



The pole-and-line fishery for skipjack is the largest in the Hawaii fisheries. Average annual catches have been nearly 10 million pounds. Fishermen rely heavily on birds to signify that fish are present at or near the surface of the water.

Hawaii Fisheries

KEWALO BASIN IN HONOLULU is the main home of Hawaii's commercial fishing fleet and the site of its only cannery. The basin has a somber history. Kewalo can be translated as "the place of wailing." The name is well deserved. In the far past, unlucky Hawaiians who violated the tribal taboos (in Hawaiian, kapus) were taken there and drowned. But today Kewalo is a lively place. It is the spot from which the tour boats sail for Pearl Harbor. Brown amphibious Hawaiian boys dive for tourists' money. Docked there are catamarans that take visitors on moonlight sails past Diamond Head. Sleek white sport fishing craft wait for hire.

Rugged fishing sampans dock in Kewalo Basin next to the glittering tourist fleet. So far as artists are concerned, the sampans steal the show. A common sight at the basin is the painter with his easel trying to capture in oil the subtle faded colors of the sampans.

At one corner of the basin, its wide windows overlooking the busy scene, stands a fine seafood restaurant. Across the basin are the dockside research facilities of the Bureau of Commercial Fisheries Biological Laboratory. Its research vessels, *Townsend Cromwell* and *Charles H. Gilbert*, tie up there.

In some ways, Kewalo epitomizes the new Hawaii, a vigorous youthful State that is a happy blend of several cultures—Polynesian, Oriental, Yankee.

THE 20 ISLANDS OF THE HAWAIIAN CHAIN lie in an arc that runs 1,600 miles from northwest to southeast. Volcanic action formed the archipelago. The westernmost islands, worn nearly to the sea surface, are the oldest. Midway, best-known of the lee islands, is 1,300 miles northwest of Honolulu and only a few degrees from the International Date Line. It is a speck of land 2 miles square, whose highest point stands 43 feet above sea level. Hawaii, the largest, youngest, and southeasternmost of the islands, contains 4,021 square miles, and its peaks, Mauna Kea and Mauna Loa, rise 13,796 and 13,680 feet above sea level, high enough to wear a glistening coat of snow in winter.

The Hawaiian Islands rise steeply from a sea floor that averages about 3,000 fathoms (18,000 feet) deep. Fishing banks are few. The most notable is Penguin Bank off the western end of the island of Molokai, yet its 334 square miles provide little more than 1 percent of the Hawaiian catch. Off the coast of the island

of Hawaii, one reaches 1,000-fathom water no more than 3 or 4 miles from shore.

Hawaii is just south of the Tropic of Cancer, at about the same latitude as Mexico City, Mecca, Calcutta, and Hong Kong. Raked by northeast trade winds, Hawaii is rarely oppressively hot and never cold. The average high temperature is about 78° F., the average low about 70° F. Sea surface temperatures are in the same balmy range.

Hawaii stands near the boundaries of two types of waters. To the northwest and often bathing the islands in the winter is North Pacific Central Water. This is warm and highly salty. To the southeast lies North Pacific Equatorial Water, warmer and far less salty. Between the two, and transitional between them in nature, is the west-flowing extension of the California Current. During summer, the entire State is often in the path of flow of the extension. Standing like stones in a stream, the islands set up a complex pattern of eddies in the current.

HAWAII FISHERIES MOSTLY HUG THE SHORE. About three-quarters of the catch is taken within 20 miles of the islands. The area fished in 1964 was about 24,000 square miles, a little larger than Lake Michigan. In that typical year, one-fourth of the commercial catch was made in two small areas, which together were only 4.3 percent of the entire area fished. Fishing areas are within easy distance of the two chief ports, Honolulu on the island of Oahu and Hilo on the island of Hawaii. There are no known biological or oceanographic reasons for these areas to be so much more productive than others; it appears they are so heavily fished because of their convenience. The most productive area—off the small town of Waianae,



Hawaii's fishing grounds are close to the main islands. The more important commercial species are shown in typical areas where Hawaiian fishermen operate. All fishing grounds for a species are not shown.

a few miles northwest of Honolulu—lies on the lee side of the island of Oahu and hence offers calmer seas.

The Waianae fishing grounds are immensely productive. In 1964, they provided a pelagic catch of about 7 pounds per acre, which seems to be a high yield for the open sea. The great Iceland Banks, for example, while immensely rich in bottomfishes (of which Waianae has few), supply 5.3 pounds per acre of pelagic fishes. The Samoa-based longline fishery for albacore in the South Pacific averages 0.009 pound per acre, or about 0.1 percent of the Waianae yield. On the other hand, the world's richest fishery, off Peru, yields about 400 pounds per acre.

THE FISHES OF HAWAII are, on the whole, common to most warm seas. A quick introduction to the Hawaiian language, a tongue that contains only 12 letters (7 consonants and the 5 vowels), can be gained by running through a list of the fishes landed commercially in the State. Kahala, akule, mahimahi, hapuupuu, aweoweo, opakapaka—it runs to more than 60 melodious names. The most famous Hawaiian fish, the humuhumu-nukunukuapuaa of the popular song, is not caught commercially. The fish fauna is less exotic than appears at first glance, for the names are the Hawaiian equivalents of more familiar English names.

The State of Hawaii, with 0.4 percent of the U.S. population, in 1968 provided

0.3 percent (12.9 million pounds) of the U.S. fish catch and 0.7 percent (\$3.4 million) of its value. For the United States as a whole, the average price to the fishermen was 11.5 cents a pound. In Hawaii it was 26.8 cents.

Varied though the fishery resources are, five species of tuna and tunalike fishes account for most of the Hawaiian catch—80 percent by weight and 65 percent by value in 1968. The species are skipjack tuna (aku), albacore (ahipalaha), big-eye tuna (ahi), little tuna (kawakawa), and yellowfin tuna (ahi). These fishes have been caught throughout Hawaii's history. The first European visitors, late in the 18th century, described the canoe fishery for skipjack. Oahu's most famous landmark, Diamond Head, took its Hawaiian name—Leahi—from its resemblance to a tuna's dorsal fin.

Most of the elements of Hawaii's economy have boomed over the past two decades. Garment-making, for example, has grown from a handful of small shops to a \$25 million a year industry, marketing vivid Hawaiian fashions on the mainland and in Europe and Asia. Tourism brought the State 15,000 visitors and \$6 million in 1946; in 1967, about 1 million visitors spent \$400 million.

But the fishing industry has failed to keep pace.

THOUGH SEVERAL METHODS OF COMMERCIAL FISHING are used in Hawaii, two techniques account for the bulk of the catch. These are pole-and-line gear, used to take skipjack, and longline gear, used to take bigeye and yellowfin tunas and marlins and other billfishes.

One species, skipjack, is the most abundant in the commercial catch. In 1965, a record year, skipjack constituted 82 percent of the total Hawaiian catch,

by value 56 percent. In 1968, these percentages were 48 and 43.

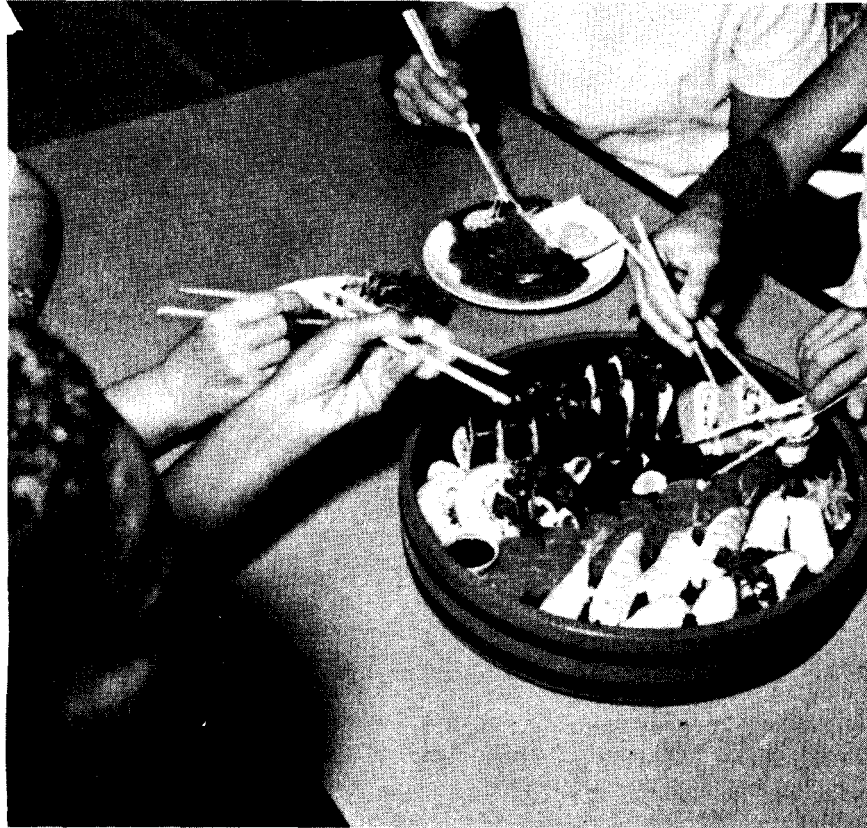
In the skipjack fishery, the number of boats decreased from 32 in 1948 to 17 in 1966, the number of fishermen from 260 to 154. The average catch has remained at almost 10 million pounds—for only the most efficient fishermen have been able to operate and they have about doubled their efficiency. On the other hand, skipjack fishermen have had to work much harder by making more frequent trips than in the past.

In the longline fishery, the number of boats decreased from 59 in 1948 to 30 in 1966, the number of fishermen from 190 to 87. The catch has also declined, being little more than half what it once was.

THE SKIPJACK FISHERY had a prominent place in Hawaiian mythology. Kapus protected the fish at certain times of the year. The origins of the commercial catch are lost in history, but we know some of the first Japanese to reach the islands—shipwrecked fishermen rescued early in the 19th century by American whalers—earned their livelihood by fishing and selling skipjack.

John N. Cobb, in the first widely printed study of Hawaii's fisheries, reported a skipjack catch in 1900 of 401,053 pounds, valued at \$41,383. The skipjack catch fluctuates widely. Since 1948 the smallest catch was made in 1957, when 6.1 million pounds were taken; the largest was 16.2 million pounds in 1965. The average catch is 9.9 million pounds. A cannery was built in 1940.

The craft used in the skipjack fishery are water-hugging wooden sampans between 60 and 80 feet long and 27 to 77 gross tons. A crew of 6 to 14 men is carried. A local anchovy (nehu) is the principal bait. A pound of nehu brings about



Sashimi—raw tuna red in color and sliced thin—is part of this attractive array of Japanese-style seafood and is popular with Hawaiians of Oriental descent and also many Caucasians.

40 pounds of skipjack. Nehu is seined in Pearl Harbor or other shallow areas.

Skipjack schools are usually located by sighting bird flocks. The vessel intercepts the school. The silvery nehu are thrown in the water to attract the skipjack to the stern of the ship. Water sprays are turned on. The fish are caught on unbaited barbless hooks and flipped to the deck. When skipjack are specially taken for the fresh-fish market, they are caught beneath the arm for unhooking, a method less likely

to injure them. After a catch of sufficient size has been made (or as the day grows late), the ship heads for port. It makes a long day, for often the sampans will have spent predawn hours baiting before proceeding to sea to fish. The average catch per trip is about 6,000 pounds.

The need to fish for bait always reduces the time that might be spent scouting for skipjack. The nehu is a delicate fish and mortality in the live-bait tanks is high. Most students of the Hawaii fisheries

agree that bait is one of the most critical problems faced by the industry. Recently, the Bureau of Commercial Fisheries has demonstrated that an introduced fish, threadfin shad, is an effective skipjack bait. As much as one-third of a fishing vessel's time is probably spent in baiting. Most of the rest of the time is spent in scouting. Actual fishing can occupy as little as an hour a day.

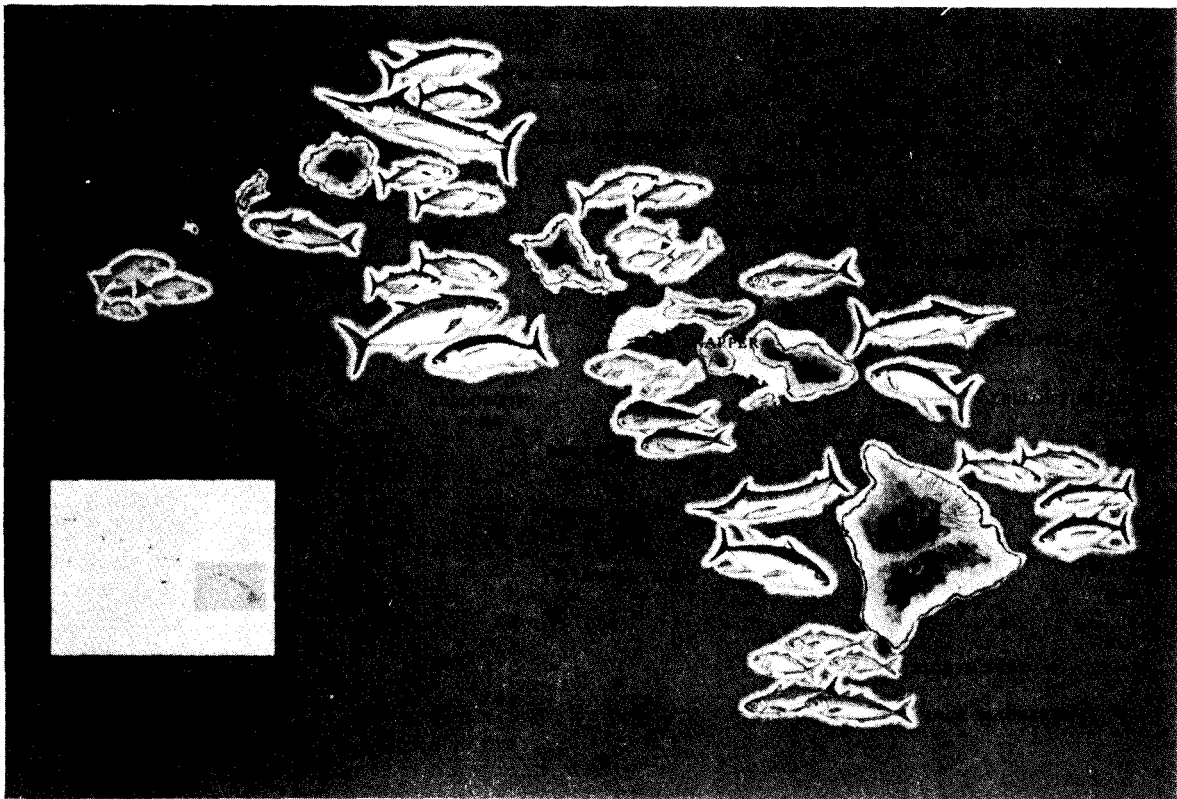
THE TUNA LONGLINE FISHERY is more recent than the skipjack fishery, having been introduced into the islands in 1917 by a Japanese immigrant. Hawaiian longliners, gear, and fishing techniques are scaled-down versions of the Japanese. A modern Japanese longliner, the kind that plies the waters of the central Pacific and often docks in Honolulu, will lay 50 miles of line at a set, a Hawaiian longliner 10 miles.

Most Hawaiian longliners remain close to shore. In the past few years, however,

with the encouragement and advice of the Bureau of Commercial Fisheries Biological Laboratory, Honolulu, some have ventured several hundred miles south of the islands. They have been rewarded with catches substantially better than those made by their rivals on the traditional grounds. But not all Hawaiian longliners have the navigational equipment or the trained personnel to make the longer voyages. In 1969, a modern new vessel joined the fleet and has fished successfully far from the islands.

The longliners draw upon the same population of fishes—bigeye tuna, yellowfin tuna, albacore, and marlins and other billfishes—that help support one of the mightiest fisheries in the world, the Japanese longline fishery. The Japanese fleet has fished the Hawaiian area since 1953. Exact catch figures are not available, but estimates place the take at several times that of the small Hawaiian fleet. Thus, tunas may be caught 500 miles

Hauling aboard a bigeye tuna caught in Hawaii's longline fishery.



from Hawaii, shipped 3,400 miles to Japan, transshipped back to the U.S. mainland for canning, and (after still another sea voyage) wind up on the shelves of a Honolulu supermarket. The canned fish migrate distances as great as do the living fish.

OTHER HAWAII FISHERIES take a wide variety of fish and shellfish, some of which could be caught in larger amounts. The bigeye scad (akule) is an example. Typically, these dark-blue fish are about a foot long, although some grow larger. They are taken near shore with handlines and nets. Good fighters, the scad has been of

increasing interest to sport fishermen. Catches of bigeye scad fluctuate widely. The year 1968 was very good and 898,770 pounds were caught. Another fish taken near shore with nets and handlines is the jack mackerel (opelu), much prized as a food fish. The catch in 1968 was 241,280 pounds.

The bottom fisheries provide several species for the Hawaiian dinner table. Among them are the snappers (uku, kalekale, opakapaka, ulaula, ehū, ulaula koae) and black sea bass (hapuupuu). About 252,000 pounds were landed in 1968. Like most fisheries for coastal species, the catch of snappers and sea bass

The gear aboard this Hawaiian longliner is used to take bigeye and yellowfin tunas and marlins and other billfishes from subsurface waters. Baited hooks are suspended at intervals along the buoyed longline, which may be 10 miles in length. Flags indicate the position of the longline in the water.



has declined since the early 1950's, when it was over 500,000 pounds annually.

Also declining are catches of the several species of jacks (uluu), closely related to the bigeye scad. The decline seems to reflect decreased commercial fishing effort rather than abundance of the fish.

Among the crustaceans, the spiny lobster once played a prominent part in Hawaii fisheries. In 1900, the catch was 131,000 pounds. The 1968 landings were about 4,520 pounds. The fishery is not intensive and rarely reaches depths below 15 fathoms. When the Honolulu Biological Laboratory leased the research submarine *Asherah* for operations off Oahu in 1965, scientists found large lobsters at depths of 50 to 65 fathoms. Lobsters this size are rarely seen, if at all, in the commercial catch.

Oysters were introduced into Hawaii in the 19th century and have become established. There are extensive beds in Pearl Harbor, but these waters are polluted, unfortunately, and no commercial catch is made. The Hawaii Division of Fish and Game is studying oyster cultivation. The venture has not yet attracted commercial interest.

One new marine product for export was added to Hawaii's slim list late in 1966. Precious coral was reported from the islands more than a century ago, but no effort had previously been made to harvest it. A small amount of precious coral is now taken between Oahu and Molokai. Fashioned into jewelry, it has enjoyed a good sale and a small industry appears to be in the making. The extent of the resource is unknown. Precious coral is found at great depths. Accessible to divers is the more plentiful and much cheaper black coral, which is fashioned into jewelry and widely sold.

A fishery traditional in Hawaii is the harvest from fishponds. The shores of the islands, particularly Molokai and Oahu, abound in stonewalled enclosures in which several species of food fish were once reared. Of the several hundred fishponds that have been mapped, only a handful are kept in repair and used, and these supplied about 12,000 pounds of fish in 1968. The milkfish (*awa*) was the most important, accounting for 50 percent of the 1968 harvest. Some scientists, notably those at the Oceanic Institute, are interested in putting the fishponds into wider use. Oyster-culture experiments have been conducted in one.

HAWAIIAN CONSUMPTION OF FISHERY PRODUCTS was once among the highest in the world. In 1900, the year the Republic of Hawaii became a Territory of the United States, the population was 150,000, one-fifth of what it is now. The total fish catch was 6.2 million pounds, or about one-half to one-third that of today. The entire 1900 catch was consumed locally, yielding about 41 pounds (round weight) per capita, a figure that is above present average U.S. consumption and approaches that of Asian countries. In 1968, the per capita consumption of locally caught fish was around 8 pounds. The change between 1900 and 1968 reflects shifting cultural tastes, rather than reduced productivity of the sea.

Locally caught fish are only a part of the fish and shellfish eaten in Hawaii. In 1963, for example, about a pound of shrimp per capita was imported from foreign sources alone. How much shrimp is shipped from the U.S. mainland is not known. The import of marine products is not new, by the way. It started almost as soon as the outside world discovered the Hawaiian Islands. Salted salmon from the

Pacific Northwest immediately became a staple in the Hawaiian diet and remains so to this day. Old records disclose that in 1900 the new Territory imported 757 pounds of salted salmon eggs (caviar), which wholesaled at the remarkably low price of \$1.28 a pound.

No reliable estimates of total Hawaiian consumption of fishery products have been made. Polynesians and Orientals have many delicious and unusual ways of preparing fish and other seafoods. Because many of her citizens are of Polynesian or Oriental descent and because many of their dishes have been adopted with relish by Caucasians, Hawaii's actual consumption per person is probably considerably higher than the 8 pounds cited above.

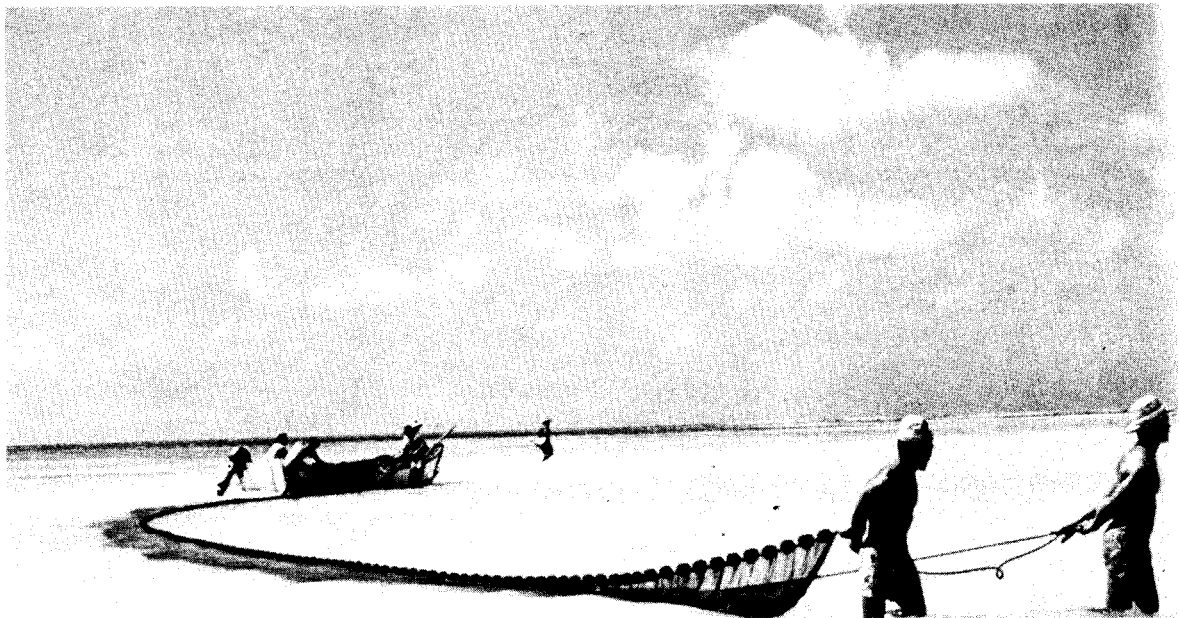
Some seafoods that appear regularly on

the Hawaiian dinner table, regardless of the family's ethnic background, are usually available in only a handful of specialized and expensive restaurants on the mainland. This is notably true of sashimi. Sashimi consists of thin slices of chilled tuna or other seafood. It is eaten raw after being dipped in a pungent mixture of soy sauce and grated hot radish.

Akin to sashimi, and also very popular, is sushi, another Japanese delicacy. The basis of sushi is a ball of cold rice that has been marinated in a weak solution of vinegar, salt, and sugar. This is brushed with fiery green horseradish and a slice of raw fish is laid on top.

Kamaboko—Japanese fishcake—is often served. One form is a white gelatinous fish loaf with a brilliantly colored outer layer. Sliced thin, kamaboko is arranged

Seining for small fish that will be used as live bait in the skipjack fishery. Nehu, an anchovy, is the most sought-after bait. It is thrown into the water to attract skipjack close to the vessel where they can be caught with pole and line and unbaited barbless hooks.





Tunas from the longline catch are sold at the auction market in Honolulu. Bureau scientists are recording data for life history and population studies. In right foreground are several marlins.

on lettuce or shredded cabbage and served cold as a side dish. Kamaboko is an integral part of several Oriental dishes and is also served as a pupu, as appetizers are called in Hawaiian.

Among the Chinese specialties are lobster in black bean sauce, steamed mullet, and half a dozen other commonly served dishes, particularly those using shrimp.

Unfamiliar to most mainlanders is the opihī, a limpet about the size of a dime; it is eaten raw. A great delicacy among the Hawaiian people, opihī cling to rocks at the water's edge. In 1968, the more than 5,000 pounds of opihī that reached the market brought the fishermen the

substantial average of \$3.54 a pound. The 1960 catch was more than 140,000 pounds.

Another Hawaiian delicacy, the opae, is rarely seen in markets or on restaurant menus because the catch is small—496 pounds in 1968. The opae is a fresh-water shrimp about 1½-inches long. It is boiled and eaten whole.

The Hawaiians also have a raw-fish dish. This is poki, chilled and cubed raw skipjack tuna, which is marinated in spicy sauce that includes the local kukui nut. Two of the most widely available Hawaiian dishes make use of imported fish—lomi salmon (salted salmon, fresh



Hawaii's fisheries produce a colorful array of fish for the local fresh market.

tomatoes, and green onions) and lau lau (butterfish and pork wrapped in taro leaves and baked in an imu, or underground oven).

A study in 1967 of the food preferences of Hawaiian families showed that 6 of the 10 most popular ethnic dishes contained seafood. They were the Chinese pohloh ha (pineapple and shrimp), Japanese shrimp tempura (fried shrimp with batter), Japanese sashimi (raw fish), Hawaiian lau lau (pork, butterfish, and

taro leaves), Japanese kamaboko (fish-cake), and Chinese ha chok kailan choy (shrimp with broccoli). Any good Hawaiian cookbook can provide these and many more novel seafood dishes to enliven mainland menus.

Almost all visitors to Hawaii are introduced to the dolphin, a fish locally called mahimahi. In 1968, about 70,000 pounds were landed in Hawaii, enough to give each visitor about 1 ounce. Mahimahi is locally popular, too, and much of it is

imported from Japan. The dolphin has never been the sole object of a fishery in Hawaii, being taken incidental to other catches. Two fishes taken in far greater abundance—the jack mackerel (opelu) and bigeye scad (akule)—the visitor will not often see, but both play a role in the Hawaiian diet.

THE CHIEF FISH MARKETS in Honolulu lie at the edge of Chinatown, where a number are clustered in a single large building. There are several neighborhood fish markets in the city, and almost each of the small grocers may carry a few fresh fish. The supermarkets offer several varieties of fresh seafoods. Retail prices are high. Locally caught fish are about \$1 a pound. Around New Year, premium tuna for sashimi will retail for as much as \$5 a pound.

The cannery in Honolulu is one of the production facilities of Bumble Bee Seafoods, a division of Castle and Cooke. One of the oldest firms in Hawaii, Castle and Cooke is now among the largest corporations in the United States. The Honolulu cannery employs about 275 people, processing 40 to 50 tons of tuna a day. Canned tuna, the principal product, is sold locally and on the mainland. Such byproducts as fishmeal, fish solubles, and canned pet foods are also manufactured. The cannery operates an ice plant (the largest in Honolulu) and a shipyard.

Kamaboko is only one form of fishcake produced in Honolulu. Fish, usually black marlin, are steamed, and cornstarch and seasoning are added. The cake is molded mechanically into a cylindrical roll. Red vegetable dye is used to color the outer part. Chikuwa, another form of fishcake, also uses marlin as its base, but the cake is broiled. Tempura fishcake, a mixture of yellowfin tuna, bonefish, snappers, and

other fish, is seasoned with carrots and burdock and then deep-fried. There are five manufacturers of fishcake in Hawaii.

A smaller industry is engaged in processing dried fish. Skipjack tuna is favored. It is prepared in the form of lamp-dried sticks—with no seasoning other than salt—or is soaked in soy sauce and spices and then dried.

Filipino fish sauce, bagoong, is also made in Honolulu. Skipjack tuna is its base. Bagoong, like many of the sauces of Southeast Asia, consists of fish which has been fermented; it is widely used as a seasoning and is a good source of protein.

None of these products has found wide acceptance on the mainland as yet, but are of sufficiently high quality and exotic appeal to make their way eventually to at least the gourmet sections of mainland markets.

THE PICTURE DRAWN THUS FAR is of a small State with few natural fishery resources that give any promise of broadening the economic base greatly. This is not necessarily correct. Thanks to intensive fishery research, it appears that Hawaii may be in a position to become one of the great fishing states.

Research on the fishes and fisheries of Hawaii is conducted by four agencies.

The Federal Government was first in the field. Pioneering research was done by the great ichthyologist, David Starr Jordan, his associate, Barton Warren Evermann, and fishery biologist John C. Cobb at the time of annexation.

In 1947, the U.S. Congress passed the Farrington Bill, which directed the Secretary of the Interior to conduct fishing explorations and related oceanographic, biological, technological, statistical, and economic studies to insure maximum development and use of the high-seas fish-



Hawaiian tuna longliners often take billfishes, such as this huge black marlin, which will be used to prepare kamaboko, or Japanese fishcake.

ery resources of the territories and island possessions of the United States in the tropical and subtropical Pacific Ocean. The Pacific Oceanic Fishery Investigations, now the Bureau of Commercial Fisheries Biological Laboratory, Honolulu, was established under this authorization in 1948.

The laboratory is widely known for its discovery of yellowfin tuna stocks in the equatorial Pacific and of skipjack tuna in the Marquesas Islands; for its elucidation of the complex pattern of transpacific migration of albacore in the North Pacific; its work on the physiology and behavior of tunas; and its pioneering

oceanographic studies of the central Pacific. Its principal mission today is bringing into production the great skipjack tuna potential of the central Pacific. To this end it is conducting work on the local Hawaiian skipjack tuna fishery, and on the subpopulations of skipjack tuna in all parts of the Pacific Ocean. It is investigating the movements of tunas underwater by use of a complex sonar on its research vessel *Townsend Cromwell*.

Aiding the local industry, and likely to be called upon more heavily if substantial development takes place, is the loan fund administered by the Bureau of Commercial Fisheries. Sixteen loans, totaling \$219,868, have been approved. These were for such items as purchase of new equipment, replacement of a vessel, and vessel repairs. Other requests for loans are pending.

The Division of Fish and Game of the Hawaii Department of Land and Natural Resources came into being in 1919 with the establishment of a Territorial Fish and Game Commission. Through World War II it confined itself largely to law enforcement, beginning scientific studies only about 20 years ago. Substantially assisting the research programs of the Hawaii Division of Fish and Game are matching funds provided by the Federal Government through the Bureau of Commercial Fisheries under the Commercial Fisheries Research and Development Act.

Funds of more than \$150,000 are supporting studies on the handling of bait fish; growth and migratory behavior of the bigeye scad; biology of the kona crab; statistics of the spiny lobster catch; development of a commercial oyster industry; and development of a prawn (shrimp) fishery, the prawn (*Macrobrachium rosenbergi*) being one common

in Southeast Asia. The Division has been so successful in cultivating *Macrobrachium* that its work has attracted wide attention among fishery biologists in Southeast Asia.

The University of Hawaii, founded in 1907, has conducted basic research on fishes for many years. Its widely known Hawaii Institute of Marine Biology, with its laboratory on Coconut Island (off Oahu), has been in operation since 1922. An Institute of Fisheries was founded in 1965. Federal funds, some available under contracts with the Bureau of Commercial Fisheries, have contributed heavily to the University's expanded marine research.

A private foundation, The Oceanic Institute, began operations in 1964. The institute is a part of the Makapuu Oceanic Center, an ocean science and technology complex, which also includes the beautiful and popular Sea Life Park, a science-oriented public marine exhibit whose proceeds help endow scientific programs. The Oceanic Institute is studying such problems as brackish-water fish culture and the behavior of whales, porpoises, and dolphins.

CONCERNED BY THE SLUGGISH ECONOMIC PACE OF THE HAWAII FISHERIES, the State Legislature in 1965 asked the Governor to convene a conference of experts to assess the potential of the central Pacific. A group of 12 scientists reviewed all available literature and drew up a series of reports. Key sections of these reports, submitted to the Governor's Conference on Central Pacific Fishery Resources, dealt with estimates of potential tuna catches. The working groups found that—if yellowfin tuna could be caught at younger ages than are now taken by the Japanese longline fleet—an

increased catch of about 110 million pounds a year would be possible. This would have boosted the total 1964 U.S. yellowfin tuna catch by nearly 75 percent. Large bigeye tuna, it was concluded, are now being fished by the Japanese long-line fleet at or above the maximum sustainable yield and no increase is foreseen. But skipjack, mainstay of Hawaii's industry, has an enormous potential.

Creatures of the warm seas, skipjack are harvested by the United States in the Atlantic (although only a few are taken at present), in the eastern Pacific, and in the central Pacific.

The skipjack taken near the shores of the Americas are small, young fish. Evidence suggests that these young fish are migrants. One of the most telling pieces of substantiating evidence is that, although intensive surveys have been conducted off North and South America for years, only a handful of skipjack larvae have ever been collected. Yet, near Hawaii the larvae are the most plentiful of all tuna larvae collected so far, and are found at many other places west of about longitude 130° W. It is believed that skipjack spawn in the equatorial central Pacific and then the young migrate from the south and west into the eastern Pacific fishery. After remaining there no more than a few months, the fish move westward again to spawn. Some undeniably enter Hawaiian waters. Three skipjack tagged in the eastern Pacific have been retrieved many months later in the Hawaiian catch.

What is the size of the central Pacific skipjack resource? Estimates vary; some place the yield at about 295 million pounds a year. If these fish could be caught, they would boost skipjack to first place in the U.S. tuna fisheries.

Thus, a resource of enormous potential

value exists in the central Pacific. The question is—how to harvest it? In the eastern Pacific, skipjack are taken with purse seines. In the 1950's, efforts to use this gear in Hawaii were unsuccessful, but there have been so many developments in gear and techniques that scientists are urging new long-term trials to harvest this resource.

THE DRIVE TO IMPROVE HAWAII'S FISHERIES appears likely to follow two lines. First, the State Government is seeking to outline a long-range development plan for existing fisheries, one that would inject new life into the present industry. Second, increasing effort may be thrown behind the drive to solve the scientific and technological problems that stand in the way of harvesting the latent skipjack resource fully.

Hawaii's fisheries are now small, colorful, and not as prosperous as they might be. But as with so many things in this young and energetic State, they hold promise of contributing materially to the future economic welfare of the Hawaiian people.

And as is also true with the other facets of the State's growth, something valuable and attractive may have to be sacrificed if the fisheries are developed. Certainly doomed by any major development would be Kewalo Basin, with its blend of Hawaii's several cultural strains and its echoes of the past. It is far too small to house a larger fleet. But this is a choice Hawaii or any other developing community faces and solves perpetually.

THOMAS A. MANAR became Chief, Publication Services, Biological Laboratory, Bureau of Commercial Fisheries, Hono-

lulu, Hawaii, in 1965. Previously he had been for 15 years at the University of California, chiefly its Scripps Institution of Oceanography. He is a member of the Society of Technical Writers and Publishers.