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THE "AKULE" FISHERY OF HAWAII

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The fisheries of Hawaii are typical of many island fisheries, in that they are characterized by relatively low productivity and high species diversity. The majority of the species fished are not conducive to large commercial operations, but are nevertheless important to the economy of the islands.

The Hawaiian fish fauna is reported to number 682 species (R. T. B. Iversen, Southeast Region, National Marine Fisheries Service, NOAA, Honolulu, HI 96812, pers. commun.), but fewer than 50 species contribute to the bulk of the commercial fish catch.[1] Of these, the akule, Trachurops crumenophthalmus, ranks second only to the tunas and billfishes in annual landings. During the years 1970 to 1975, akule landings accounted for approximately 38% of the reported commercial fish catch (not including tunas and billfishes). By commercial standards, the akule fishery is a relatively small fishery, highly dependent on local supply and demand. Since 1951, the annual catch has fluctuated from a low of 68,329 kg (68.4 metric tons) in 1963 to an alltime high of 444,482 kg (201.7 metric tons) in 1970 (Figure 1).

The following report briefly describes the biology of the species, fishing methods, preservation and marketing, protection, and management.

BIOLOGY

Vernacular Names

Ature, Aturepai	Cook Islands
Ature, Aramea, Orare	Tahiti
Otule	Tonga
Otule	Samoa
Buma	Solomons
Torro	New Guinea (Port Moresby)
Meaji	Japan

In the Americas, this fish is more commonly referred to as bigeye scad. In Hawaii, various names have been given to this fish at different sizes. Small fish of 5.1-7.6 cm (2-3 in.) in length are known as paa'a, the intermediate sizes as hahalalu, and fish greater than 22.8 cm (9 in.) as akule (Pukui and Elbert 1957).

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[1]Commercial fish catch by species. State of Hawaii, Department of Land and Natural Resources, Division of Fish and Game, Honolulu, Hawaii.

The akule is circumtropically distributed in the warm coastal waters of the Atlantic, Indian, and Pacific Oceans. In Hawaiian waters, the akule ranges throughout the Hawaiian archipelago from Kure Island to the island of Hawaii. The akule inhabits the coastal waters of all the islands, from the shallow shoreline out to depths of 100 m (50 fathoms), and is relatively scarce in offshore waters. Tagging results obtained by the State of Hawaii, Division of Fish and Game indicate that the majority of akule tended to remain in the proximity of the area of release.

The akule is a relatively fast growing fish. After the first year it measures about 229 mm, and in 2 years the akule grows to approximately 305 mm in length (Gosline and Brock 1960). The size at which the female akule reaches sexual maturity and begins spawning was determined by Kawamoto (1973) to be about 235 to 250 mm FL (fork length). The males mature at about 220 to 230 mm FL. The ovaries are predominantly mature or in spent condition during the months of April through November, indicating that spawning occurs during this period. The presence of schools of young fish under 152 mm in late August suggests that peak spawning occurs during the spring and early summer months.

"According to growth estimates, hahalalu appear in our inshore waters from 150 mm FL, or 4 months after hatching. The bulk of akule caught by the commercial fishery range in size from 210 to 265 mm making them between 8 and 18 months old." (Kawamoto 1973.)

FISHING METHODS

The present commercial akule fisheries are conducted by two principal methods: handline and "surround" net. Although this report deals with their application to the akule fishery, the methods described are also utilized to catch a number of other species.

The handline method involves fishing from a vessel at night utilizing a light to attract the fish. This method depends on the phototaxic response of food organisms to light which in turn attract the akule. As such, the best fishing results are obtained by fishing during the dark phase of the moon with a suitable source of light.

Powell (1968) describes in detail the akule night-fishing method. Night fishing is generally conducted in inshore waters to a depth of 100 m (50 fathoms). Akule are hooked usually at depths from the surface to 10 m (5 fathoms).

The handlines are constructed of lightweight material with three to five baited hooks or artificial lures. In bait fishing, small anchovy or chum made of finely ground fish is first released to attract and excite the akule into taking the baited hooks. In fishing with lures, the small lures (fly) are continuously lowered and raised at a steady

pace in order to mimic the movement of plankton or small fish in the water. Nightly catches average 18.1 to 22.7 kg (40 to 50 lb) per boat but occasional catches may exceed 45.4 kg (100 lb). The lure method is more commonly used because of its simplicity. Bait fishing is at times reverted to when lure fishing is poor.

Historically, surround nets were restricted in use to the relatively shallow shoreline waters. Schools of fish were sighted from high grounds on land or from atop trees. The "spotter" coordinated the net setting operation by hand signals to the fishermen.

With the introduction of fish spotting from airplanes and the use of scuba diving gear, the net fishery has greatly increased its operational efficiency. Presently, the net fishery is composed of small vessels operating daily in waters relatively close to land and some larger vessels having long-range capabilities and equipped with brine chill refrigeration system and purse seine power block. The larger vessels possess multispecies fishing capability.

The surround-net fishery utilizes two types of net: bag net (akule net) and gill net. The nets are variable in design according to species of fish to be caught and the habitat to be exploited. Basically, the nets are panels with a float line and a lead line. The weights are heavy enough to take the net to the bottom but not too heavy as to make it difficult to retrieve. The floats are sufficiently large to keep the net upright, without lifting the net off the bottom. Both nets are set in water deeper than the depth of the net.

The bag net is a combination bag and seine net constructed from nylon webbing of 3.8 cm mesh. The bags commonly in use measure about 16 m (48 ft) long with a mouth opening of 12 to 16 m (36 to 48 ft) in width. The height of the bag varies with the depth of the seine net used. The seine portion is formed by sections of net each 100 m (300 ft) long and varying in depth from 12 to 26 m (36 to 78 ft). The desired length of net is derived by lacing sections together and can be as much as 1,000 m (3,000 ft) in length. The depth of the net used is determined by the depth of water. Although present nets fish depths down to 33 m (99 ft) the depth of the water where the bag is attached does not exceed the bag depth.

The setting pattern depends upon the behavior of the fish school, depth of water, and current condition during the fishing operation. A skiff is used in setting the net around a school of fish. The two ends of the net are overlapped to completely encircle the fish. Divers then enter the water on the down-current end of the net and remove the lacing between the two net sections. A bag is attached in-between the sections and secured by weaving foot-long "chopsticks" through the webbing. The circle of the net is reduced in size by "cutting" and moving sections of net toward the center to direct the surrounded fish into the bag.

After the fish have entered the bag, the sticks are removed while the mouth bottom of the bag is brought to the surface and secured to the vessel. The fish are brailed with nets into refrigerated (ice or brine) holds on the vessel. The seine-net sections are then retrieved manually or with a power block. This method of fishing usually catches most of the fish in a school.

The gill net is constructed from 15 or 18 lb test, 6.3 cm (2.5 in.) mesh monofilament webbing. Blue monofilament is preferred because of its relative transparency in local waters. The more commonly used nets are 1.7 to 3.3 m (5 to 10 ft) in depth, with a section ranging from 42 to 100 m (126 to 300 ft) in length. The complete net is composed of several sections laced together and can be as long as 1,000 cm (3,000 ft).

Gill nets are utilized in depths to 12 m (36 ft) in areas of rough terrain. As gill nets are light and portable, land operations have developed in which the skiffs are hauled by trucks to locations close to the fish school.

Following setting directions provided by the airplane spotter, the net is set around a fish school by fishermen in skiffs. When the net is set, divers with a skiff enter the water to frighten the fish. Akule instinctively move down and outwards, thereby hitting the net and entangling themselves. The net is retrieved and iced down completely without removing the fish. The fish is removed after returning to shore. A smaller proportion of the fish is usually caught by the gill net method as many escape over the net and the larger meshes selectively gill only the larger fish.

PRESERVATION AND MARKETING

The preservation and marketing of fish in the islands are regulated by consumer preference for fresh fish. The bulk of the commercially caught akule is "iced" and distributed fresh through the auction market.

PROTECTION AND MANAGEMENT

Presently, the akule fishery is managed through two regulations. The first was established in 1929, prohibiting the use of nets with stretch mesh size of less than 38.1 mm (1-1/2 in.). Because of a decrease in catch during the years 1951-65, a second regulation was enacted in 1968 to protect the young akule. The 1968 regulation prohibits the netting of akule under 21.6 cm (8.5 in.) in total length from July through October during the season of peak recruitment into the fishery.

The regulatory measures presently in effect seem to provide adequate protection of the resource as annual landings appear to be holding up at a relatively high level.

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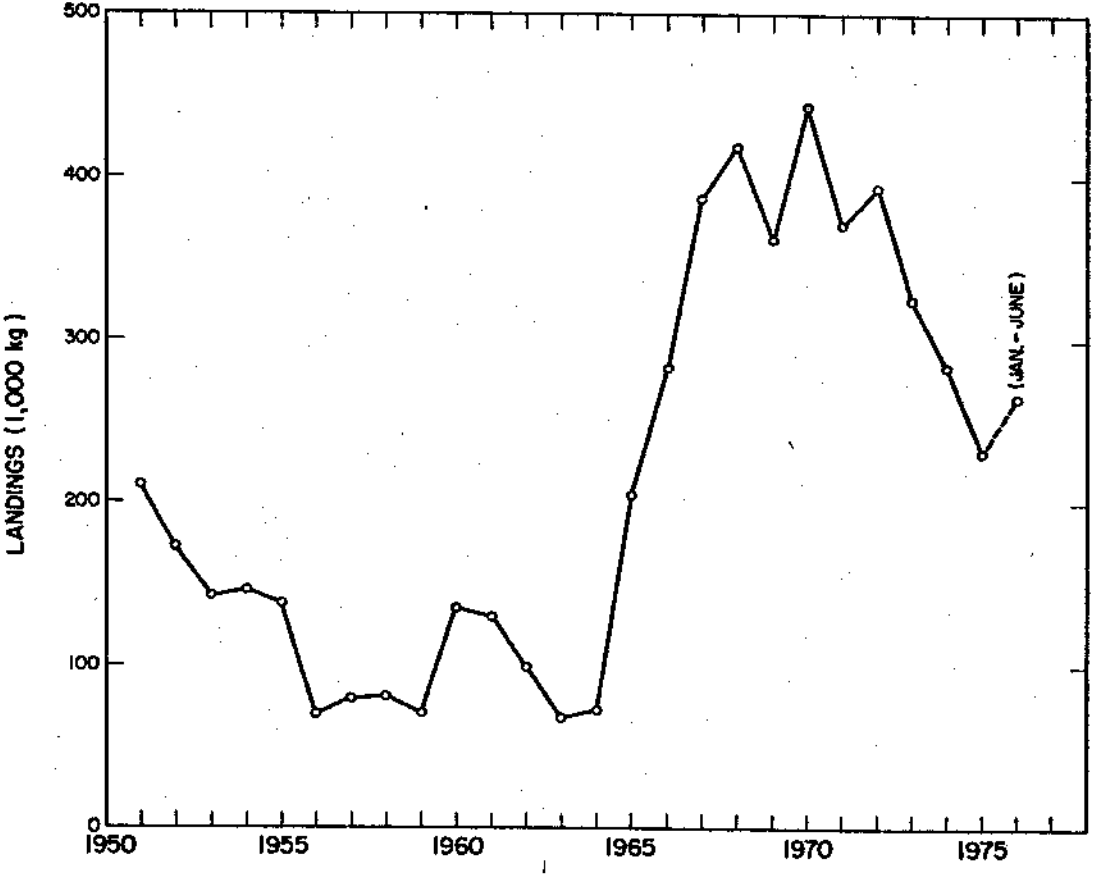

Figure 1.--Hawaii commercial akule landings by years.