

# Weight Frequencies for Striped Marlin, *Tetrapturus audax*, Caught Off Southern California

JAMES L. SQUIRE, Jr.

## Introduction

Striped marlin, *Tetrapturus audax*, are caught by marine game fish anglers off southern California only during a brief period of the year, with most of the catch landed between 15 August and 15 October of any one year. The annual catch may range from 50 to 2,300 marlin but averages about 800. Angler catch rates are low off southern California when compared with those of other striped marlin fishing areas in the northeast Pacific, such as the area about the tip of Baja California Sur, Mexico (Squire, 1974). This area lying about 750 miles to the southeast of southern California is intensively fished by U.S. anglers (Talbot and Wares, 1975).

Catches in both the southern California and Baja California areas were sampled during 1967-70 for weight frequencies and other biological parameters by the National Marine Fisheries Service (Eldridge and Wares, 1974). The mean weight of marlin was found to be greater by about 16.8 kg (37 pounds) for landings in southern California when compared with landings near the tip of Baja California Sur, Mexico (Talbot and Wares, 1975), an area that is near the center of striped marlin distribution in the northeast Pacific.

The southern California fishery is near the northeastern limit of striped marlin distribution in the Pacific Ocean and marlin are caught in increasing numbers by this fishery during periods of sea surface temperatures of 20°C (68°F) or greater (Squire, 1974).

Geographical areas within the south-

James L. Squire, Jr., is with the Southwest Fisheries Center, National Marine Fisheries Service, NOAA, La Jolla, CA 92038.

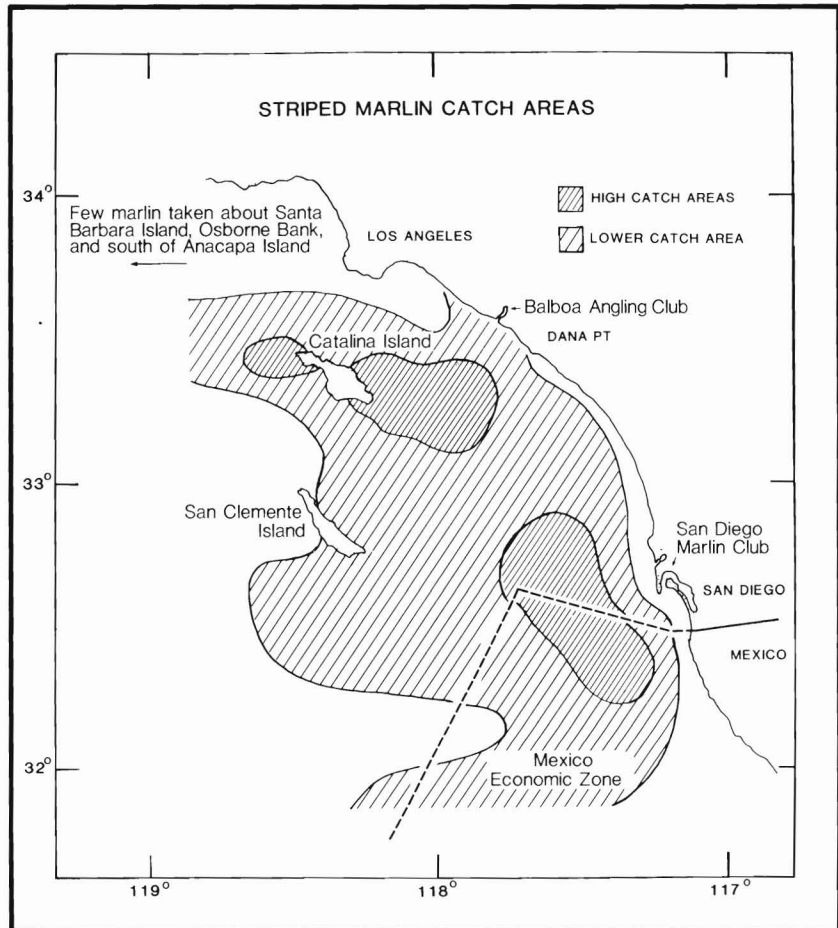


Figure 1.—Major catch areas for striped marlin off southern California.

ern California Bight yielding high catches of striped marlin may vary between years, from a fishing area to the west and southwest of San Diego to an area between the mainland near Dana Point to and about Santa Catalina Island, a range of about 90 miles. The time

distribution of the catch differs slightly between the Santa Catalina Island area and the area off San Diego. Figure 1 illustrates the major fishing areas for striped marlin relative to the locations of the weigh stations from which the data used in this report were obtained.

In southern California the major locations for weighing angler-caught striped marlin are the San Diego Marlin Club, located on San Diego Bay, San Diego, Calif., and the Balboa Angling Club, located on Newport Bay, Balboa, Calif. Both clubs maintain weight records for all marlin landed, and the records compiled at these two locations represent an estimated 90 percent or more of the total southern California landings. Weights are assumed to be accurate as the marlin are weighed on scales that are certified by either the San Diego or Orange County Sealer of Weights and Measures. Marlin caught in the vicinity of Santa Catalina or San Clemente Islands are sometimes weighed at the town of Avalon, Santa Catalina Island, Calif. These marlin are frequently taken across the Catalina Channel to Newport Bay where they are reweighed by the angler at the Balboa Angling Club.

Weight frequencies from club weight records and the work of Eldridge and Wares (1974) are described. An analysis of trends in weight frequency, both by area and by year, is presented.

### Data Sources

Striped marlin are usually weighed on the same day as they are caught, except for a few that are tagged and released or released on the fishing grounds. Special care, such as covering the marlin with a wet cloth or sheltering it from the elements to prevent dehydration after capture, is not usually taken. Since sea surface temperatures off the coast of southern California are in the range of 20-22°C (68-72°F) during the fishing season and offshore air temperatures are near that of sea surface temperature, the degree of dehydration before weighing is probably minimal. However, the magnitude of the weight difference between time of capture and weighing ashore is not known.

Weights are recorded in pounds of total or round weight. Marlin are not examined to determine sex so weights given in this paper represent a composite weight of both male and female marlin.

Data on the date landed and total weight are published annually in the yearbooks of both the San Diego Marlin

Club and the Balboa Angling Club. Information is also included on the angler's name, boat captain, type of tackle, weight of fish, and time to land the marlin.

Weight records in this paper represent striped marlin weights for 15,138 fish. The Balboa Angling Club recorded weights for 6,620 marlin over a period of 36 years (1945-80); the San Diego Marlin Club has recorded weights for 8,518 marlin over a 21 year period (1960-80). Weight data for this review were obtained from the reports of Talbot and Wares (1975) and record books of the San Diego Marlin Club and the Balboa Angling Club. Typically, few marlin were reported weighed in July and November, and both clubs recorded the highest catch in September.

The only historical weight records of striped marlin for the early 1900's are those published by Jordan (1916) describing the average weight of 251 specimens landed at Santa Catalina Island from 1910 to 1916. For the 251 samples of "Japanese spearfish," *Tetrapturus mitsukurini* (synonymy given by Jordan and Snyder, 1901), Jordan reported the average weight to be 82.6 kg (182 pounds). This weight would indicate mean size reduction of approximately 18.1 kg (40 pounds) when compared with the 1960-75 mean weight off southern California of 64.4 kg (142 pounds). The reduction in average weight by 18.1 kg (40 pounds) may be the result of fishing.

### Weight Record Analysis

Data giving striped marlin mean weights by month and year, number of marlin in the sample and weight averages by month are presented in Table 1, for 21 years of San Diego Marlin Club data and 36 years of Balboa Angling Club data.

Figure 2 shows the percentage of landings by month for weight records compiled by the San Diego Marlin Club and the Balboa Angling Club; catch trend by month from both clubs' records were similar, with peak catches during the same month (September). Slightly higher landings (7 percent greater) were recorded for August (the beginning of

the fishing season) from Balboa Angling Club records, when compared with San Diego Marlin Club records. The landing weights were slightly less (4 percent less) in the Santa Catalina Island and Channel area in November as reflected in the Balboa data compared with the San Diego area records. Effort data were not available; therefore, any catch percentage differences could be the result of variations in fishing effort.

Weights were grouped by 4.5 kg (10 pound) increments and plotted by year for data from 1945-80 for the months July through October, or by weight data for each season, to determine if any modal size groups could be observed moving through the fishery. An example of the weight structure of the catch is given in Figures 3a, b, and is typical of other years. The figures show that for 1963, a record catch year, little change is evident between weight groups during the months of July, August, September, and October. The landings weighed at the Balboa Angling Club appear to have a distribution similar to the catches landed at the San Diego Marlin Club.

### Discussion and Summary

Biological research conducted at San Diego during the period 1967-70 indicated that of 462 marlin sampled, 67 percent were female. During the early part of the fishing season females were the predominant sex caught, with the sex ratio changing to about 50:50 later in the season. Females were heavier than males for a given length, and statistical tests indicate this difference to be significant (Wares and Sakagawa, 1974). Marlin landed at San Diego were heavier when compared with marlin of the same length near the tip of Baja California Sur, and at Mazatlán, Mexico, as determined by comparing weight as a function of eye (orbit) to tail fork length (Fig. 4).

There is a small difference in monthly mean weight of marlin landed at the Balboa Angling Club compared with weights recorded by the San Diego Marlin Club. The marlin weighed at the Balboa Angling Club averaged 4.1 kg (9.1 pounds) heavier in July when compared with those weighed at San Diego, 1 kg (4.5 pounds) heavier in August, 1.5 kg

Table 1.—Striped marlin mean weight by month and year as recorded from sport catches landed at the San Diego Marlin Club and Balboa Angling Club (the number of fish is in parentheses). Weight is in pounds (round weight) as recorded.

Year	July		August		September		October		November		Average weight
	No. of Fish	Mean wt.	No. of Fish	Mean wt.	No. of Fish	Mean wt.	No. of Fish	Mean wt.	No. of Fish	Mean wt.	
<i>The Marlin Club</i>											
1960	( 3)	145.00	( 96)	152.00	( 276)	132.31	( 46)	141.73			137.61
1961	( 4)	170.00	( 24)	168.33	( 344)	140.47	( 1)	155.50			142.50
1962	( 1)	135.00	( 16)	134.37	( 39)	145.51	( 1)	155.50			142.36
1963	(14)	136.42	(463)	136.92	(904)	132.07	( 78)	116.66			132.83
1964			( 95)	128.47	(422)	127.96	(371)	142.08	( 79)	146.89	134.97
1965			( 24)	122.29	(126)	139.44	(148)	146.48	( 2)	145.00	141.58
1966	( 6)	111.00	(112)	133.30	(367)	128.46	( 97)	128.19	( 2)	135.00	129.17
1967	(11)	124.09	(203)	122.24	(347)	121.13	( 43)	131.74	(217)	145.41	128.42
1968	(12)	121.66	( 43)	119.88	(331)	135.69	(146)	139.93	( 59)	150.76	136.81
1969	( 2)	110.00	( 32)	143.75	(191)	146.30	( 33)	148.93	( 11)	153.18	146.33
1970	( 2)	155.00	( 31)	124.67	( 32)	139.68	( 30)	154.00	( 1)	185.00	138.85
1971			( 26)	137.50	( 48)	147.50	( 33)	146.0			144.60
1972	( 2)	195.00	( 17)	142.65	( 75)	142.40	( 29)	142.07	( 2)	155.00	146.40
1973	( 1)	195.00	( 25)	145.40	( 20)	145.50	( 30)	151.30	( 1)	205.00	149.14
1974	( 4)	135.00	( 57)	137.00	( 90)	142.20	(133)	148.90	(10)	150.0	144.38
1975	( 1)	175.00	( 62)	150.00	( 72)	152.40	( 55)	152.40			151.70
1976	( 1)	145.00	( 10)	142.00	( 63)	143.30	( 60)	142.10	( 5)	141.00	142.60
1977	( 5)	135.00	( 47)	145.76	(115)	152.48	( 61)	157.30	( 48)	158.75	153.21
1978	( 3)	158.33	( 40)	142.25	(148)	147.64	(239)	148.26	( 75)	150.73	148.03
1979	( 4)	135.00	( 92)	144.13	(149)	141.11	( 58)	152.50	( 42)	156.43	145.62
1980	( 3)	171.67	(185)	146.62	(198)	148.43	(123)	148.17	(14)	144.29	147.75
21-year mean	( 79)	137.10	(1,700)	137.52	(4,357)	135.70	(1,814)	143.61	(568)	149.15	
<i>Balboa Angling Club</i>											
1945			( 53)	138.58	( 84)	137.97	( 3)	121.66			137.85
1946			( 82)	142.19	( 91)	140.76	( 13)	146.53			141.80
1947			( 30)	149.66	( 35)	139.00	( 50)	144.40	( 4)	150.00	144.32
1948			( 27)	145.00	( 60)	142.23					143.16
1949	( 2)	190.00	( 34)	139.41	( 61)	146.47					144.89
1950	( 3)	131.66	( 40)	144.25	(120)	137.66	( 45)	151.22			141.77
1951	( 4)	167.50	( 33)	143.78	( 67)	163.33	( 6)	163.33			144.72
1952			( 80)	144.25	(281)	125.41	( 56)	151.96			133.59
1953			( 16)	161.25	( 10)	147.00	( 3)	178.33			158.10
1954			( 19)	158.68	( 26)	159.61			( 4)	172.50	160.30
1955			( 9)	163.88							163.88
1956			( 23)	172.36	( 31)	146.29	( 50)	175.92			166.50
1957			(221)	159.54	(138)	149.02	( 39)	160.89			156.03
1958	( 55)	148.63	( 46)	146.30	( 47)	134.78	(115)	130.47	( 6)	143.33	137.93
1959	( 46)	146.95	(317)	129.79	(148)	129.59	( 16)	146.25	( 3)	138.33	131.77
1960			( 75)	150.46	( 71)	138.94					144.86
1961			( 29)	153.62	( 57)	137.45	( 12)	138.33			142.34
1962			( 8)	141.25	( 12)	152.50					148.00
1963			(180)	134.86	( 54)	133.14	( 79)	139.05	( 5)	133.00	135.58
1964			( 35)	127.28	(143)	130.87	(238)	143.21	( 59)	152.62	139.49
1965			( 22)	137.72	( 20)	147.00	( 81)	145.50			143.69
1966	( 4)	125.00	( 62)	137.41	( 91)	134.89	( 68)	127.50			133.17
1967			( 43)	135.46	(117)	127.99	( 35)	132.28	( 48)	147.70	133.97
1968	( 5)	119.00	( 68)	129.85	(103)	137.23	( 82)	144.87	( 36)	148.61	138.74
1969			( 16)	153.75	(125)	142.36	( 52)	146.92			144.52
1970			( 26)	126.15	( 51)	133.62	( 15)	141.66			132.82
1971			( 32)	152.19	( 46)	132.39	( 20)	154.50			143.37
1972			( 22)	149.54	( 12)	157.50	( 16)	146.25			150.40
1973	( 1)	155.00	( 12)	135.00	( 15)	144.33	( 2)	155.00	( 1)	205.00	143.71
1974	(13)	140.38	( 85)	138.17	(116)	147.28	(112)	143.39	( 3)	168.33	143.52
1975			( 38)	146.05	(110)	149.45	( 7)	155.00			148.87
1976	( 2)	125.00	( 61)	152.29	( 59)	145.60	( 54)	149.81	( 17)	151.76	147.81
1977	( 1)	125.00	( 35)	144.71	( 96)	155.94	(169)	150.74	( 3)	148.33	151.58
1978	( 1)	155.00	( 37)	146.89	( 50)	153.00	( 46)	161.96	( 2)	155.00	154.41
1979	( 3)	158.33	( 142)	138.73	( 85)	139.06	( 4)	152.50	( 3)	178.33	139.83
1980	( 2)	150.00	( 63)	142.78	( 32)	150.00	( 8)	160.00	( 3)	151.67	146.58
36-year mean	(142)	146.20	(2,112)	142.04	(2,673)	139.02	(1,496)	145.71	(197)	150.81	
2%			32%		40%		23%		3%		
Combined mean, both clubs	(221)	142.94	(3,812)	140.02	(7,030)	136.96	(3,310)	144.56	(765)	149.58	

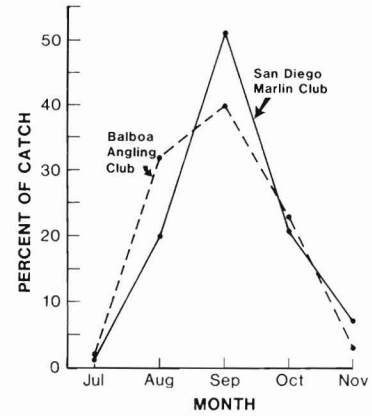


Figure 2.—Percentage of catch by month recorded for landings of striped marlin at San Diego (1960-80) and Balboa, Calif. (1945-80).

62.1 kg (136.9 pounds) during September, the month with the highest catch, when compared with weights for August and October. In October and November mean weight increased to 65.8 kg (145 pounds) and 68 kg (150 pounds), weights that are slightly above the weight observed at the beginning of the season.

Although the mean weight of marlin taken in recent years is only slightly higher than those weights recorded in the late 1940's, there occurred a period from 1953 through 1957 when anomalous weights were observed. In 1952 the average weight recorded at the Balboa Angling Club was 60.0 kg (134 pounds) with a catch of 417 fish, a catch which was well above the average landing of 184 marlin. In 1953 the catch was low (29 marlin) but the average weight increased 10.9 kg (24 pounds) to 71.7 kg (158 pounds) over the previous year (1952). The average weight continued to be well above the long-term average (64.4 kg or 142 pounds) during the next four seasons, 1954-57, with catches of 49, 9, 103, and 398 marlin respectively. In 1956 the average weight was the maximum recorded, 75.8 kg (167 pounds). Average weights decreased in 1958 to near the long-term average but with an above average catch of 269 mar-

(3.3 pounds) heavier in September, and 0.7 kg (1.6 pounds) heavier in November.

Combined mean weights for the 15,138 marlin in the sample (Table 1) show a slight decrease in mean weight to

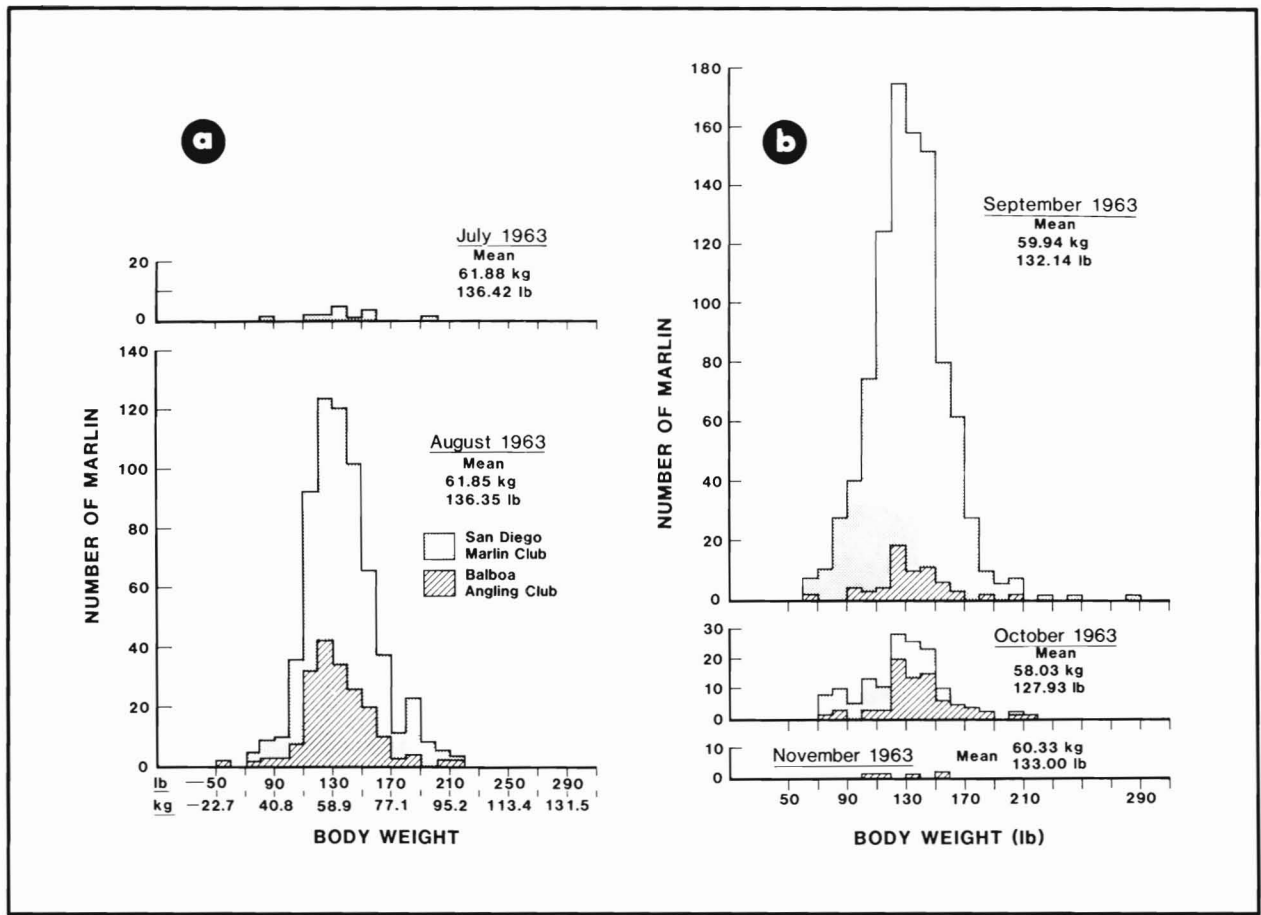


Figure 3.—Distribution of landing weights by 4.5 kg (10-pound) increments for the 1963 season.

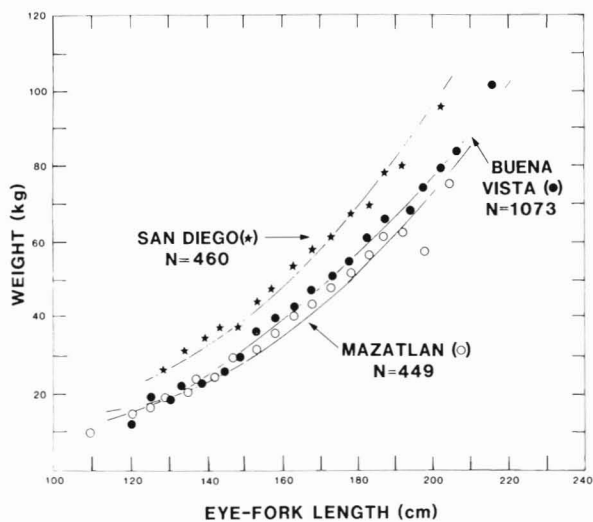


Figure 4.—Weight as a function of eye-fork length of striped marlin from the northeastern Pacific. (Buena Vista is located in the east side of the Baja California Mexico peninsula near the southern tip.) From Wares and Sakagawa (1974).

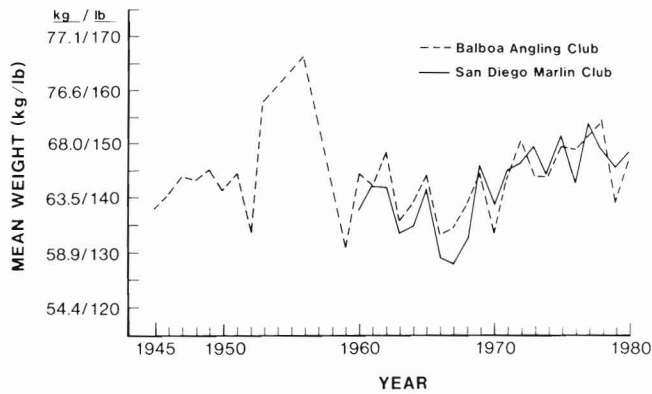


Figure 5.—Mean weight of striped marlin by year for landings at the Balboa Angling Club, 1945-1980 and the San Diego Marlin Club, 1960-1980.

lin. Data indicate that predominantly larger (older) marlin were common to the fishing area in the 5-year period from 1953-57, with marlin of lower mean weight recruited back into the fishery in 1958. From 1958 through

1980 both sets of data (Fig. 5) show no substantial change in average weight even though large catches of striped marlin have been made by the commercial longline fleet in the northeast Pacific.

### Acknowledgments

The work of Karen Blakney in reviewing and tabulating recordbook data and preparing length frequency graphics for analysis is appreciated. The manuscript was reviewed by Norman Bartoo and Earl Weber and their suggestions are appreciated.

### Literature Cited

- Eldridge, M. B., and P. Wares. 1974. Some biological observations of billfishes taken in the eastern Pacific Ocean, 1967-1970. *In Proc. Int. Billfish Symp.*, Part 2, p. 89-101, NOAA Tech. Rep. NMFS SSRF-675.
- Jordan, D. S. 1916. Notes on California fishes. *Copeia*. No. 36, 80 p.
- Squire, J. L., Jr. 1974. Catch distribution and related sea surface temperature for striped marlin (*Tetrapturus audax*) caught off San Diego, California. *In Proc. Int. Billfish Symp.*, Part 2, p. 188-193. NOAA Tech. Rep. NMFS SSRF-675.
- Talbot, G. B., and P. Wares. 1975. Fishery for Pacific billfish off southern California and Mexico, 1903-69. *Trans. Amer. Fish. Soc.* 104(1):1-12.
- Wares, P. G., and G. Sakagawa. 1974. Some morphometrics of billfishes from the eastern Pacific. *In Proc. Int. Billfish Symp.*, Part 2, p. 107-120. NOAA Tech. Rep. NMFS SSRF-675.