Angler Catch Rates of Billfishes in the Pacific Ocean

JAMES L. SQUIRE, JR.[1]

ABSTRACT

In 1969, 1970, and 1971 marine game fish anglers participating in the Pacific phase of the National Marine Fisheries Service cooperative marine game fish tagging program were asked to complete a postcard form which requested information of the number of days of billfishing the angler engaged in and the catches made. From the 17,876 angler days reported, the catch consisted of 10,234 billfishes. The average for the 3-yr period was 0.57 billfish per angler-day or 1.75 days of fishing per billfish. Analysis of data for the geographical areas in the eastern Pacific and Australia (Queensland) where billfishing is conducted resulted in a wide range of catch per effort for all billfish species combined. Off southern California, U.S.A., the catch was 0.10 fish per angler-day, equaling 10.3 days of fishing per fish. Off Baja California, Mexico, records show 0.82 fish per angler-day equaling 1.22 days fishing per fish, and fishing off Mazatlán yielded 1.21 fish per angler-day and 0.82 days fishing per fish. Off Acapulco, Mexico, the results were 0.95 fish per angler-day and 1.05 days per fish. Fishing off Australia the records show 0.55 fish per angler-day equaling 1.83 days per fish.

The measurement of catch rates is of value in evaluating fishing success relative to seasonal changes, specific types of fishing gear or changes in gear, and effects of environmental change. However, its greatest use has been in the determination of the effect of fishing on the stock or stocks of fish being utilized by sport and commercial fisheries.

The only comprehensive sources of catch and effort data for billfishes in the Pacific Ocean are the reports of the commercial longline fishery for tunas and billfishes published by the Research Division of the Japanese Fisheries Agency. These data have been used by researchers in the eastern Pacific in determination of commercial catch rates for billfishes (Suda and Schaefer, 1965; Kume and Schaefer, 1966; Kume and Joseph, 1969).

The billfish sport fishery in the northeastern Pacific off Mexico and the United States is reported to capture at least 10,000 fish each year (Talbot[2]); however no accurate totals for sport-caught billfishes are available. The number of billfishes taken by the sport fishery is a fraction of that landed by the commercial fishery. However, the economic value of the sport fishery resulting from the expenditure for goods and services by the thousands of billfish anglers in the pursuit of the sport is assumed to be substantial.

The problems in obtaining a measure of catch and effort in marine sport fisheries are many. In contrast to a commercial fishery, where commercial landings and sometimes fishing records are kept and the number of operating units is known, the sport fishery consists of many small and mobile units which may or may not land their billfishes at locations where a record of the landing might be made. A report on the problem of obtaining sport fishery statistics was made by the Institute of Statistics, University of North Carolina (D. W. Hayne, 1964[3]) and many of the observations in that report are applicable to the design of a statistically accurate billfish angler survey.

As part of the cooperative marine game fish tagging program, conducted first at the Tiburon Marine Laboratory, Tiburon, California, and later at the Southwest Fisheries Center, La Joila, California, an annual report describing the progress in billfish tag-

[1]Southwest Fisheries Center, National Marine Fisheries Service, NOAA, La Jolla, CA 90237.

[2]Talbot, Gerald B., U.S. Bureau of Sport Fisheries and Wildlife, Clemson University, P.O. Box 429, Clemson, S.C. Personal communication.

[3]Hayne, D. W., The measurement of catch and effort in marine sportfishing. Report to the U.S. Bureau of Sport Fisheries and Wildlife, September 15, 1964. Institute of Statistics, Raleigh Section, North Carolina State, University of North Carolina, memo, 23 p.

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.

ging was mailed to individuals that had participated in the program. This mailing list consisted of names of billfish anglers, most of whom fished in the eastern Pacific or off the east coast of Australia.

In the annual reports for 1969, 1970, and 1971, a postcard was enclosed requesting information on the amount of fishing effort and catch. The billfish angler was asked to recall the number of days of billfishing and the number of billfish caught by species. The anglers were requested to give an "honest" answer and told that information on zero catches was important. The technique of postcard survey has been the subject of considerable controversy. The California Department of Fish and Game has used this technique and a number of researchers have published on the results of this type of survey (Calhoun, 1950, 1951; Clark, 1953; Pelgen, 1955; Abramson, 1963; Jensen, 1964).

Hayne reported that it is difficult for a fisherman to remember precisely his catch of the previous year. However, with regard to billfishes, the frequency at which the average billfish angler participates in the sport is limited and the annual catch of billfish per angler is small. Billfish are "trophy fish" and the author believes that the average billfish angler can recall within close limits the number of fish caught during the previous year and the number of days he participated in the fishery.

METHODS

A sample of the questionnaire used is shown in Figure 1. The form was also used to update the mailing list for the Cooperative Marine Game Fish Tagging Program annual report. The postcard form was sent to the billfish anglers in February of 1970, 1971, and 1972, and a prompt return of the card was requested. The number of survey cards sent each

NOAA FORM 88-10 (7-71) | ANGLER SURVEY | OMB NO. 41-R2602

We would appreciate your furnishing the following information. Please return the completed card by mail. No postage is required.

Do you wish to continue receiving these tagging reports? ☐ Yes ☐ No

Please estimate your LAST YEAR'S catch, by area, in the spaces below:

AREA	NUMBER OF DAYS YOU FISHED FOR BILLFISH	TOTAL NUMBER CAUGHT (landed or released)	
		MARLIN	SAILFISH
Southern California			
Baja California			
Mazatlan			
Acapulco			
Other			

YOUR NAME

STREET ADDRESS

CITY | STATE | ZIP CODE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

U.S. MAIL

NOAA-National Marine Fisheries Service
Southwest Fisheries Center
P.O. Box 271
La Jolla, California 92037

Figure 1.—Angler survey card.

Table 1.—Combined catch and effort data for surveys conducted in 1969, 1970, and 1971.

Area	Angler days	Species/catch (numbers)			Catch rates	
		Striped marlin	Sailfish	Black marlin	Fish/angler day	Days/fish
USA						
Southern California	6,458	593	51	0	0.10	10.03
Mexico						
Baja California	8,710	6,168	964	0	0.82	1.22
Mazatlán	1,316	697	900	0	1.21	0.82
Acapulco	249	16	221	0	0.95	1.05
Australia (Queensland)						
Cairns	1,143	0	172	452	0.55	1.83
Total	17,876	=10,234 (all species)			Aver. 0.57	Aver. 1.75

year with the annual tagging report varied from 1,900 to 2,600.

RESULTS

Approximately 50% of the survey cards were returned within a 3-mo period and the number of angler days in each of the major fishing areas, the number of billfishes caught, and calculations of numbers of fish per angler day and numbers of days of fishing per fish are given in Table 1.

The combined totals for the fishing areas off southern California, U.S.A., about the tip of Baja California, Mazatlán, and Acapulco, Mexico, and

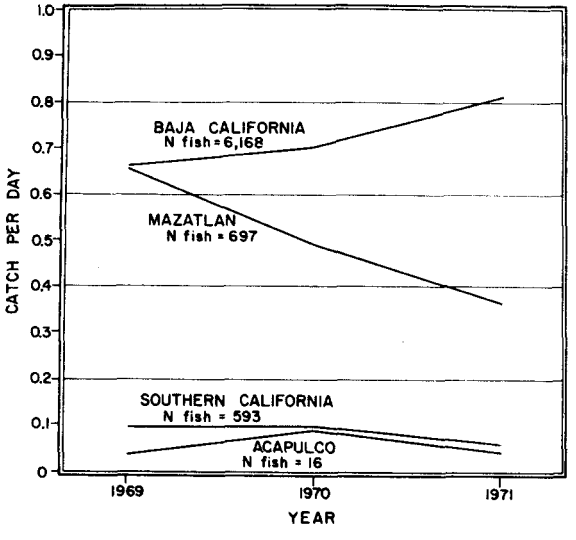

Figure 2.—Sport fishing catch per day for striped marlin in the eastern Pacific.

Cairns, Queensland, Australia, were 17,876 angler days, catching 10,234 billfishes for an average of 0.57 fish per day and 1.75 days of fishing for each billfish.

A breakdown of the totals given in Table 1 for each year is presented in Table 2.

For these selected fishing areas the annual statistics from the survey on total catch and effort are as follows: 1969, 6,286 angler days, 3,404 billfishes caught equaling 0.54 fish per day and 1.90 days of fishing per fish; 1970, 6,286 angler days, 3,588 billfishes caught equaling 0.58 fish per day and 1.75 days of fishing per fish; 1971, 5,304 angler days,

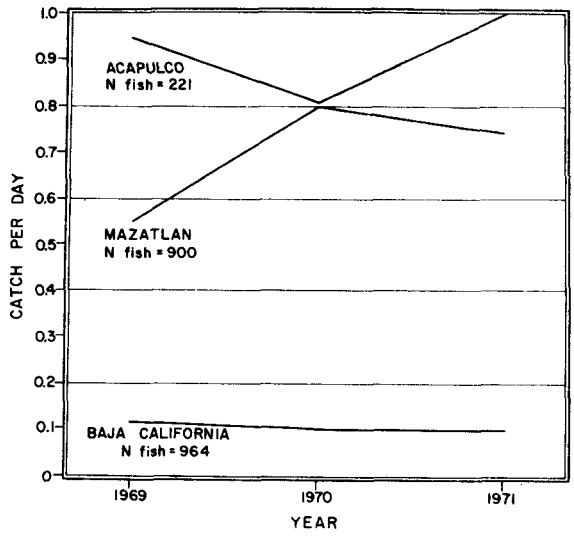

Figure 3.—Sport fishing catch per day for sailfish in the eastern Pacific.

3,242 billfishes caught equaling 0.61 fish per day and 1.64 days of fishing per fish.

A graphic presentation of the catch per effort data is given for striped marlin *Tetrapturus audax* in Figure 2; for sailfish *Istiophorus platypterus* in Figure 3; and for black marlin *Makaira indica* in Figure 4. Catch per effort data for combined

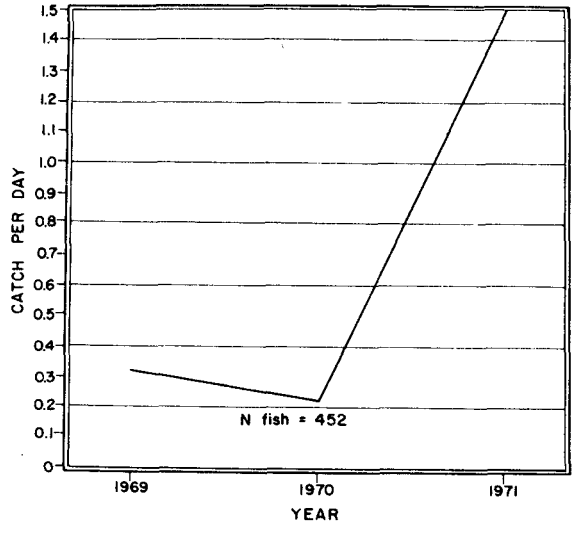

Figure 4.—Sport fishing catch per day for black marlin off Queensland, Australia.

Table 2.—Catch and effort data for the years 1969, 1970, and 1971 by species and by area.

Area	Angler days	Striped marlin			Sailfish			Black marlin			Total		
		Catch	Catch/ angler day	Days/ fish	Catch	Catch/ angler day	Days/ fish	Catch	Catch/ angler day	Days/ fish	Catch	Catch/ angler day	Days/ fish
1969													
Southern California	2,297	220	0.10	10.44	—	—	—	—	—	—	220	0.10	10.44
Baja California	2,519	1,657	0.66	1.52	314	0.12	8.02	—	—	—	1,971	0.78	1.27
Mazatlán	583	382	0.65	1.52	322	0.55	1.81	—	—	—	704	1.21	0.83
Acapulco	112	5	0.04	10.70	106	0.94	1.05	—	—	—	111	0.94	1.05
Cairns (Australia)	775	—	—	—	162	0.21	4.66	236	0.31	3.20	398	0.53	1.93
1970													
Southern California	2,068	221	0.01	9.30	11	<0.00	88.0	—	—	—	232	0.11	8.90
Baja California	3,398	2,258	0.70	1.50	357	0.10	9.50	—	—	—	2,615	0.77	1.30
Mazatlán	461	214	0.50	2.10	374	0.80	1.20	—	—	—	588	1.27	0.80
Acapulco	97	9	0.09	10.70	75	0.80	1.20	—	—	—	84	0.86	1.15
Cairns (Australia)	262	—	—	—	10	0.03	26.2	59	0.22	4.40	69	0.26	3.70
1971													
Southern California	2,093	152	0.07	13.70	40	0.02	52.30	—	—	—	192	0.09	10.90
Baja California	2,793	2,253	0.82	1.24	293	0.10	9.50	—	—	—	2,546	0.91	1.10
Mazatlán	272	101	0.37	2.69	204	0.75	1.33	—	—	—	305	1.12	0.89
Acapulco	40	2	0.05	20.00	40	1.00	1.00	—	—	—	42	1.05	0.95
Cairns (Australia)	106	—	—	—	—	—	—	157	1.48	0.69	157	1.48	0.69

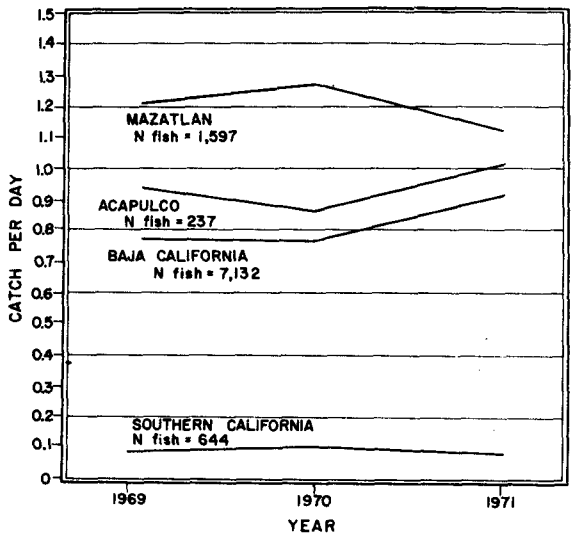

Figure 5.—Combined species (striped marlin and sailfish) catch per day in the eastern Pacific.

species of billfish at locations in the eastern Pacific are shown in Figure 5.

SUMMARY AND DISCUSSION

Striped marlin catch and effort data for fishing off southern California show a catch rate of 0.10 fish per day or less, and the catch rate off Acapulco is lower than southern California. The Baja California, Mexico, catch rate is highest, ranging between 0.66 and 0.82 fish per day with a slight increase shown in the catch rate in 1971 as compared to 1969. For the fishing area off Mazatlán the catch rate has declined from 0.65 to 0.37 during the survey years.

During the 3-yr period catch rates for sailfish ranged about the 0.9 to 1.0 fish-per-day level off Acapulco and the 0.55 to 0.80 fish-per-day level off Mazatlán. The catch rate is much lower off Baja California than off Mazatlán and Acapulco, remaining steady at a rate of about 0.1 fish per day. Black marlin catch rates off Cairns, Australia varied considerably from a low of 0.22 to a high in 1971 of 1.48 fish per day.

In 1968 and 1969 the Tiburon Marine Laboratory conducted field sampling for billfishes about the tip of Baja California and at Mazatlán, Mexico. Catch and effort data were collected from available sources such as the sportfishing fleet operators and Mexico's Department of Tourism. Catch and effort data for Mazatlán and Las Palmas Bay (at the tip of Baja California) are shown in Figure 6. Statistical data from the field sampling program show a catch rate for sailfish at Mazatlán of 0.74 fish per day and the postcard angler survey shows about 0.70 fish per day. For striped marlin caught about the tip of Baja California, Mexico, the Las Palmas Bay data shows a catch rate of 0.60 fish per day, the angler postcard survey shows about 0.75 fish per day.

Comparative catch-per-unit-effort data are not available for southern California waters, but experienced anglers state the figure of 0.10 billfish per day appears reasonable.

Marine game fishing for billfishes is an important economic factor in many areas of the world. The monetary expenditure of marine anglers per billfish caught is recognized as substantial. The point

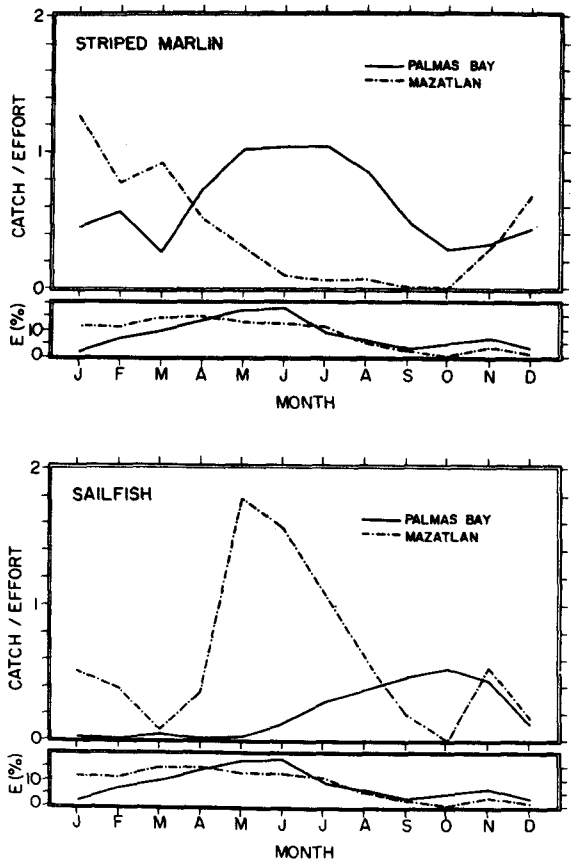

Figure 6.—Striped marlin (upper panel) and sailfish (lower panel) catch and effort rates off Las Palmas Bay (tip of Baja California) and Mazatlán, Mexico, 1968-1969.

(catch per effort level) at which the majority of anglers will cease to fish is dependent upon location and accessibility of the fishing grounds. An example of this is billfishing off southern California, which has by the angler survey records a low catch rate of 0.10 fish per day, or 10.02 days per billfish. The accessibility of the fishing grounds to the large southern California fleet of sportfishing boats makes for a large effort in spite of a low catch. If this same catch rate were common about the tip of Baja California, Mexico, the number of U.S. anglers traveling to this distant area to fish for billfishes might be only a fraction of the present number.

The angler survey sampled to a greater degree those individuals who participated in the tagging program, and had fished off southern California, the west coast of Mexico, west coast of Central America, or Australia. The postcard survey method for obtaining billfish catch and effort data has the potential of sampling more billfish anglers than any other method. Selection of a mailing list based on active billfish anglers belonging to the major billfish clubs throughout the United States and in other countries could provide a sampling frame for a reliable worldwide statistical determination of sportfishing catch and effort activity. The postcard method could provide a source of continuing information on the status of billfish angling relative to the resource base on which it depends for the least monetary expenditure, when compared with other sampling methods.

LITERATURE CITED

ABRAMSON, N. J.
1963. Distribution of California angling effort in 1961. Calif. Fish Game 49:174-182.

CALHOUN, A. J.
1950. California angling catch records from postal card surveys: 1936-1948; with an evaluation of postal card nonresponse. Calif. Fish Game 36:177-234.
1951. California state-wide angling catch estimates for 1949. Calif. Fish Game 37:69-75.

CLARK, F. N.
1953. California marine and fresh water sport fishing intensity in 1951. Calif. Fish Game 39:115-125.

JENSEN, P. T.
1964. Landing estimates of California's marine recreational salmon fishery. Calif. Fish Game 50:48-52.

KUME, S., and J. JOSEPH.
1969. The Japanese longline fishery for tunas and billfishes in the eastern Pacific Ocean east of 130°W, 1964-1966. [In Span. and Engl.] Bull. Inter-Am. Trop. Tuna Comm. 13:277-418.

KUME, S., and M. B. SCHAEFER.
1966. Studies on the Japanese long-line fishery for tuna and marlin in the eastern tropical Pacific Ocean during 1963. [In Span. and Engl.] Bull. Inter-Am. Trop. Tuna Comm. 11:103-170.

PELGEN, D. E.
1955. Economic values of striped bass, salmon, and steelhead sport fishing in California. Calif. Fish Game 41:5-17.

SUDA, A., and M. B. SCHAEFER.
1965. General review of the Japanese tuna long-line fishery in the eastern tropical Pacific Ocean 1956-1962. [In Span. and Engl.] Bull. Inter-Am. Trop. Tuna Comm. 9:307-462.