Landings of Billfishes in the Hawaiian Longline Fishery

HOWARD O. YOSHIDA[1]

ABSTRACT

The landings of the Hawaiian longline fishery are dominated by the tunas. During 1964 to 1967, the tunas, by weight, made up an average of 66% of the catch, whereas the marlins and swordfish, *Xiphias gladius*, comprised about 34%. The catch of billfishes is composed of the striped marlin, *Tetrapturus audax*, blue marlin, *Makaira nigricans*, black marlin, *M. indica*, sailfish, *Istiophorus platypterus*, shortbill spearfish, *T. angustirostris*, and swordfish.

The annual landings of blue marlin ranged between 47 and 366 metric tons during 1952 to 1970. The annual landings of striped marlin fluctuated between 93 and 228 metric tons during the same period. The blue marlin dominated the catch from 1952 to 1961. Subsequent to 1963, the billfish catches have been dominated by the striped marlin.

The monthly landings and the monthly catch rates of blue marlin and striped marlin showed similar trends. The monthly landings of striped marlin, however, showed greater fluctuations than the monthly catch per unit of effort. This was attributed in part to a change in the size composition of striped marlin in the third quarter.

The Hawaiian longline fishery has been described in the past primarily from the viewpoint of a fishery for deep-swimming tunas, usually yellowfin tuna, *Thunnus albacares*, and bigeye tuna, *T. obesus*. June (1950), Otsu (1954), Shomura (1959), and Hida (1966) all have made studies on this fishery as it related to the tunas. One of the exceptions is a paper by Strasburg (1970) on the billfishes of the central Pacific Ocean, in which he briefly discussed the billfishes landed in Hawaii. This report considers the Hawaiian longline fishery as it relates to the billfishes, particularly the blue marlin, *Makaira nigricans*, and the striped marlin, *Tetrapturus audax*, primarily during the period from 1963 to 1970.

The data used for this report came primarily from two sources. The billfish landing data through 1968 were obtained from the Fishery Statistics of the United States. The landing data for 1969 and 1970 and fishing trip data are from the files of NMFS (National Marine Fisheries Service), Honolulu, Hawaii. Billfish weight and sex data from 1964 to the middle of 1970 were collected at the Honolulu auction markets by samplers from our Laboratory.

[1] NOAA, National Marine Fisheries Service, Southwest Fisheries Center, Honolulu Laboratory, Honolulu, Hawaii 96812.

DESCRIPTION OF THE FISHERY

The Hawaiian longline fishery is the only American fishery employing the longline method of fishing (Shomura, 1959). The history and description of the fishery are given by June (1950) and Otsu (1954).

Typical Hawaiian longline boats evolved from the Japanese sampan-type, live-bait boat (June, 1950). They are characterized by a narrow bow, angular lines and a low freeboard aft. The overall length of these vessels ranges from 8.53 to 18.90 m (28 to 62 ft). All except one of the vessels in the Hawaiian fishery have wooden hulls. The length of a fishing trip averages 8 or 9 days for a Honolulu-based vessel and the majority of the trips are made within sight of the main Hawaiian Islands (Shomura, 1959).

The number of longline boats in the Hawaiian fleet has steadily declined over the years. In 1952 there were 42 boats in the Hawaiian fishery. In 1964 the number was down to 31 and in 1970 to 20. Although the number of boats in the fishery has been declining, one new boat was recently added to the longline fleet. This vessel has a steel hull and a refrigerated fish hold, and has an extended cruising range. The vessel began operations in July 1969 and has fished

FROM Shomura, R. S., and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2. Review and contributed papers. NOAA Technical Report NMFS SSRF-675, 1974.

as far as 1,482 km (800 miles) from the Hawaiian Islands (Kanayama, 1970).

Similar to the Japanese longline fisheries, the catches in the Hawaiian longline fishery are made up mostly of large tunas. During the period from 1964 to 1967, considering only the tunas and the billfishes, the tunas, by weight, made up about 66% of the catch, the marlins about 32%, and the swordfish, *Xiphias gladius*, about 1% (Fig. 1). Among the tunas, bigeye tuna dominated the catch followed by yellowfin tuna and albacore, *Thunnus alalunga*. Among the billfishes, striped marlin dominated the catch, followed by blue marlin and swordfish. Small numbers of sailfish, *Istiophorus platypterus*, and shortbill spearfish, *Tetrapturus angustirostris*, are also taken. In 1970, the tunas and billfishes landed by the longline fishery were valued to the fishermen at $1,311,471. The billfishes contributed $291,837 (22%) to this amount.

Other species taken on the longline, in their order of importance, are dolphin or mahimahi, *Coryphaena hippurus;* wahoo, *Acanthocybium solandri;* and a few skipjack tuna, *Katsuwonus pelamis*.

LANDINGS OF STRIPED MARLIN AND BLUE MARLIN

The annual landings of blue marlin ranged between 47 and 366 metric tons during the period from 1952 to 1970 (Fig. 2). The landings declined steadily

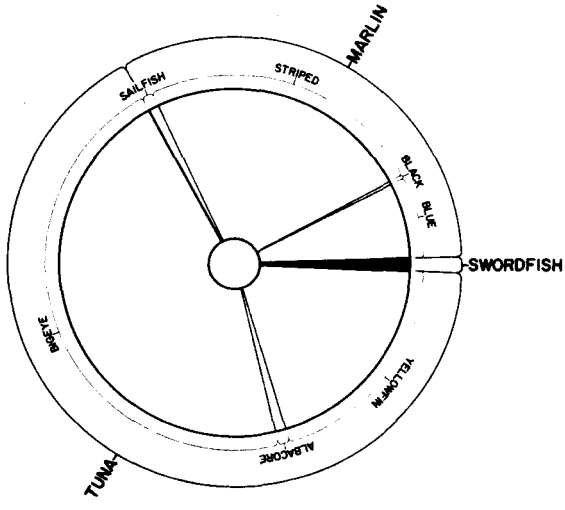


Figure 1.—Composition of the tuna and billfish landings in the Hawaiian longline fishery.

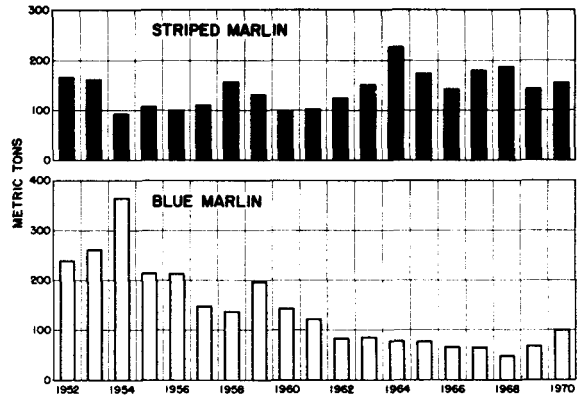


Figure 2.—Annual landings of blue marlin and striped marlin from 1952 to 1970 in Hawaii.

from a high of 366 metric tons in 1954 to a low point of 48 metric tons in 1968. The landings recovered a little in 1969 and 1970.

The annual landings of striped marlin fluctuated between 93 and 228 metric tons during this same period (Fig. 2). No clear trends are evident in the landings although it appears that the landings between 1963 and 1970 were slightly higher than the landings prior to 1963. Of interest is the change in dominance from blue marlin to striped marlin in the landings beginning in 1962. This change was caused primarily by the declining blue marlin catches.

Strasburg (1970) presented data on the monthly landings of blue marlin and striped marlin in the Hawaiian fishery from 1950 to 1963. For the period 1950 to 1960, Strasburg noted a complementary nature in the landings of the two species in that striped marlin were caught in large numbers when the blue marlin catches were lowest and vice versa. He noted, however, that the landing peaks of the two species tended to coincide in 1961 and 1962. Monthly landings from 1963 to 1970, however, again showed a displacement in peak landings for striped marlin and blue marlin (Fig. 3). Blue marlin catches were highest in summer and lowest in winter, whereas striped marlin were more abundant in the winter than in the summer. The striped marlin landings were also characterized by having more than one peak in a year, and by wide fluctuations from month to month. The biggest dip in the landings each year usually occurred in the third quarter.

Of interest is a similar complementary nature in the catches of yellowfin tuna and bigeye tuna in the Hawaiian longline fishery. The peak catches of yellowfin tuna are made during the summer while good

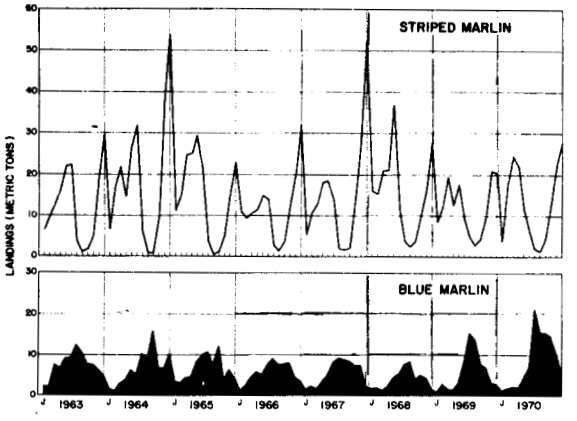


Figure 3.—Monthly landings of blue marlin and striped marlin from 1963 to 1970 in Hawaii.

catches of bigeye tuna are made during the winter and spring (June, 1950; Otsu, 1954; Shomura, 1959). This suggests that striped marlin and bigeye tuna may be responding to a different set of environmental factors from the blue marlin and yellowfin tuna. Strasburg (1970) has suggested a relation to the food supply to explain the complementary abundance of striped marlin and blue marlin around Hawaii. He noted that blue marlin fed largely on skipjack tuna, which were more abundant in the summer. This may account for the larger numbers of blue marlin during the summer.

Further evidence that the blue marlin are indeed responding to the presence of their prey can be seen in the relation between the landings of skipjack tuna and blue marlin in Hawaii (Fig. 4). Generally speaking, good catches of blue marlin corresponded to good catches of skipjack tuna. The situation in 1965, however, did not conform to the general trend. The reason for this is not known.

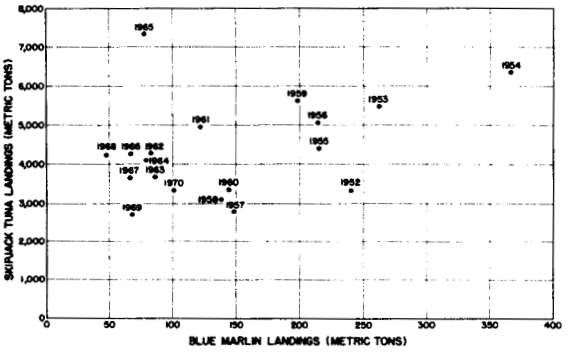


Figure 4.—Relation between landings of skipjack tuna and blue marlin in Hawaii.

CATCH PER UNIT OF EFFORT

The CPUE (catch per unit of effort) for striped marlin and blue marlin was determined to see if CPUE had any effect on the monthly landings. As Shomura (1959) indicated, measures of effort such as number of hooks or baskets of gear fished, are not readily available for the Hawaiian longline fishery. Thus for his analysis of the abundance of tunas around Hawaii, he used the number of trips as a measure of effort. Following Shomura, the number of trips was used to calculate CPUE, here given as number of fish caught per trip on a monthly basis (Fig. 5).

The catch rates for striped marlin and blue marlin showed the same trends as the monthly landings. Similar to the monthly landings blue marlin catch rates usually peaked from July to September. During the period from 1961 to 1969, however, the annual summer peak in the catch rates has shown a small but steady decline.

Similarly, the monthly catch rates of striped marlin showed the same trends, although the fluctuations were not as pronounced as the monthly landings. As did the monthly landings, the monthly catch rates for striped marlin showed two peaks annually, usually one in the spring and the other in the fall. In contrast to the blue marlin, the annual peaks in the monthly catch rates for striped marlin from 1961 to 1969 have increased slightly.

SIZE OF FISH

The quarterly weight-frequency distribution of striped marlin by sex is shown in Figure 6. The size

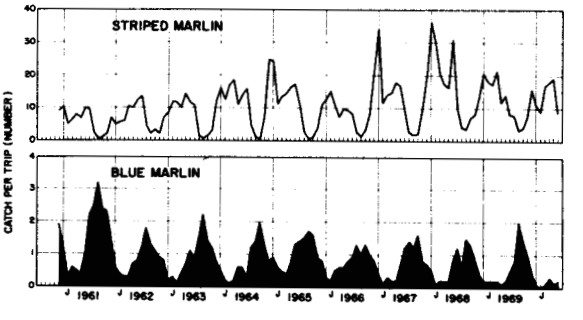


Figure 5.—Monthly catch per trip of blue marlin and striped marlin.

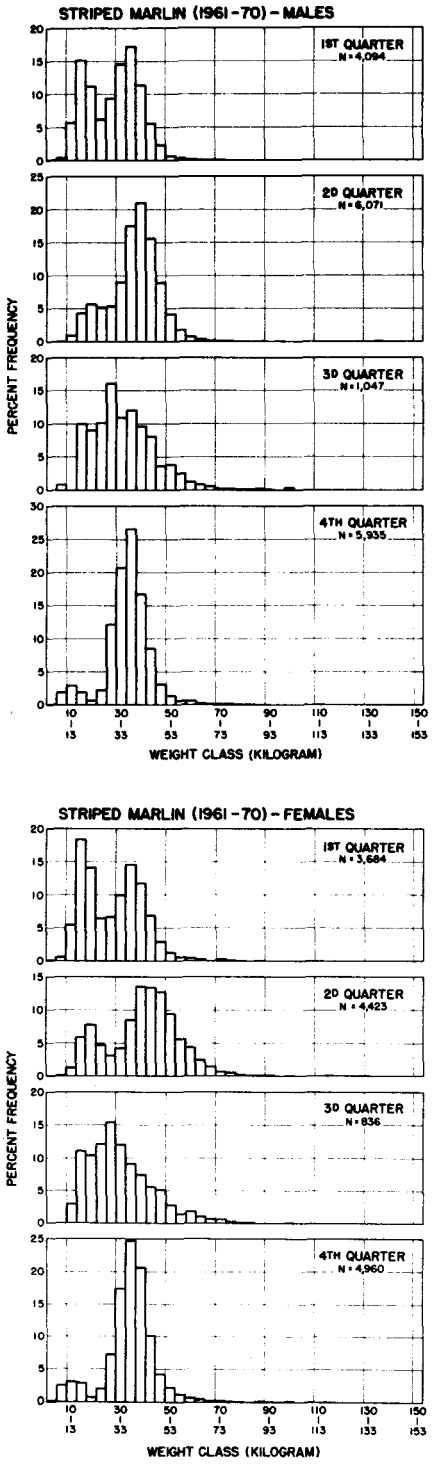


Figure 6.—Weight-frequency distribution of striped marlin.

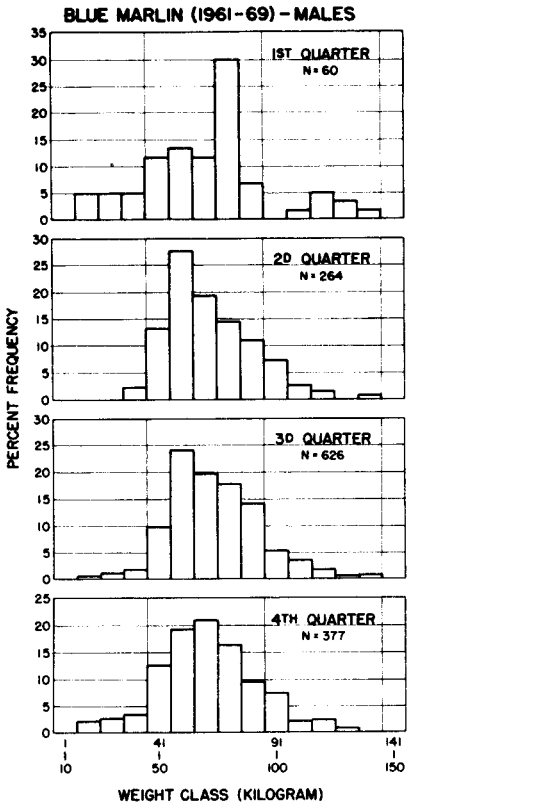
of male and female striped marlin are about identical and the size-frequency distribution of the males and females show almost no difference. They ranged from 3 to 147 kg (7 to 324 lb). It is interesting that during the first, second, and fourth quarters, the size-frequency distribution shows a bimodal distribution while in the third quarter the size distribution only shows one mode. In the first quarter the modes are located between 14 and 18 kg (31 and 40 lb) and 34 and 38 kg (75 and 84 lb), in the second quarter between 18 and 22 kg (31 and 48 lb) and 38 and 46 kg (84 and 101 lb), and in the fourth quarter between 10 and 14 kg (22 and 31 lb) and 34 and 38 kg (75 and 84 lb). In the third quarter the single mode is located between 26 and 30 kg (57 and 66 lb).

It was noted earlier that the monthly landings showed greater fluctuations than the monthly catch rates and that the biggest dip in the landings was found consistently during the third quarter. This was apparently caused by a combination of low catch rates and the presence of only intermediate size fish in the landings in the third quarter. In the third quarter striped marlin represented by the larger of the two modes found in the other three quarters are evidently not present in large numbers in Hawaiian waters.

Of interest is the observation that larvae of striped marlin are not found in Hawaiian waters (Matsumoto and Kazama, 1974). Matsumoto and Kazama have suggested several reasons for the absence of striped marlin larvae, including the possibility that adult striped marlin leave Hawaiian waters to spawn elsewhere. They cite as evidence the absence of the larger size group of striped marlin in the Hawaiian Islands area starting in about July. As noted above, my data show that the larger striped marlin are not present in the commercial landings in large numbers in the third quarter.

In contrast to the striped marlin, the blue marlin show striking differences in size between the sexes and also in their size distribution (Fig. 7). The females grow to be much larger than the males; they ranged from 7 to 444 kg (15 to 979 lb). In the first and fourth quarters no clearly defined modes are present in the female weight-frequency distribution. In the second quarter a single mode is evident between 140 and 144 kg (309 and 317 lb). The third quarter distribution shows a mode between 120 and 184 kg (264 and 406 lb).

The size distributions of the males, on the other hand, show a pronounced mode between 44 and 80 kg (97 and 176 lb) in all quarters of the year. They ranged from 12 to 140 kg (26 to 309 lb).



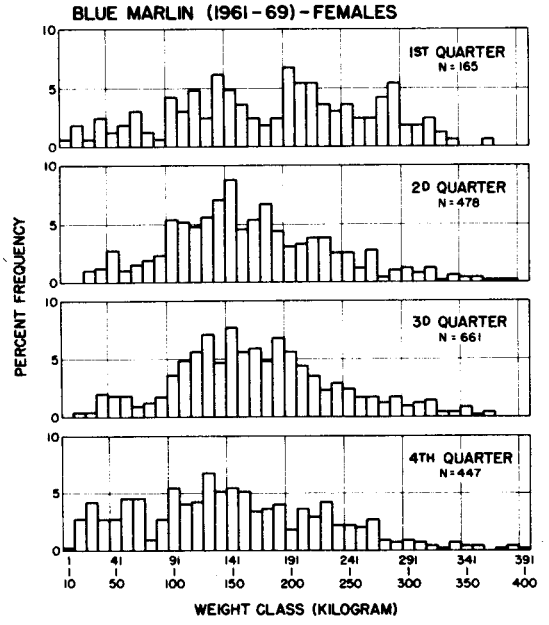


Figure 7.—Weight-frequency distribution of blue marlin.

LITERATURE CITED

HIDA, T. S.
1966. Catches of bigeye and yellowfin tunas in the Hawaiian longline fishery. *In* T. A. Manar (editor), Proceedings of the Governor's Conference on Central Pacific Fishery Resources, p. 161-167. State of Hawaii, Honolulu.

JUNE, F. C.
1950. Preliminary fisheries survey of the Hawaiian-Line Islands area. Part I - The Hawaiian long-line fishery. Commer. Fish. Rev. 12(1):1-23.

KANAYAMA, R. K.
1970. The *Kilauea:* Hawaii's first modern tuna boat. Aloha Aina (Love of Land), Dep. Land Nat. Resour., Hawaii 1(3):3-5.

MATSUMOTO, W. M., and T. K. KAZAMA.
1974. Occurrence of young billfishes in the central Pacific Ocean. *In* R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675 p. 238-251.

OTSU, T.
1954. Analysis of the Hawaiian long-line fishery, 1948-52. Commer. Fish. Rev. 16(9):1-17.

SHOMURA, R. S.
1959. Changes in tuna landings of the Hawaiian longline fishery, 1948-1956. U.S. Fish Wildl. Serv., Fish. Bull. 60:87-106.

STRASBURG, D. W.
1970. A report on the billfishes of the central Pacific Ocean. Bull. Mar. Sci. 20:575-604.