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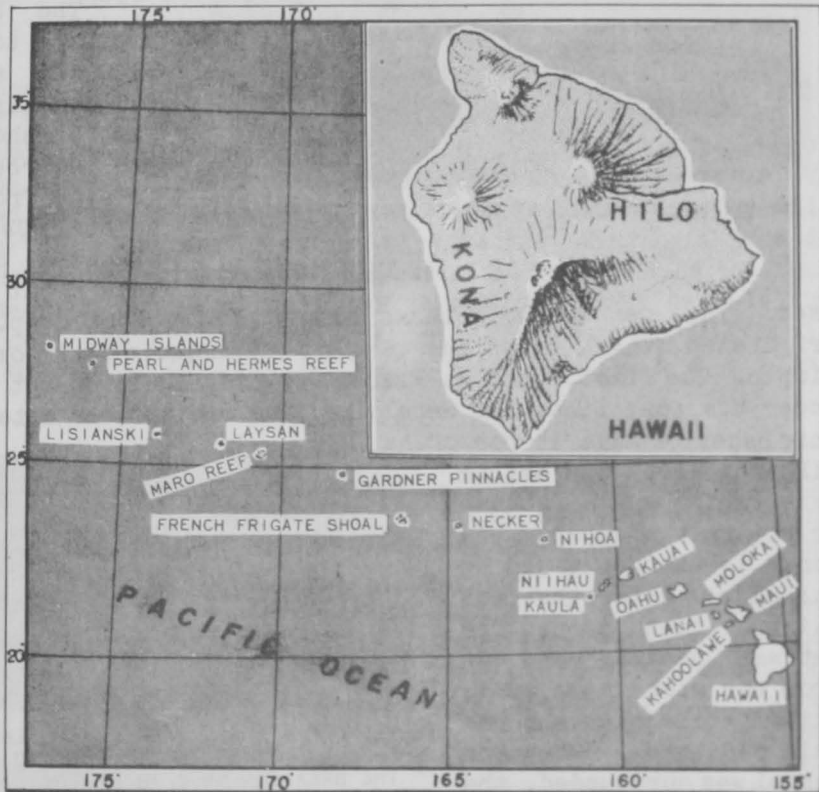
FISHERY EXPLORATION IN THE HAWAIIAN ISLANDS

(AUGUST TO OCTOBER 1948, BY THE VESSEL OREGON OF THE
PACIFIC EXPLORATION COMPANY)

By Howard H. Eckles *

INTRODUCTION

From January to October 1948, the Pacific Exploration Company, under contract with the Reconstruction Finance Corporation, operated the motor vessels Oregon and Alaska in the region of the Hawaiian Islands and the Pacific Trust Territories. Scientists from the Fish and Wildlife Service were detailed to accompany these vessels to observe the results of the exploratory fishing and to collect biological and oceanographical data. The period from January to June 1948 was covered in a previous report by O. R. Smith and M. B. Schaefer.^{1/} The present report covers the activities of the M/V Oregon from August to October 1948. I was aboard as observer from August 11 to September 19, 1948.



THE M/V OREGON CONDUCTED EXPLORATORY FISHING IN THE HAWAIIAN ISLANDS REGION JANUARY-JUNE 1948. INSET SHOWS THE KONA AND HILO COASTS ON THE ISLAND OF HAWAII.

The Oregon, equipped for tuna live-bait fishing, sailed from Honolulu on August 11, to conduct exploratory tuna fishing operations outside the areas normally fished by the local Hawaiian sampan fishery. A full load of bait was obtained at French Frigate Shoals. Brooks Bank, St. Rogatien Bank, and part of Gardner Pinnacles Bank to the northwest of French Frigate Shoals were scouted for tuna. The Oregon proceeded along the chain of

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^{1/}"Fishery Exploration in the Western Pacific (January to June, 1948, by Vessels of the Pacific Exploration Company)," Commercial Fisheries Review, March 1949, page 1.

small islands and banks from French Frigate Shoals to Kauai. Next, the Kona Coast region off the Island of Hawaii and then the area around Maui and Molokai were scouted for tuna. The vessel returned to Honolulu on September 15. During the first part of October, further bait fishing and tuna fishing activities were carried out near Maui and southwest Oahu. This completed the exploratory tour and the Oregon returned to the mainland.

OBSERVATIONS ON BAIT

East Island is the most accessible of the small islands at French Frigate Shoals; so bait was sought there before the other islands were visited. Approx-



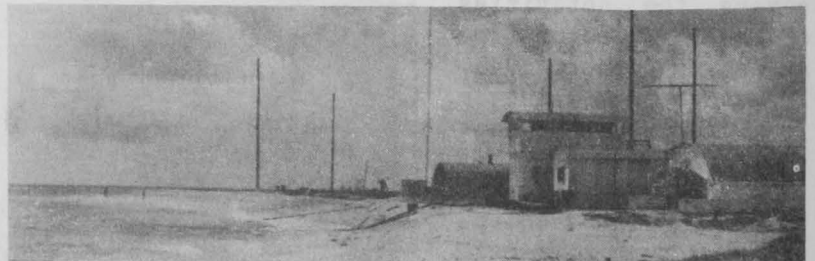
THE OREGON ANCHORED AT FRENCH FRIGATE SHOALS.

mately 300 "scoops"^{2/} of small silver-sides (Hepsetia insularum), known to the Hawaiians as "iao", were caught at East Island on August 14 and 15. This is the same species of bait fish which the Oregon caught when she visited this same area in January and February 1948.

The bait fishing methods were similar to those already described by Smith and Schaefer. The "iao" found at East Island was mostly found just offshore between the breakers and the reef in schools which ranged in size from approximately 10 to 100 scoops. Usually a surround net, constructed of blanket mesh with openings about 1/5-inch on a side, was

used. This net was 18 fathoms long and 2 fathoms deep. The "iao" is not easily frightened, which makes the task of surrounding all or part of a school rather simple. The "iao" found at French Frigate Shoals do not sound or attempt to escape under the lead line, but merely mill in one spot or attempt to jump the cork line.

This behavior made it possible to set the net in water which was 2 fathoms or slightly deeper, as long as the net could be pulled into water that was waist or chest deep. The net was usually paid out from the stern of a small skiff while one end was held on shore. When the school was surrounded, the net was pulled in by the lead line. It was often

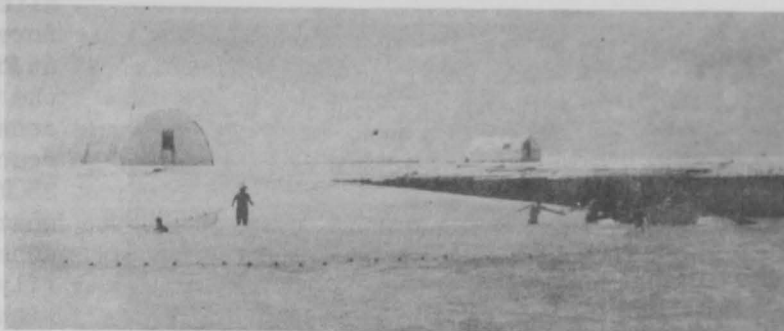


VIEW OF A CORAL SAND BEACH, EAST ISLAND, FRENCH FRIGATE SHOALS. SEVERAL SETS FOR IAO WERE MADE JUST OUTSIDE OF THE BREAKERS ON THIS BEACH.

necessary for the fishermen to dive down along the lead line and free it from rocks or snags. Goggles or face plates were used to enable the divers to see clearly under water. When the net was mostly in, a pocket was formed from the webbing and the captured bait was transferred to a bait receiver by lowering a gate on one end and allowing the fish to swim inside. At times, it was possible

2/A "scoop" is estimated to contain about 10 pounds of fish.

to capture an entire school or to recapture fish which escaped the net, since the "iao" would lie in adjacent areas while the fish caught in one set were being transferred into the bait receiver. Thus, it was possible to reset the net upon these same fish. It was also possible to herd the "iao." Consequently, the fishermen were able to drive a school into the net while it was being paid out.

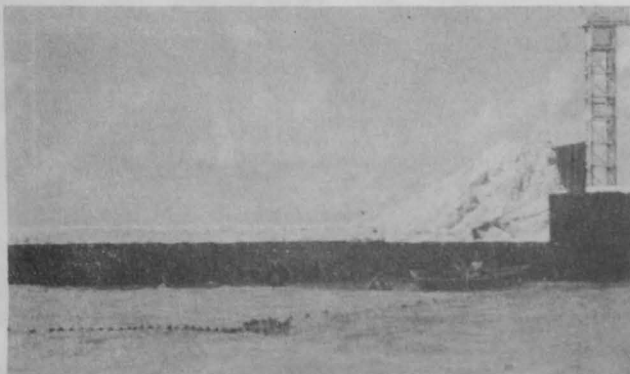


MAKING A SET ON A SCHOOL OF IAO (*HEPSETIA INSULARUM*) TERN ISLAND, FRENCH FRIGATE SHOALS. MOST SETS WERE MADE IN WATER WAIST OR CHEST DEEP.

After the first day, August 14, bait was scarce at East Island. So the Oregon was anchored off Gin and Little Gin Islands. Hawaiian fishermen aboard the vessel who had visited the area in March 1948 reported large quantities of "iao" on the sandy shores of Little Gin Island. However, only a few scattered schools were found in August. Seventy-eight scoops were taken during two days' bait fishing there.

The Oregon was equipped with two bait tanks on the deck aft and a well on each side just forward of the midships section, equipped to hold bait, and the methods of transporting and handling bait on the Oregon were similar to those used by California live-bait tuna fishermen off Mexico and Central America. Two hundred scoops were placed in the forward bait tank. These fish started milling almost immediately and survival was good. Bait placed in the after bait tank did not fare as well. Forty scoops were lost out of 180 originally placed in the tank. Part of these fish were handled rather roughly, as it was necessary to hold them longer than usual in the net, and transfer to the bait receiver was difficult. Smith and Schaefer noted a similar difficulty in holding fish in the aft bait tank.

After visiting Disappearing Island and East Island a second time, where no bait was sighted, the Oregon was anchored off Tern Island. This island is not easily reached, due to a wide expanse of reefs and coral heads. Therefore, it was necessary to anchor close by the reef and go in with a power boat and bait receiver. Very large schools of "iao" were present off Tern Island in water 3-15 feet deep. They occurred mainly in the quiet water alongside a dock area. Over 500 scoops were taken during two days. This completed the vessel's bait load of approximately 900 scoops.



CLOSING THE SURROUND NET AROUND A SCHOOL OF IAO AT TERN ISLAND.

During the period August 14 to 19, all of the more accessible islands of French Frigate Shoals had been scouted for bait with the results above noted. Whether the stock of "iao" present in this area would maintain a sizable bait fishery is not known. However, quantities of bait sufficient to supply at least two or possibly three tuna clippers the

size of the Oregon were present during the August period when the vessel was at French Frigate Shoals. Weather conditions were quite favorable during this period,



TOWING BAIT RECEIVER, FROM THE SAND ISLANDS OF FRENCH FRIGATE SHOALS, TO THE OREGON. A SKIFF IS PLACED ACROSS THE STERN TO GIVE ADDED BUOYANCY TO THE BAIT RECEIVER.

although observations made before and after the time spent at French Frigate Shoals showed the northeast trade winds to be constant in this area, often reaching velocities as high as 25 miles per hour. Thus, calm weather may be the exception and considerable chop might ordinarily be encountered while bait fishing in the French Frigate Shoals area. These conditions, although not prohibitive, would hamper transferring bait in receivers and brailing from the receiver to the live-bait tanks.

Mortality of the bait after leaving French Frigate Shoals was negligible after the first day, on which approximately 100 scoops died. This mortality occurred mainly in the two brine wells among the last fish transferred aboard the Oregon, and it is believed that it was mainly due to rough handling, as the "iao" survived well after



TRANSFERRING "IAO" FROM BAIT RECEIVER TO THE TUNA EXPLORATORY FISHING VESSEL, OREGON, OFF FRENCH FRIGATE SHOALS, HAWAIIAN ISLANDS. THE BAIT RECEIVER WAS TOWED FROM THE SMALL SAND ISLANDS IN THE AREA WHERE THE BAIT WAS TAKEN.

becoming accustomed to the conditions in the tanks, even though fairly rough seas were encountered. The bait were fed ground-up fish and fish blood daily.

The "iao", though not generally used by Hawaiian skipjack fishermen, has proven to be a good tuna bait. It is readily taken by tuna when thrown as chum. When the Oregon wasn't moving, or was moving very slowly, the bait would school up alongside the boat and a few times it was possible to recapture the fish with a scoop net and return them to the bait tank. As many as eight "iao" were removed from one skipjack stomach after capture. Most of the bait was expended as chum for the tuna schools encountered during the trip, but a few scoops remained aboard the Oregon on its arrival at Honolulu on September 15.

Limited observations on bait at other islands in the Hawaiian Chain were possible, although no effort was made to catch bait except at Kihei on Maalaea

Bay, Maui. The bait found at Kihei is a small anchovy locally called "nehu" (Anchoviella purpureus).

This fish is not only the most common kind of bait in the Hawaiian area, but it is also preferred above other species by the Hawaiian skipjack fishermen. It occurs at Kihei in schools similar in size to the schools of "iao," just off the breakers and out into deeper water. It prefers muddy or sandy bottoms and very often occurs in cloudy waters, so that a slight flipping or "breezing" at the surface is the



DIPPING NET INTO BAIT RECEIVER.

only indication that a school is present. The Oregon's crew took nearly 400 scoops of "nehu" using a 40-fathom by 2-fathom net. However, a somewhat longer and deeper net is needed for this fish, as it often occurred in waters three or more fathoms deep. The vessel returned to Kihei during the first part of October. This time, a blanket mesh seine 72 fathoms long and $5\frac{1}{2}$ fathoms deep in the center was used. This net tapered to $3\frac{1}{2}$ fathoms at each end. Approximately 900 scoops of "nehu" were taken during two days. The "nehu" is both smaller and more delicate than the "iao." When transferring this bait from the net to the receiver and from the receiver to the bait tanks, it was necessary to use buckets to make certain that the fish were not crowded excessively. The "nehu" lived well in the bait tanks for several days, until expended on schools of skipjack.

OBSERVATIONS ON TUNA AND TUNA FISHING

After obtaining bait at French Frigate Shoals, a short run was made to the eastern side of Gardner Pinnacles Bank, by way of Brooks Bank and St. Rogatien Bank. Calm weather was encountered on the first day's fishing, but thereafter unfavorable weather conditions prevailed. Numerous black skipjack (Euthynnus yaito, the western Pacific relative of the black skipjack, Euthynnus lineatus, which occurs off Mexico and Central America) and a few 15- to 25-pound yellowfin

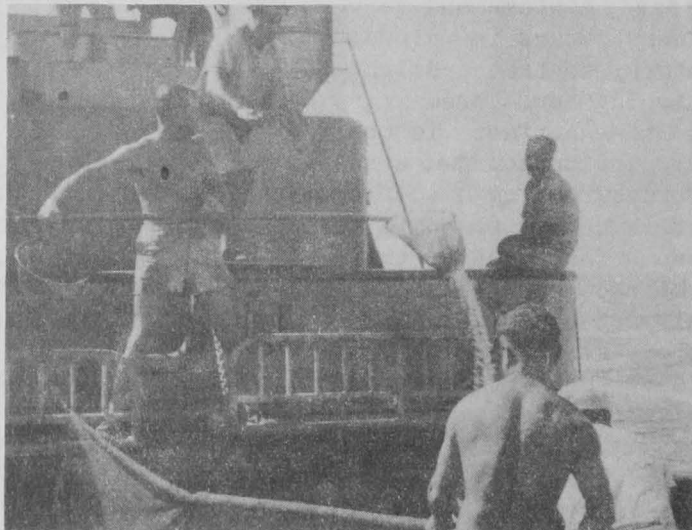
tuna (Neothunnus macropterus) were taken on troll lines and by the fishermen in the racks on the first day. One small school of one-pole^{3/} yellowfin tuna was



TRANSFERRING BAIT (IAO) FROM BAIT RECEIVER TO THE OREGON'S BAIT TANKS.

were absent on banks at this time and the tuna caught were all located by means of trolling.

From August 22 to August 26, the Oregon explored the chain of banks from French Frigate Shoals to Kauai, including waters around Necker, Nihoa, and Niihau Islands. Black skipjack, wahoo (Acanthocybium solandri), and dolphin (Coryphaena hippurus) were taken frequently on troll lines. Black skipjack were abundant on banks and around the islands in relatively shallow water. Sea birds were very common in this area east of French Frigate Shoals. Sooty terns, noddy terns, and wedge-tailed shearwaters were common. Booby birds and the black-footed albatross were present, but tended to remain in the vicinity of the small islands. On August 24, west of Nihoa, the first school of oceanic skipjack (Katsuwonus pelamis) encountered was located by birds "working."^{4/} The school was chummed up and 26 fish were taken by fishermen in the racks. The fish were small, averaging 4-5 pounds in weight. They were reluctant to approach the Oregon and they did not bite well except for a brief period. During the morning and afternoon of August 25, west of Niihau Island, numerous schools of very small black skipjack averaging 11-12 inches and



CREW MEMBERS OF THE OREGON BRAILING IAO (HEPSETIA INSULARUM) FROM A BAIT RECEIVER INTO LIVE BAIT TANKS. NOTE USE OF THE CROWDER NET.

^{3/}A term used in the eastern Pacific tuna fishery to designate fish under 30 pounds which would ordinarily be caught by one fisherman using one pole.

^{4/}Birds' diving and flying low over the waves while feeding.

one pound in weight were located under birds. These fish took bait readily and were easily caught from racks. However, because the fish were so small, fishing for them was soon discontinued. Two yellowfin tuna were taken on troll lines late the same afternoon, but schools of yellowfin tuna could not be located by chumming these areas. On August 26, numerous schools of oceanic skipjack were located by observing birds diving and feeding at the surface in the area southwest of Niihau Island. Indications were that oceanic skipjack were abundant here, as birds could be seen "working" and fish were jumping over a wide area. Skipjack were chummed up to the Oregon on two different occasions and nearly 100 fish were taken from the racks. These were also small 4- to 5-pound fish. As before, they were reluctant to take either live-bait hooks or "squids," although the "iao" were taken readily.

From August 27 to August 29, tuna were sought in the area 35 miles northeast of Nawiliwili, Kauai. The weather during this period was generally bad for tuna fishing due to rain, poor visibility, and strong northeast trade winds. Four

schools of large oceanic skipjack, probably 15 to 25 pounds, were located by birds during the three days. The skipjack were moving fast and were feeding on flying fish. This made it difficult to catch the fish or to maneuver into a position so that bait could be thrown effectively. Strong winds made chumming difficult, because the bait fish were often blown out of position alongside the racks when thrown from the height of the Oregon's bait tanks, which were approximately 10 feet



VIEW OF NIHOA ISLAND LOOKING WEST FROM THE STERN OF THE OREGON.

above the water. Rough seas and rolling of the ship made the use of side racks extremely hazardous. The skipjack were seen jumping astern of the vessel after the bait which had been thrown, but none came close enough to the racks to be caught. It was evident that there were commercial quantities of skipjack in this vicinity, but their rapid movement and poor weather conditions made it impossible to make a catch.

In the hopes of finding more tuna and better weather conditions, the Kona Coast off the Island of Hawaii and the area northwest of the Kona Coast around to Hilo, Hawaii, were scouted from September 1 to September 9. The southwest side of Maui and the area around Lanai and Kahoolawe Islands were scouted en route. Several schools of small skipjack were spotted by "working" birds, but the fish were scattered and moving rapidly; so chumming was not successful. The weather was generally good, except when crossing channels or outside the lee of the islands. The weather on the Kona Coast was continually good during this period, as there is a lee from the trade winds formed by the high elevation of the Island of Hawaii. However, signs of tuna were scarce and only occasional catches of oceanic skipjack were made. Schools were located by birds "working" at the surface, but the behavior of the fish was so erratic that it was difficult to maneuver the ship into position to chum effectively. At times, a school was worked up astern and

alongside, but the skipjack kept outside the reach of the tuna poles, even though extra long ones were used. An opportunity was offered to observe these schools.



DISPLAYING A SMALL YELLOWFIN TUNA (*NEOTHUNNUS MACROPTERUS*) TAKEN ON ST. ROGATIEN BANK NORTH WEST OF FRENCH FRIGATE SHOALS.

The numbers of fish did not appear to be large nor were they concentrated into compact schools. A few fish were apparently spread over a wide area. Local fishermen of the Kona Coast stated that large schools of both yellowfin and skipjack tuna are fairly common on the Kona Coast in the late spring and summer.

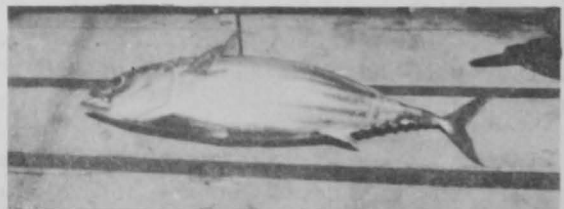
From the Kona Coast, the *Oregon* proceeded to Maui. The areas around Maui and Lanai were scouted until September 14. One very large school of oceanic skipjack was located to the windward of Maui and was followed and chummed for nearly two hours. Fish were seen breaking the surface and many birds were flying and "working" over an area estimated to be nearly a mile square. However, the main school apparently remained deep, as no fish were brought up to the vessel's racks. The great numbers of birds, and their actions, indicated that an extremely large school of fish were present. Other flocks of birds were seen from time to time, but chumming usually raised no fish.

As the bait supply was nearly exhausted and provisions were running low, it was necessary to return to Honolulu.

In early October, further scouting was carried out around Maui and southwest Oahu. As before, numerous flocks of birds were present and some oceanic skipjack schools were located. Approximately 60 skipjack, 10 to 15 pounds, were taken southwest of Oahu. These fish were also reluctant to bite.

SUMMARY AND CONCLUSIONS

During the period from the middle of August to early October, approximately 50 schools of tuna were encountered. Only one school of yellowfin tuna was seen, although yellowfin were taken on troll lines at five different times, so that other schools were probably present. Thirteen schools of black skipjack were encountered. These were mainly located by trolling, although three schools were located by following "working" birds. Twenty-one schools of oceanic skipjack were encountered. All of these were located by birds. No oceanic skipjack were taken on troll lines. Fourteen unidentified schools were indicated by large numbers of birds. The oceanic skipjack was most common around Kauai, Oahu, Molokai, and Hawaii, and it is probable that most of the unidentified schools were oceanic skipjack. The black skipjack was most common near the islands and shoals from Gardner Pinnacles to Niihau. Yellowfin tuna were not seen in abundance during this survey, but Hawaiian fishermen reported two large schools of yellowfin near Niihau during September while the *Oregon* was on the Kona Coast.



OCEANIC SKIPJACK (*KATSUWONUS PELAMIS*) TAKEN OFF THE KONA COAST, HAWAII.

Whether mainland-style "tuna clippers" would be commercially feasible in the Hawaiian Islands cannot be determined by an exploratory period of such a short duration. It certainly can be stated that the abundance of tuna is sufficient for considerable expansion of the present local fishery carried on by live-bait sampans for skipjack and "flagline"^{5/} boats for yellowfin tuna, which is now well established in the waters adjacent to the main islands. Sea conditions resulting from the northeast trade winds make the operation of a tuna clipper difficult in most areas except in the lee of the islands. The rapid and erratic movements of the tuna make a fast and highly maneuverable vessel desirable. A thorough knowledge of local conditions would be essential. Experience is necessary to be able to estimate the movements of a tuna school by observing the movements of birds above them. The tuna in this area rarely stop and feed in one spot; therefore, skill is needed in maneuvering and running with the school to insure effective chumming and the landing of a good catch.



FISHERMEN OF THE OREGON IN THE RACKS.

The sampan-type vessels used in Hawaii are not generally equipped with circulating pumps for live-bait wells, or with refrigeration for holding the catch. The addition of these features to this type of vessel, or the use of a smaller, more rapidly maneuverable tuna clipper, would probably give a more efficient type of vessel for fishing tuna in the Hawaiian area.

^{5/}A fishery employing long-lines buoyed to fish several fathoms below the surface. Hooks are baited with dead fish.



AQUATIC RESOURCES OF THE RYUKYU AREA

Obtaining a supply of live bait is the most important problem of the Ryukyu skipjack fisherman. The Japanese sardine and anchovy, which are considered best for skipjack fishing, are not available in Ryukyu waters, so the natives resort to whatever species of small fish are present. Most important among these are the Ryukyu sardines, red scads, and cardinal fishes. Ryukyu coastal and offshore operations for the skipjack are limited by the availability of bait; very often boats cannot fish on their regular schedule because of lack of this necessity.

Skipjack fishing vessels operating from Kyushu obtain bait at a large live bait center near Kagoshima Bay, where adequate amounts of sardines (*Sardinia melanosticta*) and anchovy (*Engraulis japonicus*) are available.

--Fishery Leaflet 333