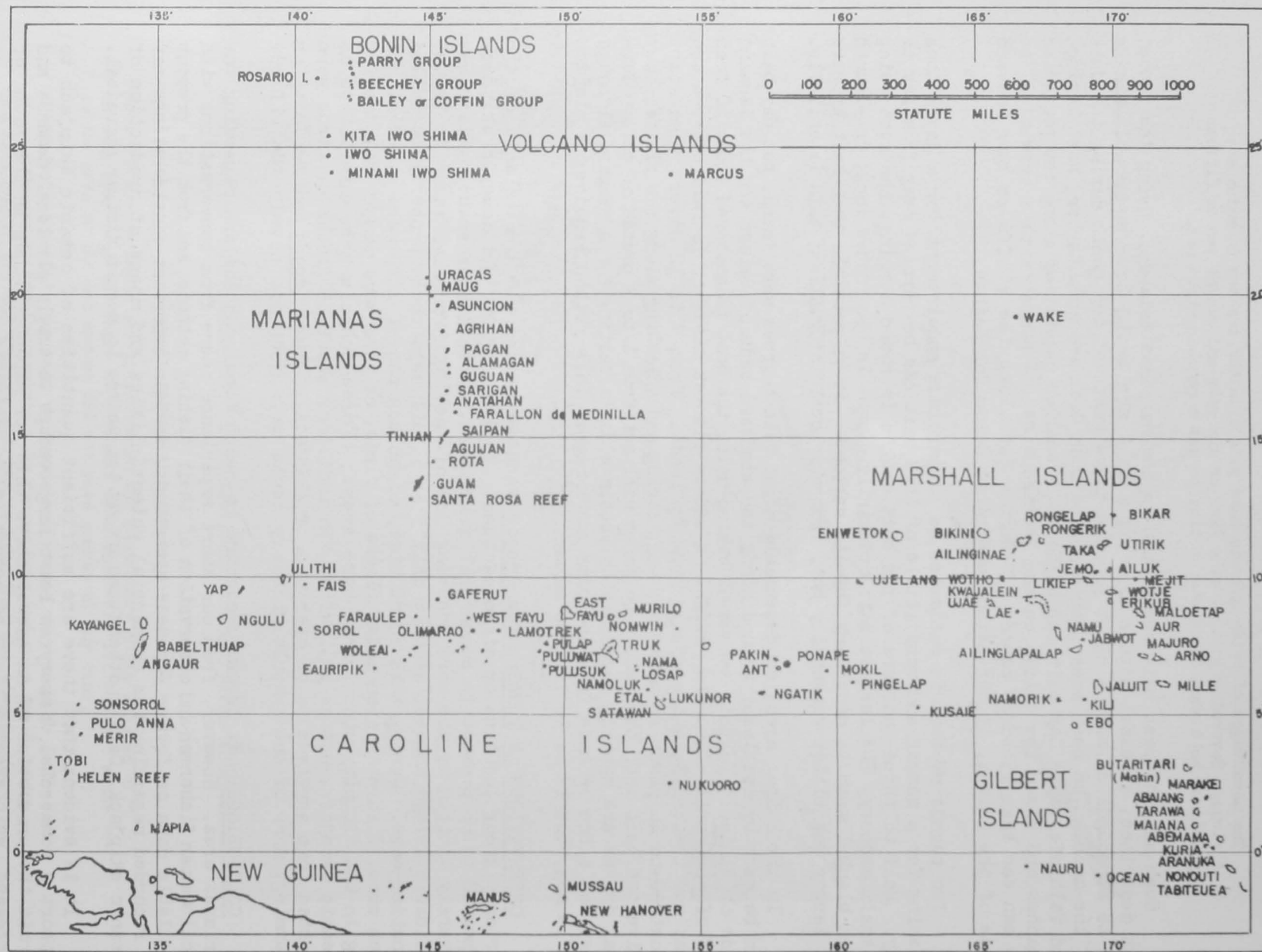


FIGURE 2 - SHOWING MAINLY THE UNITED STATES TRUST TERRITORY OF THE PACIFIC ISLANDS AREA WHERE THE VESSELS OREGON AND ALASKA CARRIED ON PART OF THE PROSPECTING FOR TUNA IN THE WESTERN PACIFIC. THE BALANCE OF THE AREA COVERED BY THESE VESSELS IS SHOWN IN FIGURE 1.

On the other hand, the supply of live bait is as yet uncertain and should be the object of further study. The prewar fishery by Japanese (Okinawan) fishermen from Saipan and Tinian, and probably the more northerly islands also, seems to have been limited by the bait supply. From the observations at Guam and from theoretical considerations, it appears likely that bait fishes are more abundant in the Guam area than elsewhere in the Marianas.

The kinds, quantities, and habitat of the bait fishes makes it appear impractical to employ large, long-range vessels like those now used by Californians off Mexico and Central America, unless, perhaps, by establishing separate bait-catching operations, using small boats which would catch and hold bait in pounds from which the larger vessel could bait up. It seems probable that a profitable fishery for oceanic skipjack in the Marianas might be based on small boats of limited individual bait capacity and limited cruising range.

Cruise in the Palau Regions of the Western Carolines

The Oregon sailed from Guam on April 22 for the Palaus, stopping briefly at Ulithi and Yapen route. From April 29 to May 23, she engaged in an extensive survey of the Palau region and also visited Pulo Anna, Sonsoral, Tobi, and Helen Reef, which are outlying islands extending some 350 miles to the south.

OBSERVATIONS ON BAIT: As in the Marianas, much of the time in the Palaus was taken up by scouting and fishing for bait. About 14 days were devoted to this task, which is a very short time in view of the difficulties of fishing in a new region.

One and a half days of scouting around Ulithi Atoll revealed only a few schools of fish about one inch long. However, the natives told us the Japanese had taken bait there, so we can assume that some bait may be found at times.

A half day of scouting in the harbor at Yap revealed no bait at all, and so little fish life that further scouting was abandoned.

The abundance of bait in the Palaus was in market contrast to Yap or Ulithi. It was immediately obvious that bait fish were plentiful. Schools of 2- to 5-inch fish, amounting to a few scoops, or several hundred scoops, could be found along much of the tortuous shore lines of the many islands between Peleliu and Koror. Jagged rocks, undercut limestone cliffs, and coral limited the seining areas. Sea urchins were also a definite hazard to seining. In some spots, there are thick clusters of a small species with long sharp spines that can inflict painful wounds. Nevertheless, schools of bait can be found and seined on numerous small sand beaches scattered throughout the islands. The bait fish were a species of the silverside family, like the Hawaiian iao, 2½ to 5 inches long, a flat herring of about the same size, and a smaller round herring. Natives of Koror told us that the silverside was "number two bait" for the Japanese. "Number one bait" was apparently a small translucent anchovy, but we did not find any of these.

The silverside was the most common bait along the beaches and cliffs, and it was the only species caught by us in important quantities. The little round herring seemed to prefer deeper water, and was more commonly caught under a light set over the stern of the Oregon. The preset net, described before, was used to catch them. No large hauls were made, but 15 to 30 pounds were collected on several occasions. The little round herring lived for several days in the bait tank, but we never had enough to make a thorough test of its durability.

The flat herring were very wild and they would dart under and around a seine or, when once surrounded, they would jump over the cork line. Sometimes the air was full of leaping fish. The silversides were wild too, and very good at finding holes under a net, but they could be seined more easily than the herring. The



TYPICAL SHORE LINE SOUTH OF KOROR, PALAU ISLANDS. BAIT FISH WERE SEINED ON THIS SAND BEACH.

most successful method seemed to be to use stealth in setting a fairly long seine around a school (preferably over a sand beach) closing all means of escape before the school became alarmed. In order to do this, men must work in the water and use face-plates or goggles

to hand-work the lead line over or around snags, but this is no hardship in the 80° F. to 82° F. water.

A typical West Coast bait lampara net did not prove successful, but further trials might be worthwhile. We got a few round herring in a lampara in deep water off Malakai wharf, but they gilled in the $\frac{1}{2}$ -inch stretch mesh of the bag, so if a lampara is used it should have finer mesh.

In spite of the fact that bait was plentiful, catching enough to fill the Oregon's tanks was not easy. A discouraging number of blank or nearly blank hauls were made, and difficulties were experienced in keeping the fish alive. On one occasion (May 12), about 65 scoops of silversides in the aft tank started dying suddenly about 12 hours after they were put in the tank. The cause of this mortality could not be determined. Most of the dying fish had "red noses," which may have resulted from their habit of pushing against the web while the seine is being dried up. These particular fish were from a set made with a Galapagos net of relatively hard web and fished like a beach seine.

The after bait tank was the one in which iao from French Frigate Shoals suffered heavy losses (see activities at French Frigate Shoals and Line Islands), but the intake screen had been altered on May 6 from a single large vertical slot to a diffusion chamber with many slots extending along the base of one side. Conditions in the tank, by themselves, could not have caused all the loss because another batch of silverside lived fairly well in it, without any further alterations in the tank or any changes in the volume of water pumped.

The batch of bait which was held most successfully was "made" on May 16, north of Eil Malk, Palau. On this day, 130 scoops of medium-sized (about 4") silversides were taken in four sets. A "Hawaiian net" was used. This was 40 fathoms by $1\frac{1}{2}$ fathoms of woven or blanket mesh, $\frac{1}{5}$ -inch square (5 meshes to the inch).

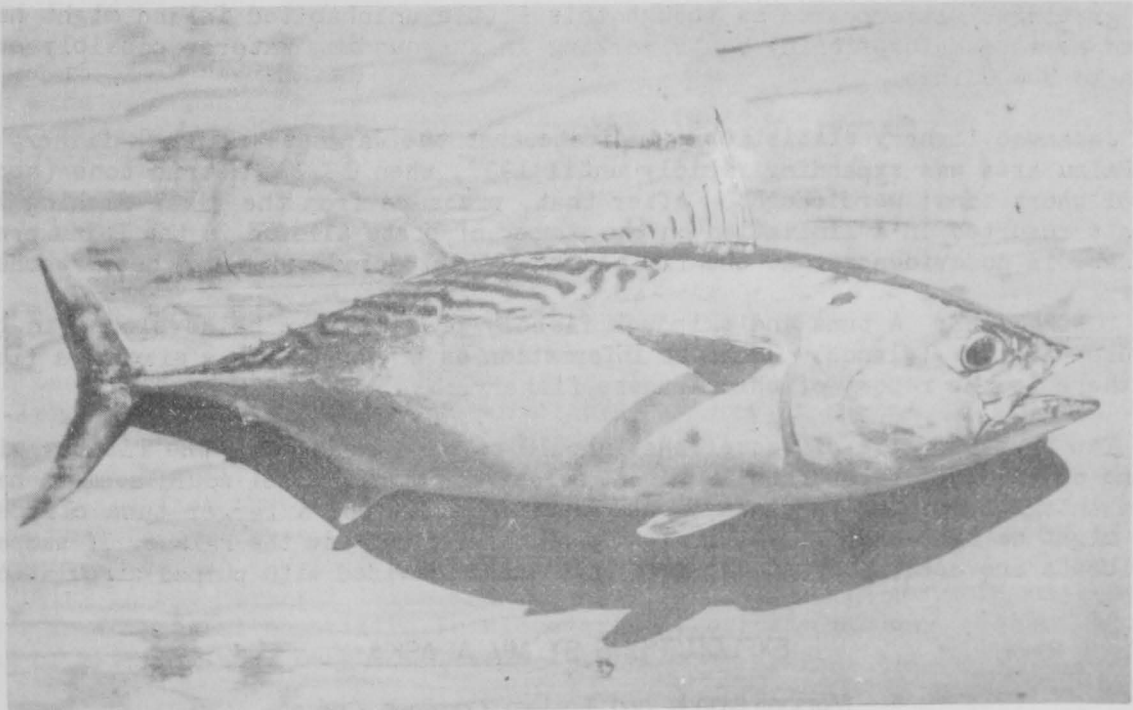
The 130 scoops were divided between all tanks, 40 going in the brine well, 70 in the forward tank, and 10 in the after tank. The 10 put in the aft tank were the last fish scooped from a receiver. Partly because of choppy seas, this batch had rough handling in the receiver and, for this reason, they were isolated in the

after tank. Therefore, it was not surprising to find about half of them dying at 2:00 A. M. on the next morning. The rest of the bait continued to live well with an estimated mortality of about 10 percent daily. It was taken on the scouting trip to Helen Reef, and the last few scoops were dumped on June 2, about 2 days from Wake Island. It had been fed only 2 or 3 times, and much of it had been used up for chum.

As a result of the Oregon's explorations on the bait situation, it can be said that bait is plentiful in the Palaus, though it is difficult to catch. At least two kinds of bait fish, the silverside and the round herring, can be kept alive in the tanks of a modern tuna clipper. The Japanese at Saipan used bait tanks which depended upon holes through the hull for circulation of water and, with these tanks, they could not keep bait alive overnight.^{4/} Natives at Koror reported that the Japanese used the same method in the Palaus.

The natives at Koror also reported that the Japanese used several bait-catching boats to supply bait to fishing boats, and that bait was held for several days in an enclosure from which the fishing boats were supplied. If large tuna clippers are to operate in the Palaus, this might be the best way to solve the bait problem.

OBSERVATIONS ON TUNA: About 11 days were spent scouting for tuna in the Palau region, including a trip southward to Sonsoral Island, Pulo Anna, Tobi, and Helen Reef. During this short period, 23 schools of fish were seen under birds, and 14 of these could be identified either by a good view of the fish or by actually bringing a few on deck. There were seven schools of oceanic skipjack, five of



BLACK SKIPJACK OR BONITO, EUTHYNNUS YAITO. FRENCH FRIGATE SHOALS.

big-eyed tuna, one of mixed oceanic skipjack and big-eyed tuna, and one of black skipjack. (Specimens from some of these schools have been preserved and exact identification awaits further study.) In addition, there were signs of many more;
^{4/}See footnote on page 8.

that is, flocks of birds were seen that may have been over fish. About 20 such flocks were seen, but an accurate record was not kept because small groups of birds would usually be in sight all the time the vessel was running along the reefs. Tuna seemed to be most abundant along the southeast side of the Palaus and around Helen Reef. Very few signs of fish were seen on the northwest side of the Palaus.

Bait was tossed at most of the identified schools, as well as under some birds when fish were not seen. The bait (mostly silversides) behaved very well, forming little schools and following the vessel. In one case, a little school of bait came up under the counter and was dipped up with a scoop and used again. The tuna and skipjack took the bait, but all of the fish seen were very wild and erratic, so we never landed more than a few specimens from any one school.

Both at Koror and at Sonsoral, the natives volunteered the information that tuna did not bite very well during May because that was their spawning time. The natives at Koror also said that Japanese skipjack boats did not go out in May, for the same reason. The large individuals of both big-eyed tuna and oceanic skipjack collected were either in or very close to spawning condition, which would seem to confirm the natives' reports.

There is some indication that the Japanese tuna and skipjack fishery in the Palau Islands extended well south of that group. Natives at Sonsoral, Pulo Anna, and Tobi Islands reported that Japanese fished around those islands, and on the one small sand spit island at Helen Reef we discovered a ruined building that may have been used to smoke fish for fish sticks or "katsuobushi." Under the wreckage of the building, we could see three or four brick oven-like fireplaces with iron doors and iron gratings. It appeared as though this little uninhabited island might have served as a base for fishing boats working in surrounding waters, possibly even south to New Guinea.

Japanese fishery statistics^{5/} indicate that the Japanese skipjack fishery in the Palau area was expanding rapidly until 1937, when 13,774 metric tons (about 15,051 short tons) were caught. After that, pressure from the rival fishing interests resulted in a limitation on the number of boats allowed in the Palau area, so there is no evidence that the limit of profitable production had been reached.

CONCLUSIONS: A tuna and skipjack fishery probably can be developed in the Western Caroline Islands. Our only information as to the possible size of a fishery there is the report of the Japanese fishery.

The type and size of vessel that should be used to develop the fishery will depend on the logistics of the area. A relatively small vessel would seem to have an advantage in coming in close to the bait grounds, but a larger tuna clipper-type might be necessary if the fish must be carried outside the Palaus. If sampan-type boats are used, they should have bait tanks provided with pumped circulation.

EXPLORATIONS BY MV ALASKA

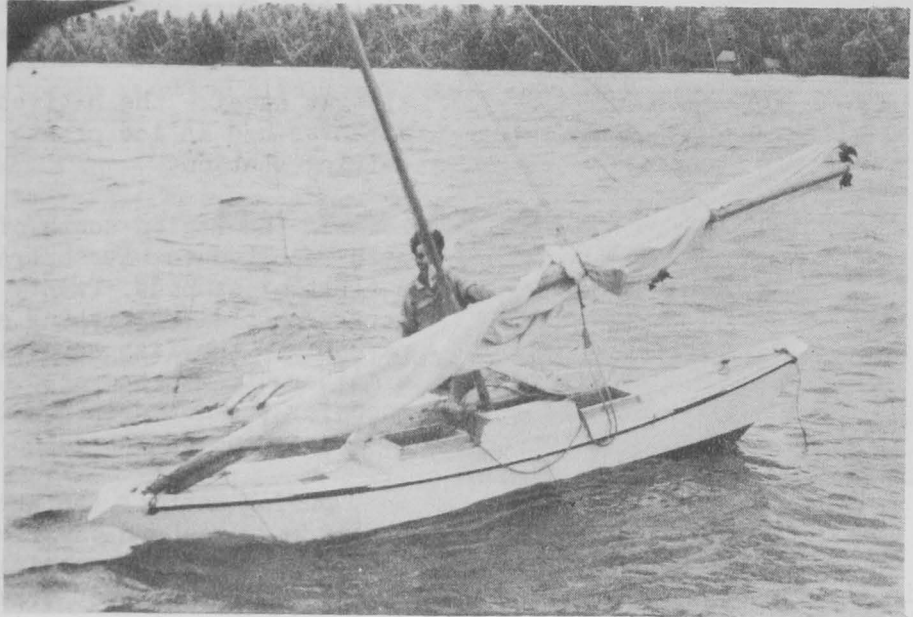
Marshall Islands and Eastern Carolines Cruise

The Alaska left Honolulu on January 17, followed the Hawaiian chain of islands to French Frigate Shoals, then proceeded southwesterly, arriving in the Marshall Islands on January 29 when Milli Atoll was raised. From Milli, she scouted northward to Kwajalein, then southward again to Ebon. From Ebon, she headed for Kusai, 5/Japanese Tuna Fisheries, Fishery Leaflet 297, Fish and Wildlife Service.

the most eastern of the Caroline Islands, and then worked westward from island to island reaching Truk on February 19. The waters around Truk, including Kuop, Nama and Losap, were scouted fairly thoroughly during the next three weeks. Leaving Truk on March 12, she then headed southward to Kapingamorangi and then back to Honolulu by way of the Ellice, Phoenix, and Line Islands, arriving at Honolulu April 10.

OBSERVATIONS ON BAIT: Since the Alaska was not immediately concerned with bait, there was no special effort to scout for it. In general, cursory examina-

tions of beaches through the Marshalls and eastern Carolines indicated that bait was not abundant. Schools of flat herring, 3 to 5 inches long, were seen at Ailinglaplap in the Marshalls and at Truk in the Carolines, but judging by the Oregon's experience with herring in the Palaus (see p. 13), these might be difficult to catch. Marshall Islanders told us that the Japanese found plenty of bait at Jaluit, but the supply was limited



TYPICAL MARSHALL ISLANDS OUTRIGGER CANOE OFTEN USED TO TROLL FOR TUNA AND SKIPJACK.

at Ailinglaplap. In the eastern Carolines, the natives told us the Japanese found bait at Losap and Satowan, south of Truk.

OBSERVATIONS ON TUNA: Very few fish were seen during the Alaska's cruise, and no attempt was made to make a set. Only two schools of fish that may have been tuna were sighted in the Marshalls and four in the Carolines. None of these was large and the fish were not seen closely enough to permit identification. Six schools that appeared to be skipjack were sighted south of the Equator on the run through the Ellice and Phoenix Islands. One school was seen near Palmyra. However, the fact that very few tuna schools were sighted by the Alaska does not prove that tuna might not be found in commercial quantities. From records of the Japanese fishery^{6/} and from biological work done under the auspices of the Navy at Bikini in the Marshall Islands, it is known that yellowfin and skipjack schools occur in commercial quantities in Micronesia at certain seasons. About 15,000 tons of skipjack were caught in the vicinity of Truk, Panape, and Jaluit in 1937.^{6/}

The natives were interviewed on fishing methods and seasons at almost every island visited. In all, 21 interviews were secured from 14 widely separated islands. The reports were almost unanimous in agreeing that January, February, and March were poor months for tuna fishing. Almost all agree that May, June, July, and August were the best months. The disagreements as to April and the fall months ^{6/}Fisheries of Former Japanese Mandated Islands, Fishery Leaflet 273; Japanese Tuna Fisheries, Fishery Leaflet 297; Fish and Wildlife Service.

might indicate a natural variability in the date of starting the season and a gradual decline in availability of fish towards its close. Apparently, a few tuna could be caught by trolling at any time of year.



AT LOSAP, SOUTH OF TRUK. THE ISLAND CHIEF COMING OUT TO MEET THE ALASKA.

Occasionally, the natives could tell us something about the extent of the Japanese fishery. At Jaluit, the natives said the Japanese operated a mothership and 6 to 10 boats in the vicinity. They also caught bait there for fishing around Milli Atoll and Killi Island.

At Kusai, the natives reported that the Japanese had an ice plant that served as a receiving station.

In the region south of Truk, the Japanese were reported to have operated a mothership and a fleet of sampans. Twenty sampans and a tender were reported as fishing around Losap and, apparently, the fish were taken to Satawan where a mothership was operated. The natives gathered wood for the mothership, which may indicate that at least some of the catch was smoked.

During most of the exploration of the Marshalls and eastern Carolines, the weather was too rough for purse seining, except, possibly, in the lee of some of the atolls. The steady northeast trade winds were usually estimated as blowing at Beaufort force three or four and sometimes five. However, that does not necessarily mean that a purse seiner could not work in that area. The natives in the Marshalls reported that the weather was unusually windy during the Alaska's visit. Also, according to Pilot charts of the Hydrographic Office, the northeast trade winds are less strong during the summer months.

CONCLUSIONS: It seems obvious that the Alaska's exploratory cruise was made at the wrong time of year, both for tuna and for weather. It may be possible to develop a tuna fishery in the Marshalls and eastern Carolines, but it probably will be limited to the late spring and early summer months. The Japanese fishery provides the only clue as to the possible productivity of a tuna and skipjack fishery in eastern Micronesia.

