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FISH BULLETIN 143
Southern California Marine Sportfishing Survey: Private Boats, 1964; Shoreline, 1965–66

by
LEO PINKAS
,
MALCOLM S. OLIPHANT,
and
CHARLES W. HAUGEN
1968

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FRONTISPIECE. Typical southern California open coast sandy shoreline where sportfishermen usually catch barred surfperch, California corbina, yellowfin croaker, and shovelnose guitarfish. *Photograph by Leo Pinkas.*

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ABSTRACT

Effort, catch, and catch rates for southern California sportfishing from private boats and from the shoreline were estimated for one-year periods. These categories represent two of four major types of marine sportfishing; the others are fishing from party boats and from piers and jetties.

Probability sampling plans employing fisherman interviews were used in obtaining the basic data for the surveys. Shoreline surveys were supplemented by aerial progressive counts of fishing poles.

Private boat sportfishing activities during 1964 were estimated at 2.8 million man hours (mh) of fishing. The catch of almost 1 million fish was composed primarily of five species, Pacific bonito, California halibut, white croaker, sand bass, and kelp bass.

A 12-month survey, 1965–66, revealed that surf fishermen expended an estimated 1.7 million mh of effort in taking 0.5 million fish. More fishing effort was expended from the bay shoreline, 869,557 mh, than from the open coast, 776,732 mh. The catch in each area was markedly different. White croaker, queenfish, and smelt (jack and top) were the most significant species in inland bays, while for the open coast, barred surfperch, opaleye, and California corbina were most important.

A synoptic picture of the annual sportfishing activities and harvest in southern California was constructed. The total effort from party boats, piers, jetties, private boats, and the shoreline was estimated to be 12.3 million man hours of fishing. Three groups contributed well over half of the 7.3 million fish captured: tunas, 1.9 million; sea basses, 1.4 million; and croakers, 1.1 million. Pacific bonito, with 1.6 million fish, made the largest contribution by a single species. California barracuda was second with 0.6 million and white croaker was third with 0.5 million.

ACKNOWLEDGMENTS

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We wish to thank all the people who assisted us throughout our investigation. Special thanks are due the thousands of sportfishermen who willingly cooperated with our census clerks.

The following people assisted us in collecting the basic fishing data: Ronald D. Black, Richard J. Cavaliere, Patrick C. Collier, Wade Corder, Jack A. Hanson, Gerald A. Iriye, Robert Michaud, Med F. Peck, Warren L. Schaffer, Gregory Smith, and James C. Thomas.

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Laura L. Richardson performed the difficult task of converting our rough drafts into a finished manuscript.

General guidance and overall review of our work was provided by John E. Fitch. The editorial staff of John L. Baxter, Patricia Powell, and Phil M. Roedel assisted in polishing and guiding this report through the various prepublications stages.

LEO PINKAS
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CHARLES W. HAUGEN
June, 1968

1. INTRODUCTION

California's first comprehensive measurement of marine sportfishing from piers, jetties, private boats, and the shoreline was initiated in 1957. Limited funds restricted this survey to central and northern California (Miller and Gotshall, 1965). A similar study in southern California, Point Conception to the United States-Mexico border, was undertaken in 1962 when manpower and funds became available through the Federal Aid to Fish Restoration Act. Monetary and staffing limitations also restricted the scope of the latter investigation. Piers and jetties were surveyed in 1963 (Pinkas, Thomas, and Hanson, 1967), private vessels in 1964, and the shoreline from April 1965 through March 1966 (Figure 1) .

The goal of each survey was to ascertain the magnitude and significance of marine sportfishing activities within the respective geographical areas. These fishing activities, as a group, represented the last major gap in our knowledge of California's marine fisheries.

The basic objectives and concepts of the southern California series of surveys engendered probability sampling plans to estimate total fishing effort, total catch, and species composition of the catch. Slightly different approaches were utilized in each survey, in part to accommodate geographical and behavioral (fishermen) variations and in part as a reflection of our experience and maturity in conducting surveys.

This report summarizes the findings of our creel census of private boat and shoreline fishermen. Their activities, plus the catch, are analyzed individually, as a group with pier and jetty fishermen, and finally in juxtaposition with the other major sportfishing group—the partyboat fishery.

2. METHODS

2.1. Definitions

General terms are frequently ambiguous, change with time, or mean different things to different people. Although most of the technical terms in this report are in general use by fisheries investigators and have been defined by Miller and Gotshall (1965) for marine sport fish surveys, certain specific ones are described here for clarity and understanding.

2.1.1. Partyboats:

All boats regardless of size that carry passengers (fishermen) for a fee. Usually operated by a skipper knowledgeable in marine sportfishing methods and practices.

2.1.2. Private boats:

All private or rented craft, skiffs, or vessels not involved in commercial fishing and not carrying paying passengers (sportfishermen) at the time of sampling.

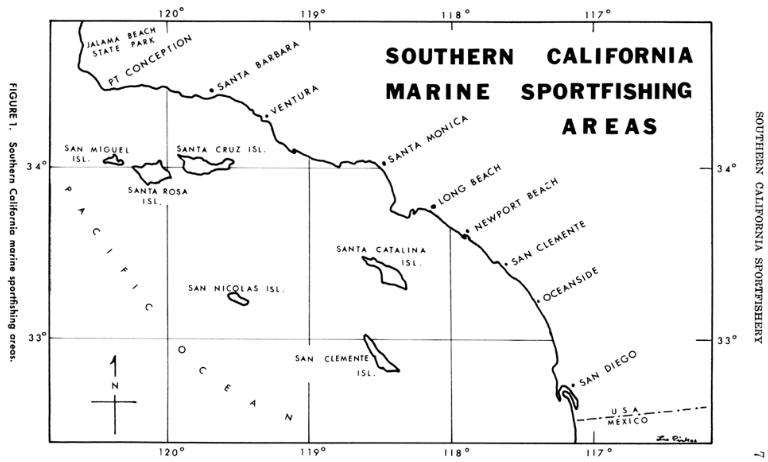

FIGURE 1. Southern California marine sportfishing areas

2.1.3. Shore or surf fishermen:

All anglers casting from the natural or artificial shoreline.

2.1.4. Launching site:

A place where skiffs and boats are launched; including mechanical lifts operated from piers or wharfs extending from the shore, improved launching ramps, and unimproved sections of beaches where it is calm and safe to launch a boat.

2.1.5. Mooring site:

A place where skiffs, boats, or vessels are secured while still afloat; as used here, principally floating docks within protected harbors.

2.1.6. Length of fishing trip—private boats:

The total elapsed time between departure and return of a skiff, boat, or vessel. If an interviewed party indicated it had fished, the entire time was considered as fishing effort because most people could not accurately recall the actual span of time spent fishing or in traveling.

2.1.7. Length of fishing trip—shoreline:

The total elapsed time between start of fishing (as reported by the fisherman) and the estimated time of departure (as determined by the presence or absence between interview rounds). If the fishing party was absent, one-half the time interval between interview rounds was used as the time of departure.

2.1.8. Boat day:

The total time, during a calendar day, that a private boat engaged in sportfishing activities; including travel time to and from point of depature.

2.1.9. Man day—private boast:

The total time, during a calendar day, spent by one person aboard a private boat engaged in sportfishing activities. The time span is equivalent to a boat day.

2.1.10. Man day—shoreline:

The total time during a calendar day that one person fished from the shoreline. A man day is equivalent to length of fishing trip—shoreline.

2.1.11. Catch-per-man-day:

The average number of fish caught by a fisherman during a calendar day.

2.1.12. Catch-per-man-hour:

The average number of fish caught by a fisherman in one hour.

2.1.13. Catch-per-boat day:

The average number of fish caught from a boat during a "boat day" in a calendar day.

Common fish names are used throughout this report. Their scientific equivalents and taxonomic order follow Roedel (1962, 1963) and the American Fisheries Society (1960) (Table 1).

2.2. Private Vessel Survey—1964

Preliminary surveys indicated that the population of sportfishing boats in southern California could be divided into two categories: (i) boats launched from trailers (either from ramps or by hoists), and (ii) boats operating from mooring sites in marinas. Apparent differences in sportfishing activity between the two groups warranted stratification into sub-populations, i.e., a launching site stratum and a mooring site stratum.

The launching site stratum consisted of all launching ramps and hoists in the sample area with each site treated as a sampling unit. We divided marinas (mooring sites) into sampling units of a size that would permit the sampler to see all boats entering the unit even while occupied in conducting an interview. This resulted in sampling units that averaged about 100 boats each.

Sportfishing activity was re-evaluated periodically and units added to or removed from the sample population as conditions warranted. Changes in the sampling frame were made only at the beginning of a new sampling period. The number of sampling units in the launching site stratum ranged from 17 to 25 while the mooring site stratum contained from 115 to 128.

In forming our sampling plan, financial and manpower limitations dictated that we use days as the primary sampling unit and the launching and mooring sites as the second stage sampling units. In this way it was possible to operate with as few as two sampling clerks—one for each sub-population. We had, however, three samplers available and arbitrarily assigned two to the mooring site stratum and one to the launching site stratum.

The year was divided into six 2-month periods. Within each period we stratified weekdays from weekend days and holidays in an attempt to minimize the variance of the estimates. Proportional allocation was used to divide the 36 sampling days (arbitrarily assigned to each period per man) between the strata of weekdays and weekend days.

The launching site stratum estimates cover the 12-month period January through December 1964. Mooring site sampling did not begin until March 1 because extensive field reconnaissance was needed to resolve difficulties in forming a sampling frame and to establish procedures. Catch and effort estimates for this stratum therefore cover the 10 months March–December 1964.

All sample days and geographical units were selected at random in advance of actual field work. One launching site and two mooring sites were drawn independently for each sample day of its respective stratum. The construction of this portion of the sampling frame was facilitated by the use of a table of random numbers (Rand Corp., 1955).

Interview hours were from 0900 to 1800 Pacific Standard Time. Upon arrival at an assigned sampling unit the clerk would determine, from the number of trailers present or the number of empty slips, the sample fraction to be used during the day; i.e., whether he would interview each boating party, every second, third or *n*th party.

As each *n*th boat landed, the clerk would record the time of landing and the type of activity, i.e., sportfishing, sailing, water skiing, etc. If sportfishing was one of the activities, the interview was continued to ascertain the time the boat departed, the number of persons in the party, the location fished, and the number and species of fish caught.

2.3. Shoreline Survey 1965–66

2.3.1. Ground Census

Prior to establishing a sampling frame for our creel census of shoreline fishermen, considerable pre-census scouting and study of coastal maps was done to find a suitable geographical unit for sampling. Many obvious categories, such as rocky shores and sandy beaches, were quickly ruled out because, with few exceptions, there were no distinct boundaries (Figure 2) . Two exceptions were the categories "open coast" and "bays": here the differences were marked and easily definable (Figure 3) . We retained the distinction throughout the survey.

These preliminary studies led us to use, for a 2-month period, geographical areas based on expected fisherman behavior, namely limited access and unlimited access units.

The limited access unit concept assumed that: (i) an area was accessible through a single point such as a path, stairway, or gate; (ii) fishermen would enter and leave the given area via the access point only; and, (iii) by strategically stationing a census taker at the access point interviews yielding completed trip data could be obtained.

The unlimited access units were open coast or bay areas with infinite accessibility points that could be censused by traversing the shoreline and interviewing fishermen engaged in their sport. The method would yield incomplete trip data.

The criteria for establishing an area as a sampling unit were availability to the general public and its size; specifically of a length that could be censused in approximately 2 hours by one man.

The above screening device automatically created a third geographical category, inaccessible areas. The term does not mean to imply that no fishing occurred, on the contrary, local landholders and their guests fished the areas to a greater or lesser degree. Since the general public was excluded, we decided not to sample this type of area from the ground. A measure of the fishing activity was gleaned, however, by an aerial censusing technique to be described later.

The sampling frame used during April and May 1965 sampling period consisted of 119 units. The coast, including bays, was divided into 46 limited access units and 73 unlimited access units.

By the end of April's field sampling it became apparent that the "limited access unit" concept was grossly inadequate because fishermen did not behave as anticipated. The unlimited access approach, on the other hand, appeared to reflect true fishing activity within an area. Therefore, all geographical areas were reviewed and revised to create only two types of units, unlimited access and inaccessible areas.

The new sampling frame was first utilized for the June 1965 sampling period. It contained 90 open coast and 10 bay units all of the unlimited access type. One bay unit was added beginning in July and thereafter the list remained stable through to March 31, 1966 when the field phase of the survey ended.

FIGURE 2. Typical southern California open coast, rocky shoreline where sportfishermen catch opaleye, black perch, halfmoon, and cabezon. *Aerial photograph by Chet Hart, December 1964.*

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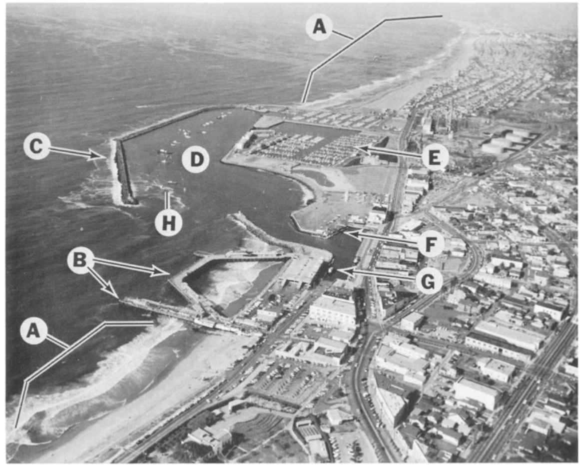

FIGURE 3. King Harbor, Redondo Beach, California illustrating the variety of available sportfishing opportunities: A, open coast surf-fishing; B, piers for shallow to deep water fishing; C, rock jetty; D, protected harbor or bay; E and F, mooring and launching sites for private vessels which fish the open sea or in protected bays; G, point of embarkation for partyboats which fish the open or deep sea areas; H, live bait receiver. *Aerial photograph by Chet Hart, December 1964.*

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Each calendar month in the year-long survey, April 1, 1965 through March 31, 1966, was temporally stratified by weekdays and weekend days. Each of these divisions was split into morning and afternoon sampling periods. In April and May the sampling areas were stratified into limited and unlimited access units.

The arbitrary assignment of 60 sampling days per month was governed by available manpower. This schedule was successfully met throughout the survey except for May and June when 54 and 56 days were assigned. Allocation of sampling effort between weekdays and weekend days was proportionate to the number of days in each category for each month. Within each group of days the effort was evenly distributed between morning and afternoon sampling periods. The April and May distribution deviated slightly to accommodate the unlimited and limited access divisions. In April the time was evenly divided between the limited and unlimited access units while in May sampling effort was distributed in proportion to the numbers of units in each listing.

The distribution of sampling effort between the open coast and bay units (June through March) was on a proportional basis except that a minimum of two sampling days was assigned to the bay units to satisfy the requirement imposed by variance calculations. Thus 8 bay and 52 coastal units were scheduled for sampling each month except in June when 8 bay and 48 open coast units were sampled.

Days and units at all levels in our shoreline sampling plan were selected in a random manner using a table of random numbers (Rand Corp., 1955).

We varied the length of the sampling day according to the number of daylight hours and to comply with our decision to keep the working day (including traveling time) within reasonable limits in the summer. Thus our sampling day (interview time) was 10 hours long during November, December, January, and February; 12 hours long during March, April, September, and October; and 14 hours long in May, June, July, and August.

We were unable to measure sportfishing activity at night along the southern California shoreline because of budgetary limitations, despite the fact that it is an important component of surf fishing activities, (Hull, 1964; Patterson, 1965; and personal communications with ardent surf fishermen).

2.3.2. Aerial Census

In addition to our main "interview type" probability sampling from the ground, we were fortunate in being able to conduct 14 aircraft flights along the open coast to assess sportfishing effort. Thirteen of the flights afforded the opportunity to compare estimates of fishing effort by the aerial progressive count technique and the shoreline interview probability plan. The flights also yielded some data on the relative amounts of fishing activity in areas not included in our ground shoreline sampling frame.

The methods used in the aerial counts were essentially the same for all flights. Progressive counts of fishing poles began at the United States-Mexico border between 1000 and 1115 hours and continued northwesterly along the coastline to Goleta. After about a one-hour stop for lunch and refueling the flight was continued to Jalama Beach County Park where tallying was terminated. Total flight time was usually close to 3 hours.

Each flight consisted of a pilot and a biologist observer. To facilitate tallying of fishing poles and note taking, a series of strip charts (United States Geological Survey topographic series) of the coast was assembled in sequence south to north in a loose-leaf three-ring notebook. Each chart was placed within a clear plastic envelope. Notations were made with a wax marking pencil on the plastic. These original flight notes were Xeroxed for our permanent records and then the plastic was wiped clean (soft rag or tissue) for reuse.

The aerial pole counts were tallied into either (i) the areas included in the ground survey or (ii) an "all other area" category. Low coastal fog, haze, and flight restrictions near airports sometimes precluded observation of some of the coastline. Adjustments in the fishing pole counts were made by first calculating the pole-per-sampling unit (ground survey units) for the observed areas, then expanding this value by the total number of sampling units. The net result was two sets of adjusted counts, one for the areas included in the ground survey and one for all the other areas.

To obtain pole hour estimates for the ground survey area for a period, the adjusted aerial count was expanded by the total hours in the sampling period. The estimate for the year was calculated by expanding the mean adjusted pole count from the 14 flights by the total sampling hours in the year.

Fishing effort in areas not covered by our ground survey was estimated by using the adjusted aerial counts in conjunction with the ground survey estimates of effort. The estimate of fishing effort outside the ground survey area was calculated by a simple proportion formula using the ratio of aerial pole counts in units covered by the ground survey (A) to the ground survey estimate of pole hours (B) and the aerial pole count in the unsurveyed area (C) to the (unknown) estimated effort in the unsurveyed area (D):

$$\frac{A}{B} = \frac{C}{D} \qquad \text{then:} \qquad D = \frac{BC}{A}$$

TABLE

2.4. Calculating the Estimates

The same basic approach was used to calculate the various parameters for our private boat survey as for our shoreline survey. The parameters for the 1964 private boat survey were, man hours and man days of fishing; catch by species; total catch; catch-per-man hour of fishing; number of fishermen per boat; catch-per-boat day; catch-per-boat hour; and average length of boat trip. The descriptive figures for the 1965 shoreline sportfishing survey were man hours of fishing; catch by species; total catch; catch-per-man hour of fishing; and average length of fishing trip. Standard errors were also calculated for these estimates except for average length of fishing trip.

Estimates were calculated by a straightforward expansion of the mean observed value of the measured parameters by a factor of the product of the numbers of days in a stratum and the appropriate number of units in a listing. The estimation procedure is best illustrated by following through the calculations for man hours of fishing along the coast.

Estimation procedures for man hours of fishing:

$$\bar{X}_h = \frac{\sum_{i=1}^{n_h} X_{hi}}{n_h}$$

$$\hat{X}_h = \bar{X}_h \; N_h \; P_h$$

$$\hat{X} = \sum_{h=1}^{4} \hat{X}_h$$

TABLE

Variance of the estimate:

$$v(\hat{X}_h) = N_h^2 P_h^2 \; \frac{\sum_{i=1}^{n_h} (X_{hi} - \bar{X}_{hi})^2}{n_h (n_h - 1)}$$

$$v(\hat{X}) = \sum_{h=1}^{4} v(\hat{X}_h)$$

where

$\bar{X}_h$	mean observed man hours of fishing per day per unit in the hth sampling period
h	1 AM sampling period weekend stratum 2 PM sampling period weekend stratum 3 AM sampling period weekday stratum 4 PM sampling period weekday stratum
X_{hi}	Observed man hours of fishing in the ith day of the hth sampling period
$\hat{X}_h$	estimated man hours fishing for a stratum
$\hat{X}$	estimated man hours of fishing for a month
n_h	number of days sampled in the hth sampling period
N_h	number of days in hth sampling period
P_h	number of sampling units in the hth sampling period
$v(\hat{X}_h)$	variance of the estimated man hours of fishing for the hth stratum
$v(\hat{X})$	variance of the estimated man hours of fishing for a month

TABLE

Catch per unit of effort estimates and their respective variances for each stratum were calculated using the ratio estimate technique of Cochran (1963). The variance estimates for the ratio of the combined strata were calculated using a variation of the formula given by Hansen, Hurwitz, and Madow (1953) (page 190 #4.5) (modified by Norman J. Abramson, Biometrical Analysis Section, California Department of Fish and Game).

Ratio estimate:

$$R_h = \frac{\bar{y}_h}{\bar{x}_h}$$

EQUATION

Variance of ratio estimate for the hth stratum

$$v(R_h) = \frac{(N_h - n_h)}{N_h n_h (n_h - 1)\bar{x}_h^2} (\Sigma Y_h^2 + R_h^2 \Sigma X_h^2 - 2R_h \Sigma X_h Y_h)$$

EQUATION

Variance of ratio estimate for combined strata

$$v(R_{st}) = \frac{\bar{x}_1^2 N_1^2 v(R_1) + \cdot \cdot \cdot + x_h^2 N_h^2 v(R_h)}{\bar{\bar{x}}^2}$$

where

R_h	catch per man hour of fishing in hth stratum
$\bar{y}_h$	mean number of fish caught in hth stratum
$\bar{x}_h$	mean number of man hours of fishing in hth stratum
$v(R_h)$	variance of the catch per man hour of fishing in the hth stratum
Y_h	numbers of fish caught in the hth stratum
X_h	man hours of fishing in hth stratum
$v(R_{st})$	variance of the catch per man hour of fishing for several strata
$\bar{\bar{x}}$	mean number of man hours of fishing for several strata

EQUATION

Our estimate of the annual fishing effort and catch from sport boats (party boats) in southern California marine waters was derived from data in statistical reports developed and maintained by Parke H. Young, Marine Sportfish Investigation, California Department of Fish and Game, Terminal Island (Young, 1963).

3. RESULTS

3.1. Sportfishing from Private Vessels

3.1.1. Effort

Sportfishing from private vessels in southern California marine waters during 1964 was estimated at 2,773,405 man hours of fishing. This is equivalent to 443,258 man days of fishing. We were able to estimate that 142,107 boat days were expended during the year carrying an average of 2.92 fishermen per trip that lasted an average of 6.11 hours (Table 2).

This fishing activity resulted in an estimated catch of 981,460 fish comprised of over 68 species. The summer months of July and August registered peak effort and catch, 983,712 man hours and 331,001 fish. A low of 146,893 man hours of fishing and a catch of 57,522 fish was recorded for the November-December period (Table 3).

Mooring site vessels made longer trips and carried more fishermen than those from launching sites: 6.56 vs 6.09 hours and 3.87 vs 2.87 fishermen. However, the total fishing effort from mooring site vessels was only a third of that expended by launching site boats: 35,806 vs 106,301 boat days of fishing.

Differences in passenger loads are probably due to the fact that launching site boats were smaller. There is no ready explanation for the marked differences in effort except that mooring site boats are more often used strictly for "pleasure boating" than for fishing and there are fewer of these larger, more expensive craft.

3.1.2. Catch

A surprisingly small group of fishes (5 out of 68 species) made up the bulk (almost 75 percent) of the private boat catch. Pacific bonito alone contributed 42 percent of the total catch with an estimated 401,575 fish. California halibut, the second most important species, contributed only 10 percent with 98,692 fish. White croaker (84,641), sand bass (64,513) and kelp bass (61,093) ranked third, fourth, and fifth (Table 4).

A significant portion of the overall catch from private boats was composed of near-shore species. In addition to the five species mentioned above, Pacific mackerel, sculpin, halfmoon, black perch, California barracuda, queenfish, and rockfish made important contributions to the total landings. The exciting, prestige-type, offshore species, such as albacore, bluefin tuna, California yellowtail, and striped marlin were represented by relatively small numbers. Albacore were the most important of these, contributing 5,902 fish or 0.6 percent of the total catch.

3.1.3. Catch-Per-Unit-of-Effort

Relative fishing success was calculated and expressed in four different, but related, ratios of catch to effort: catch-per-boat day, 6.51 fish; catch-per-man day, 1.79 fish; catch-per-boat hour, 1.09 fish; and catch-per-man hour, 0.306 fish (Table 5). Catch per man hour is, perhaps, the most significant measure among these because it is directly comparable to similar ratios for sportfishing activities in other areas. Average catch-per-man hour of fishing values for private boats in 1964 ranged from 0.141 in the January-February period to 0.429 in the September–October period. During July and August, the period of maximum effort and catch, the catch-per-man hour was 0.350—not as good as early fall but better than spring or winter.

3.2. Sportfishing from the Shoreline

3.2.1. Effort

A total of 1,646,289 man hours of fishing effort was estimated from interviewing 6,323 shoreline fishermen for the 12 months April 1965 through March 1966. This effort was about equally divided between the open coast (47.2 percent) and inland bays (52.8 percent) (Table 6).

Monthly estimates ranged from 54,233 man hours in December to 294,024 in July. Fishing activity in July and August exceeded other months by approximately 2 times; the distribution between the open coast and inland bays was about even. Estimated effort for the other months was intermediate between the December–January lows and the July–August peak.

The distribution of fishing effort between coastal and bay areas reflected both the weather and runs of desirable fish. For example, during January almost 70 percent of the total fishing effort was expended along the open coast, apparently in response to winter runs of barred surfperch. In February and March, usually a rainy, windy period in southern California, the effort shifted predominantly to the bays, 72 and 78 percent respectively.

The average length of a fishing trip was 2.987 hours, ranging from 3.329 in September to 2.231 in February. Open coast trips were consistently shorter than inland bay trips; typical examples are: February, 2.006 vs 2.455 hours, and September, 2.907 vs 3.750 hours.

3.2.2. Catch

Sportfishing from the marine shoreline in southern California resulted in an estimated catch of 501,734 fish of at least 43 species. The peak catch of 126,528 fish in July was more than twice as high as for any other month. The winter lows were represented by December and February with 13,758 and 13,819 fish respectively. Catches in other months were intermediate (Table 7).

Inland bays yielded slightly more fish than the open coast, 266,041 vs 235,693. The monthly catch origins were almost equally divided between the two areas except for January, March, and July. Barred surfperch accounted for the January open coast catch being five times that from inland bays; 21,813 vs 4,137 fish. The larger catches from inland bays in March and July were probably the result of runs of several species, none of which was outstanding by itself.

The five most important fish to open coast surf fishermen were barred surfperch, opaleye, corbina, black perch, and walleye surfperch. Inland bay fishermen took an entirely different group of fish: in order of importance, these were white croaker, queenfish, jack and topsmelt, kelp and sand bass, and Pacific bonito (Tables 8, 9, and 10).

In the overall (total) shoreline catches, white croaker were caught and retained in greater numbers (95,010 fish) than any other species, and over 98 percent came from bays. Barred surfperch were second with 87,620 fish, and over 98 percent of these originated from the surf zone of the open coast. The third most important species to shoreline fishermen was the queenfish (47,333 fish) with 99 percent coming from bays. Opaleye and black perch ranked fourth and fifth, with 38,837 and 38,160 fish. Catches of these two species reflect the success of surf fishermen in rocky areas of the open coast.

Traditional favorites, such as California corbina, walleye surfperch, and spotfin croaker, along with Pacific bonito and smelt (jack and top), were also among the 10 most numerous species in the fisherman's bag.

Rockfish, wrasses, and halfmoons were not taken by hook and line fishermen in bays; conversely, California barracuda, bonefish, and jack mackerel were absent from the open coast catches whereas all of these species occur in both habitats.

3.2.3. Catch-Per-Unit-of-Effort

The overall average catch-per-man hour of fishing from the shoreline was calculated to be 0.305: ranging from 0.147 in February to 0.434 in January. In general, the monthly catch-per-unit-of-effort values vacillated from month to month and from area to area, showing no discernible pattern (Table 11).

The average success for open coast fishermen ranged from 0.199 fish-per-man hour in August to 0.585 in November. Although bay fisher-men also experienced a low in August, 0.178, February was the poorest month with 0.106 and June the best with 0.526 fish per-man-hour of fishing.

3.3. Results of Aerial Census

Estimates of sportfishing effort from our aerial surveys were remarkably similar to those from the more extensive and independent ground census. The mean aerial pole count of 170, for the 90 units covered by the ground survey, yielded an estimated 742,560 pole hours, while the year-long ground census estimate was 721,141.

Detailed comparisons between aerial and ground survey estimates were possible for 10 groups at the weekday and weekend day strata level. Three aerial estimates are within one standard deviation of the respective shoreline estimate. The January weekend estimate of 33,300 (aerial survey) vs. 35,569 (ground) pole hours per month is a good example: the others are June and December weekdays. Three other aerial estimates were within 2 standard deviations of the ground census: October weekdays being the best with 14,364 vs. 18,937 pole hours per month; and September weekdays and February weekend days were not far behind (Table 12).

The greatest disparities are in our estimates for January weekdays and March weekends. These showed the aerial estimates to be far greater than the ground census estimates: 12,390 vs. 5,494 and 39,744 vs. 9,555 respectively. Bias inherent in the flight procedures undoubtedly expressed itself in these estimates. Flying days in these months were during periods of optimum weather for observing and at hours of highest fishing activity on these short winter days.

The long, warm, days of July probably spread the fishing effort and the bias in our flight count was in the other direction, accounting for considerably lower estimates than from our ground census.

The aerial survey also included the 40 geographical units that were not part of the ground survey sampling frame. The average adjusted count for these areas was 39.6 poles, which expands to 172,973 pole hours for the year.

Estimates of total sportfishing effort for the entire open coast between Point Conception and the U.S.-Mexico border can be derived by combining pole hour estimates from the ground census with those from the aerial survey of the excluded ground survey units: i.e. 721,141 plus 172,973 for a total of 894,114 pole hours of fishing per year. The addition of the estimated 911,996 pole hours of fishing from the bays yields a grand total of 1,806,110 pole hours per year for the entire southern California marine shoreline (Table 12).

4. REVIEW

A synoptic and concise (in terms of effort and catch) picture of sportfishing activities in southern California marine waters can now be constructed by gathering together the various segments on the assumption they are representative of a typical year. The available data span the years 1963 through 1966.

4.1. Effort

The measure of effort coming closest to being uniform for all sportfishing segments was man hours, although pole hours is preferred for analysis of fish populations. Species and numbers of fish, of course, are comparable between areas and types of fisheries.

The estimated average effort expended from party boats was 2,797,250 man hours (mh); for private boats, 2,773,405 mh; for piers and jetties, 5,090,523 mh; for the shoreline, 1,646,289 mh; the grand total being 12,307,467 man hours of fishing per year (Table 13).

4.2. Catch

The total catch of 7,326,003 fish originated, in numerical order, from the following fisheries: party boats, 3,997,839; piers and jetties, 1,844,970; private boats, 981,460 and the shoreline, 501,734 (Table 13).

Catch details at the family and species level reflect not only ecological differences in the areas fished but also differences in *modus operandi* of fishermen sub-groups. The far-ranging party boats, led by professional guides and aided by a large live bait capacity, pursue offshore, pelagic game species such as Pacific bonito, 879,335 fish; California barracuda, 530,688 fish; Pacific mackerel, 150,739 fish; albacore, 103,748 fish; and California yellowtail, 45,834 fish. Results of bottom, reef, and kelp-bed fishing activities are evident in substantial catches of kelp and sand bass, 1,207,996 fish; California halibut, 116,489 fish; and various species of rockfish, 604,601 fish (Table 14).

Pier and jetty fishermen take a wide variety of fish ranging from the small staghorn sculpin, 1,720 fish, to the more pelagic types such as California barracuda, 17,351. The most prevalent species taken however, were queenfish, 362,892 fish and white croaker, 342,002 fish. Pacific bonito were third in importance with 283,068 fish. Surfperch also contributed significantly to the total catch, led by walleye surfperch and shiner perch with 141,151 and 132,968 fish respectively (Table 10). Despite the advantages of a range of water depths and live bait, pier and jetty fishermen are dependent, to a greater or lesser degree, on the movement of fish into or through the area.

The shoreline fisherman's take is characterized by the near-shore and surf-loving species such as croakers, surfperch, opaleye, and jack and topsmelt. Pacific bonito were taken in fair numbers, 15,193 fish, because they occasionally approach the shore and also enter protected bays. White croaker, 95,010 fish, and barred surfperch, 87,621 fish, were the important species in this area. Also of substantial importance were queenfish 47,333; opaleye, 38,838; black perch, 38,160; and California corbina, 30,647. Sharks were frequently taken but relatively few were retained, thus they escaped enumeration.

The harvest by private boat fishermen appears to be a combination of the take by the other three sportfishing groups. All the private vessels have, in one form or another, a high degree of mobility plus a fair live bait capacity, thus a large portion of their catch parallels that of the party boats: Pacific bonito, 401,575 fish; kelp and sand bass, 125,606 fish; California halibut, 98,692 fish; and rockfish, 51,516 fish. On the other hand, limited range and general inexperience (boat handling, navigation and fishing) restricts a major portion of the effort to the near-shore and inland bays. Thus we see significant catches of white croaker, 84,641; halfmoon, 19,879; and black perch, 19,558.

Our best estimate of the overall annual southern California sportfishing harvest reveals that during the 1963–66 period three groups of fish contributed well over half of the 7.3 million fish captured: mackerels and tunas, 1.9 million; sea basses, 1.4 million; and croakers, 1.1 million (Table 14). Pacific bonito, with 1,579,171 fish, made the largest contribution by a single species. California barracuda was second with 565,166 fish; white croaker was third with 545,012 fish; and queenfish, with 426,592, was fourth. Several other listings registered larger catches, however, they consist of two or more species such as rockfish with 661,220 fish.

5. RECOMMENDATIONS

Management of California's marine resources depends on a thorough knowledge of catch, effort, and basic life history of the plants and animals within the ecological system. To satisfy the first two requirements the California Department of Fish and Game has devised and maintains a continuous data collecting system for the commercial fishery that approaches 100 percent coverage. For the sportfishery, only party boat activites are monitored from year to year at a level that is also close to 100 percent.

Our southern California marine sportfish survey found that 77 percent of the total sportfishing effort is expended in areas other than party boats. This effort, an estimated 9.5 million man hours, accounts for 45 percent of the estimated catch.

Since the southern California marine sportfish survey was a piecemeal, once-only investigation, it is evident that substantial amounts of sportfishing effort and catch are not being measured at a sufficiently high level to yield meaningful managerial information.

We recommend that, in addition to the current party boat monitoring efforts, a routine program be devised and implemented to measure marine sportfishing effort and catch from piers, jetties, private boats, and the shoreline.

Life history information, the third basic essential for making management decisions, is unavailable for most of the more important species taken by southern California sportfishermen; good information is on hand only for kelp bass, California barracuda, California yellowtail, and barred surfperch. The following species, all among the 10 most significant sport fishes, are lacking in basic life history data: Pacific bonito, sand bass, various species of rockfish, white croaker, queenfish, sculpin, walleye surfperch, shiner perch and black perch. The life histories of these species should be investigated.

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7. TABLES

TABLE 1

Common and Scientific Names of Fishes Caught by Private Boat and Shoreline Fishermen in Southern California During 1964 and 1965–66

Common names	Scientific names
Mackerel sharks	Lamnidae
Thresher shark	*Alopias vulpinus* (Bonnaterre)
Cat sharks	Scyliorhinidae
Swell shark	*Cephaloscyllium uter* (Jordan and Gilbert)
Requiem sharks	Carcharhinidae
Gray smoothhound	*Mustelus californicus* Gill
Brown smoothhound	*Triakis henlei* (Gill)
Blue shark	*Prionace glauca* (Linnaeus)
Dogfish sharks	Squalidae
Spiny dogfish	*Squalus acanthias* Linnaeus
Guitarfishes	Rhinobatidae
Thornback	*Platyrhinoidis triseriata* (Jordan and Gilbert)
Shovelnose guitarfish	*Rhinobatos productus* (Ayres)
Eagle rays	Myliobatidae
Bat ray	*Myliobatis californicus* Gill
Bonefishes	Albulidae
Bonefish	*Albula vulpes* (Linnaeus)
Herrings	Clupeidae
Pacific sardine	*Sardinops caeruleus* (Girard)
Anchovies	Engraulidae
Northern anchovy	*Engraulis mordax* Girard
Salmons	Salmonidae
Silver salmon	*Oncorhynchus kisutch* (Walbaum)
Lizardfishes	Synodontidae
California lizardfish	*Synodus lucioceps* (Ayres)
Codfishes and hakes	Gadidae
Pacific hake	*Merluccius productus* (Ayres)
Sea basses	Serranidae
Kelp bass	*Paralabrax clathratus* (Girard)
Spotted sand bass	*Paralabrax maculatofasciatus* (Steindachner)
Sand bass	*Paralabrax nebulifer* (Girard)
Giant sea bass	*Stereolepis gigas* Ayres
Tilefishes	Branchiostegidae
Ocean whitefish	*Caulolatilus princeps* (Jenyns)
Jacks	Carangidae
California yellowtail	*Seriola dorsalis* (Gill)
Jack mackerel	*Trachurus symmetricus* (Ayres)
Grunts	Pomadasyidae
Sargo	*Anisotremus davidsoni* (Steindachner)
Salema	*Xenistius californiensis* (Steindachner)
Croakers	Sciaenidae
Black croaker	*Cheilotrema saturnum* (Girard)
White seabass	*Cynoscion nobilis* (Ayres)
White croaker	*Genyonemus lineatus* (Ayres)
California corbina	*Menticirrhus undulatus* (Girard)
Spotfin croaker	*Roncador stearnsi* (Steindachner)
Queenfish	*Seriphus politus* Ayres
Yellowfin croaker	*Umbrina roncador* Jordan and Gilbert
Halfmoons	Scorpidae
Halfmoon	*Medialuna californiensis* (Steindachner)
Nibblers	Girellidae
Opaleye	*Girella nigricans* (Ayres)
Surfperches	Embiotocidae
Barred surfperch	*Amphistichus argenteus* Agassiz
Shiner perch	*Cymatogaster aggregata* Gibbons
Black perch	*Embiotoca jacksoni* Agassiz
Walleye surfperch	*Hyperprosopon argenteum* Gibbons
Rainbow seaperch	*Hypsurus caryi* (Agassiz)

TABLE 1

Common and Scientific Names of Fishes Caught by Private Boat and Shoreline Fishermen in Southern California During 1964 and 1965–66

TABLE 1—Continued

Common and Scientific Names of Fishes Caught by Private Boat and Shoreline Fishermen in Southern California During 1964 and 1965–66

Common names	Scientific names
Surfperches—continued	Embiotocidae—continued
White seaperch	*Phanerodon furcatus* Girard
Rubberlip perch	*Rhacochilus toxotes* Agassiz
Pile perch	*Rhacochilus vacca* (Girard)
Damselfishes	Pomacentridae
Blacksmith	*Chromis punctipinnus* (Cooper)
Wrasses	Labridae
Rock wrasse	*Halichoeres semicinctus* (Ayres)
Señorita	*Oxyjulis californica* (Gunther)
California sheephead	*Pimelometopon pulchrum* (Ayres)
Mackerels and Tunas	Scombridae
Skipjack tuna	*Katsuwonus pelamis* (Linnaeus)
Pacific mackerel	*Scomber japonicus* Houttuyn
Pacific bonito	*Sarda chiliensis* (Cuvier)
Albacore	*Thunnus alalunga* (Bonnaterre)
Bluefin tuna	*Thunnus thynnus* (Linnaeus)
Billfishes	Istiophoridae
Striped marlin	*Tetrapturus audax* Phillipi
Rockfishes	Scorpaenidae
Sculpin	*Scorpaena guttata* Girard
Kelp rockfish	*Sebastodes atrovirens* (Jordan and Gilbert)
Grass rockfish	*Sebastodes rastrelliger* (Jordan and Gilbert)
Olive rockfish	*Sebastodes serranoides* Eigenmann and Eigenmann
Sablefishes	Anoplopomatidae
Sablefish	*Anoplopoma fimbria* (Pallas)
Greenlings	Hexagrammidae
Lingcod	*Ophiodon elongatus* Girard
Sculpins	Cottidae
Pacific staghorn sculpin	*Leptocottus armatus* Girard
Cabezon	*Scorpaenichthys marmoratus* (Ayres)
Clinids	Clinidae
Giant kelpfish	*Heterostichus rostratus* Girard
Onespot fringehead	*Neoclinus uninotatus* Hubbs
Cusk-eels	Ophidiidae
Cusk-eel	*Otophidium* spp.
Butterfishes	Stromateidae
Pacific pompano	*Peprilus simillimus* (Ayres)
Barracudas	Sphyraenidae
California barracuda	*Sphyraena argentea* (Girard)
Silversides	Atherinidae
Topsmelt	*Atherinops affinis* (Ayres)
Jacksmelt	*Atherinopsis californiensis* Girard
Lefteye flounders	Bothidae
Sanddab species	*Citharichthys* spp.
Bigmouth sole	*Hippoglossina stomata* Eigenmann and Eigenmann
California halibut	*Paralichthys californicus* (Ayres)
Fantail sole	*Xystreurys liolepis* Jordan and Gilbert
Righteye flounders	Pleuronectidae
Petrale sole	*Eopsetta jordani* (Lockington)
Diamond turbot	*Hypsopsetta guttulata* (Girard)
Rock sole	*Lepidopsetta bilineata* (Ayres)
English sole	*Parophrys vetulus* Girard
Hornyhead turbot	*Pleuronichthys verticalis* Jordan and Gilbert
Molas	Molidae
Mola	*Mola mola* (Linnaeus)
Toadfishes	Batrachoididae
Specklefin midshipman	*Porichthys myriaster* Hubbs and Schultz

TABLE 1

Common and Scientific Names of Fishes Caught by Private Boat and Shoreline Fishermen in Southern California During 1964 and 1965–66

TABLE 2

Estimated 1964 Sportfishing Effort from Private Boats in Southern California Marine Waters

Months	Average length of boat trip per day		Average number of fishermen per boat		Boat days		Boat hours		Man days		Man hours	
	Hours	S.E.[2]	Numbers	S.E.	Days	S.E.	Hours	S.E.	Days	S.E.	Hours	S.E.
January–February												
Mooring sites[1]	--	--	--	--	(2,420)	--	(14,100)	--	(9,512)	--	(54,917)	--
Launching sites	5.49	0.074	2.88	0.047	7,184	1,116	39,407	6,570	20,718	3,267	112,558	19,294
Totals	--	--	--	--	9,604	--	53,507	--	30,230	--	167,475	--
March–April												
Mooring sites	5.19	0.217	3.53	0.242	3,518	819	18,246	3,919	12,413	3,136	70,127	20,067
Launching sites	5.89	0.147	2.96	0.061	9,549	1,395	54,645	9,239	27,470	4,428	158,302	29,110
Totals	5.85	0.140	3.02	0.596	13,067	1,618	72,891	10,036	39,883	5,426	228,429	35,357
May–June												
Mooring sites	6.36	0.258	4.23	0.427	6,543	1,086	41,525	8,260	27,665	5,247	183,216	50,213
Launching sites	6.37	0.178	2.58	0.348	20,778	4,278	132,290	29,706	59,194	12,734	376,314	89,019
Totals	6.37	0.174	2.92	0.332	27,321	4,414	173,915	30,832	86,859	13,772	559,530	102,258
July–August												
Mooring sites	6.90	0.260	3.76	0.154	12,497	2,697	86,261	16,703	47,911	10,345	330,842	68,007
Launching sites	6.38	0.115	2.86	0.027	35,040	5,003	223,691	31,992	100,107	13,865	652,870	91,604
Totals	6.42	0.108	2.92	0.027	45,537	5,683	309,952	36,090	148,018	17,300	983,712	114,090
September–October												
Mooring sites	7.18	0.262	3.96	0.162	8,153	1,221	58,585	7,598	32,347	4,995	225,334	33,908
Launching sites	6.06	0.112	2.90	0.227	26,246	2,988	159,091	19,464	76,184	8,700	462,032	58,041
Totals	6.13	0.107	2.96	0.214	34,399	3,228	217,676	20,894	108,531	10,032	687,366	67,220
November–December												
Mooring sites	5.44	0.193	3.60	0.205	2,675	818	12,768	3,878	9,624	2,838	44,973	13,005
Launching sites	5.04	0.140	2.68	0.051	7,504	1,536	37,826	7,889	20,113	4,398	101,920	22,431
Totals	5.07	0.133	2.73	0.050	10,179	1,741	50,594	8,791	29,737	5,234	146,893	25,928
Sub-totals												
Mooring sites[1]	6.56	0.202	3.87	0.115	33,386	3,359	217,385	20,865	129,960	13,319	854,492	94,171
Launching sites	6.09	0.061	2.87	0.094	106,301	7,603	647,050	49,754	303,786	21,902	1,863,996	146,312
Survey Totals	6.11	0.061	2.92	0.089	139,687	8,312	864,435	53,952	433,746	25,634	2,718,488	174,030
ADJUSTED TOTALS												
Mooring sites	--	--	--	--	35,806	--	231,485	--	139,472	--	909,409	--
Launching sites	--	--	--	--	106,301	--	647,050	--	303,786	--	1,863,996	--
TOTALS	--	--	--	--	142,107	--	878,535	--	443,258	--	2,773,405	--

[1] Mooring sites were not sampled during January and February. The approximate values in parentheses were derived by multiplying the launching site estimate by the appropriate ratio of mooring site to launching site estimates for the months March through December: boat day, 0.3368; boat hours, 0.3578; man day, 0.4591; and man hours, 0.4879.
[2] S.E. = Standard error of the estimate.

TABLE 2

Estimated 1964 Sportfishing Effort from Private Boats in Southern California Marine Waters

TABLE 3

Estimated Number of Fish Caught by Sportfishermen from Private Boats in 1964 in Southern California Marine Waters

	Launching Sites		Mooring Sites		Totals	
	Numbers of fish	S.E.[1]	Numbers of fish	S.E.	Numbers of fish	S.E.
January–February	57,153	9,929	[2](24,341)	--	57,153 (81,494)	9,929 --
March–April	51,514	9,620	21,408	7,662	72,922	12,299
May–June	105,064	23,517	54,625	17,022	159,689	29,031
July–August	232,151	35,093	98,850	28,860	331,001	45,436
September–October	198,746	30,308	80,086	15,057	278,832	33,842
November–December	43,684	16,525	13,838	5,876	57,522	17,538
Totals	688,312	56,279	268,807	37,981	957,119	67,897
ADJUSTED TOTALS	688,312	--	293,148	--	981,460	--

[1] S.E. = Standard error of the estimate.

[2] Mooring sites were not sampled during January and February. The number of fish caught during this period was approximated by multiplying the January–February launching site catch by 0.4259—the ratio of mooring site to launching site catch for the months of March through December.

TABLE 3

Estimated Number of Fish Caught by Sportfishermen from Private Boats in 1964 in Southern California Marine Waters

TABLE 4

Species Composition of the 1964 Sportfishing Catch from Private Boats in Southern California Marine Waters

Species	Period I Jan.–Feb.	Period II March–April	Period III May–June	Period IV July–August	Period V Sept.–Oct.	Period VI Nov.–Dec.	Totals
Mackerel sharks							
Thresher shark	--	--	--	146	145	--	291
Cat sharks							
Swell shark	--	--	33	--	--	--	33
Requiem sharks							
Smoothhound species	--	98	476	354	--	39	967
Blue shark	--	--	--	243	--	--	243
Dogfish sharks							
Spiny dogfish	--	--	681	45	--	--	726
Sharks unidentified	--	225	274	--	928	--	1,427
Guitarfishes							
Thornback	--	--	--	315	--	--	315
Shovelnose guitarfish	277	--	308	--	--	--	585
Eagle rays							
Bat ray	--	--	--	42	--	--	42
Rays unidentified	--	--	--	--	78	--	78
Herrings							
Pacific sardine	--	--	--	--	--	118	118
Salmons							
Silver salmon	--	--	34	--	--	--	34
Lizardfishes							
California lizardfish	--	--	--	--	47	77	124
Codfish and hakes							
Pacific hake	--	--	--	2,160	--	77	2,237
Sea basses							
Kelp bass	4,042	2,806	14,540	29,824	6,484	3,397	61,093
Spotted sand bass	337	432	1,363	3,520	431	461	6,544
Sand bass	6,090	4,407	4,936	28,850	16,425	3,805	64,513
Giant sea bass	--	--	--	425	--	--	425
Tilefishes							
Ocean whitefish	438	115	485	--	79	--	1,117
Jacks							
California yellowtail	--	--	1,547	2,959	420	--	4,926
Jack mackerel	--	--	33	357	259	--	649

TABLE 4

Species Composition of the 1964 Sportfishing Catch from Private Boats in Southern California Marine Waters

TABLE 4—Continued

Species Composition of the 1964 Sportfishing Catch from Private Boats in Southern Cailfornia Marine Waters

Species	Period I Jan.–Feb.	Period II March(April	Period III May–June	Period IV July–August	Period V Sept.–Oct.	Period VI Nov.–Dec.	Totals
Grunts							
Sargo	231	29	511	540	--	77	1,388
Croakers							
Black croaker	--	684	137	42	--	--	863
White seabass	46	29	1,731	1,023	521	--	3,350
White croaker	4,318	12,289	23,459	18,240	19,184	7,151	86,641
California corbina	--	29	--	42	--	--	71
Spotfin croaker	--	87	204	468	47	--	806
Queenfish	--	4,429	2,555	5,843	3,112	--	15,929
Yellowfin croaker	--	29	33	174	39	--	275
Halfmoons							
Halfmoon	3,423	750	744	815	2,507	11,640	19,879
Nibblers							
Opaleye	1,249	432	33	360	39	1,188	3,301
Surfperches							
Barred surfperch	35	260	702	717	236	38	1,988
Shiner perch	--	29	68	90	39	192	418
Black perch	5,369	4,394	2,595	754	1,846	4,600	19,558
Walleye surfperch	138	691	513	180	39	77	1,638
Rainbow seaperch	92	--	103	--	--	--	195
White seaperch	923	813	2,595	--	79	1,303	5,713
Rubberlip perch	2,105	288	407	--	--	575	3,375
Pile perch	1,815	144	--	--	--	77	2,036
Surfperch unidentified	--	--	34	45	--	--	79
Damselfish							
Blacksmith	--	58	--	--	--	--	58
Wrasses							
Rock wrasse	--	29	--	45	--	--	74
Señorita	46	29	--	42	--	39	156
California sheephead	127	403	319	367	157	77	1,450
Mackerels and tunas							
Skipjack tuna	--	--	--	--	106	--	106
Pacific mackerel	2,781	4,379	5,872	9,564	1,500	77	24,173
Pacific bonito	5,024	6,183	46,129	166,480	173,367	4,392	401,575
Albacore	--	--	--	5,902	--	--	5,902

TABLE 4

Species Composition of the 1964 Sportfishing Catch from Private Boats in Southern California Marine Waters

Billfishes							
Striped marlin	--	--	--	--	79	--	79
Rockfishes							
Sculpin	2,690	3,324	3,797	2,553	5,140	3,521	21,025
Rockfish species	8,435	5,886	12,778	11,432	8,242	4,743	51,516
Sablefishes							
Sablefish	--	--	1,075	1,051	39	77	2,242
Greenlings							
Lingcod	185	282	34	416	--	307	1,224
Sculpins							
Cabezon	185	693	746	464	282	461	2,831
Clinids							
Giant kelpfish	115	--	--	214	--	38	367
Onespot fringehead	--	--	34	--	--	--	34
Barracudas							
California barracuda	231	2,997	4,180	4,038	4,751	38	16,235
Silversides							
Topsmelt	--	--	98	1,035	39	--	1,172
Jacksmelt	81	376	1,622	1,389	39	1,257	4,764
Lefteye flounders							
Sanddab species	162	115	711	127	408	935	2,458
Bigmouth sole	--	347	--	344	314	--	1,005
California halibut	5,574	13,656	19,126	25,472	29,904	4,960	98,692
Fantail sole	589	127	1,264	456	180	--	2,616
Righteye flounders							
Petrale sole	--	115	236	--	--	118	469
Diamond turbot	--	376	401	127	--	843	1,747
Rock sole	--	--	--	90	--	--	90
English sole	--	--	--	90	--	--	90
Hornyhead turbot	--	29	--	--	--	--	29
Flatfish unidentified	--	--	65	601	1,301	747	2,714
Molas							
Mola	--	29	--	--	--	--	29
Toadfishes							
Specklefin midshipman	--	--	34	--	--	--	34
Unidentified fish	--	--	34	129	--	--	163
TOTALS	57,153	72,922	159,689	331,001	278,832	57,522	957,119

TABLE 4—Cont'd.

TABLE 5

Observed Sportfishing Catch-Per-Unit-of-Effort from Private Boats in 1964 in Southern California Marine Waters

	Catch per boat day		Catch per man day		Catch per boat hour		Catch per man hour	
	Fish	S.E.[1]	Fish	S.E.	Fish	S.E.	Fish	S.E.
January–February								
Mooring sites	--	--	--	--	--	--	--	--
Launching sites	7.95	0.385	2.76	0.145	1.45	0.072	0.141	0.094
Combined	7.95	0.385	2.76	0.145	1.45	0.072	0.141	0.094
March–April								
Mooring sites	6.08	1.544	1.24	0.168	1.17	0.155	0.258	0.031
Launching sites	5.55	0.416	1.88	0.157	0.94	0.074	0.325	0.027
Combined	5.58	0.403	1.82	0.145	0.95	0.071	0.321	0.026
May–June								
Mooring sites	8.36	1.520	1.97	0.273	1.32	0.054	0.298	0.052
Launching sites	5.06	0.347	1.78	0.136	0.79	0.050	0.279	0.022
Combined	5.23	0.338	1.79	0.128	0.82	0.047	0.281	0.020
July–August								
Mooring sites	7.91	1.024	2.10	0.327	1.15	0.157	0.299	0.046
Launching sites	6.63	0.683	2.72	0.251	1.04	0.106	0.356	0.035
Combined	6.71	0.641	2.66	0.229	1.05	0.099	0.350	0.032
September–October								
Mooring sites	9.82	0.769	2.48	0.174	1.37	0.094	0.355	0.023
Launching sites	7.57	0.162	1.12	0.065	1.25	0.059	0.430	0.023
Combined	7.70	0.159	1.16	0.063	1.26	0.056	0.429	0.021
November–December								
Mooring sites	4.35	0.872	1.44	0.522	1.08	0.183	0.308	0.045
Launching sites	5.82	0.896	2.17	0.300	1.98	0.113	0.429	0.062
Combined	5.73	0.844	2.11	0.277	1.90	0.104	0.420	0.057
Subtotals								
Mooring sites	7.99	0.553	2.00	0.250	1.24	0.069	0.309	0.022
Launching sites	6.43	0.230	1.78	0.065	1.08	0.039	0.305	0.024
Grand Totals	6.51	0.219	1.79	0.063	1.09	0.039	0.306	0.023

[1] S.E. = Standard error of the estimate.

TABLE 5

Observed Sportfishing Catch-Per-Unit-of-Effort from Private Boats in 1964 in Southern California Marine Waters

TABLE 6

Estimated 1965–66 Sportfishing Effort Expended from the Southern California Marine Shoreline

Months	Open coast			Inland bays			Totals		
	Average length of fishing trip (hours)	Man hours of fishing (hours)	S.E.[2]	Average length of fishing trip (hours)	Man hours of fishing (hours)	S.E.	Average length of fishing trip (hours)	Man hours of fishing (hours)	S.E.
1965									
April[1]	--	(77,887)	--	--	(70,950)	--	3.126	148,837	51,799
May[1]	--	(43,376)	--	--	(83,020)	--	2.364	126,396	37,203
June	2.181	90,350	27,526	2.558	50,840	14,399	2.370	141,190	31,064
July	2.424	125,067	15,023	2.725	168,957	73,761	2.575	294,024	75,275
August	2.718	167,489	44,623	3.111	120,095	40,166	2.915	287,584	60,037
Sptember	2.907	82,866	25,196	3.750	61,734	26,638	3.329	144,600	36,666
October	2.721	47,800	10,200	3.284	66,221	11,148	3.003	114,021	15,110
November	2.324	24,355	7,594	2.863	57,197	35,656	2.594	81,552	36,455
December	2.683	27,256	7,370	3.233	26,977	7,777	2.958	54,233	10,714
1966									
January	2.286	41,584	7,044	2.746	18,195	7,079	2.516	59,779	9,986
February	2.006	26,307	8,120	2.455	67,282	22,780	2.231	93,589	24,183
March	2.259	22,395	5,510	2.911	78,089	26,982	2.585	100,484	27,538
Sub-totals (10 months)	2.451	655,469	63,018	2.964	715,587	103,557	2.708	1,371,056	
Totals	--	776,732	--	--	869,557	--	2.708	1,646,289	121,224

[1] In April and May the open coast and bay sampling units were one population, thus the estimated man hours of fishing, with the associated standard errors, applies only to the combined areas. The figures in parentheses represent an approximated distribution of effort based on the effort data June through March. For the open coast the adjusting factor was 0.4781 and for the bays 0.5219.

[2] S.E. = Standard error of the estimate.

TABLE 6

Estimated 1965–66 Sportfishing Effort Expended from the Southern California Marine Shoreline

TABLE 7

Estimated Numbers of Fish Caught by Sportfishermen from the Southern California Marine Shoreline, 1965–1966

	Open coast		Inland bays		Totals	
	Estimate	S.E.[2]	Estimate	S.E.	Estimate	S.E.
1965						
April[1]	(22,787)	--	(19,142)	--	41,929	14,858
May[1]	(14,332)	--	(20,556)	--	34,888	11,875
June	27,220	8,038	26,753	11,678	53,973	14,176
July	39,144	8,064	87,384	60,107	126,528	60,645
August	33,257	9,854	21,352	5,744	54,609	11,405
September	19,077	6,015	18,487	8,629	37,564	10,518
October	24,659	8,242	17,274	4,080	41,933	9,196
November	14,248	5,026	18,352	9,333	32,600	10,600
December	7,612	2.223	6,146	2,825	13,758	3,594
1966						
January	21,813	6,156	4,137	2,543	25,950	6,660
February	6,691	2,273	7,128	3,141	13,819	3,877
March	4,853	1,449	19,330	11,314	24,183	11,406
Sub-totals (10 months)	198,574	20,154	226,343	64,130		
Totals (12 months)	235,693	--	266,041	--	501,734	69,862

[1] In April and May the open coast and inland bay sampling units were one population, thus the estimated numbers of fish, with the associated standard errors, applies only to the combined areas. The figures in parentheses represent an approximate distribution of catch.

[2] S.E. = Standard error of the estimate.

TABLE 7

Estimated Numbers of Fish Caught by Sportfishermen from the Southern California Marine Shoreline, 1965–1966

TABLE 8

Species Composition of the 1965–66 Sportfish Catch from the Southern California Shoreline-Open Coast

Species	April	May	June	July	August	September	October	November	December	January	February	March	Totals
Sharks, unidentified	--	--	110	1,070	324	251	555	--	--	--	--	--	2,310
Guitarfishes													
Shovelnose guitarfish	--	--	--	--	313	--	113	--	--	--	--	--	426
Rays, unidentified	--	--	--	1,272	440	--	--	--	--	225	--	--	1,937
Sea basses													
Kelp bass	146	--	660	225	231	331	113	105	--	225	--	--	2,036
Sand bass	195	--	--	--	--	--	--	--	--	--	--	--	195
Grunts													
Sargo	1,752	--	--	225	231	347	--	--	104	--	--	--	2,659
Croakers													
Black croaker	--	943	--	--	--	--	--	--	--	--	--	--	943
White croaker	--	--	--	981	417	--	113	116	--	105	--	--	1,732
California corbina	1,898	949	3,110	6,323	12,260	1,628	1,725	1,093	224	210	--	224	29,644
Spotfin croaker	195	--	110	966	567	--	113	--	--	--	--	--	1,951
Queenfish	--	--	--	--	--	--	105	--	--	--	--	--	105
Yellowfin croaker	--	136	--	327	880	1,493	1,238	116	--	--	--	--	4,190
Halfmoons													
Halfmoon	1,168	--	900	323	104	945	2,220	1,620	600	563	120	--	8,563
Nibblers													
Opaleye	2,016	755	3,230	4,771	3,854	5,126	4,853	3,138	1,205	4,020	215	311	33,494
Surfperches													
Barred surfperch	5,214	8,590	11,900	9,608	10,094	4,249	9,330	3,800	2,463	13,230	3,824	3,440	85,743
Black perch	6,375	1,054	3,450	5,227	2,060	2,184	548	514	791	1,343	1,213	654	25,413
Walleye surfperch	2,190	1,237	1,610	2,533	810	1,298	548	651	414	788	206	120	12,405
Rainbow seaperch	--	--	--	--	--	--	--	--	120	--	--	--	120
White seaperch	--	123	220	222	--	579	1,103	414	311	--	240	--	3,212
Rubberlip perch	--	--	--	--	--	--	218	1,251	311	105	--	--	1,885
Pile perch	--	259	580	335	336	--	--	205	--	450	120	104	2,389
Perch unidentified	88	--	120	1,009	--	--	563	--	207	--	--	--	1,987
Wrasses													
California sheephead	146	--	--	113	116	--	--	--	--	--	--	--	375
Wrasses unspecified	292	--	110	878	116	215	428	221	120	--	--	--	2,380
Rockfishes													
Kelp rockfish	--	--	--	111	--	--	--	--	--	--	--	--	111
Grass rockfish	341	150	110	225	--	--	--	--	--	--	--	--	826
Olive rockfish	--	--	--	--	--	199	--	--	--	--	--	--	199

TABLE 8

Species Composition of the 1965–66 Sportfish Catch from the Southern California Shoreline-Open Coast

TABLE 8—Continued

Species Composition of the 1965–66 Sportfish Catch from the Southern California Shoreline-Open Coast

Species	April	May	June	July	August	September	October	November	December	January	February	March	Totals
Sculpins													
Pacific staghorn sculpin	--	--	440	1,087	104	--	668	--	--	113	--	--	2,412
Cabezon	575	136	110	330	--	116	--	694	224	218	340	--	2,743
Clinids													
Giant kelpfish	--	--	220	105	--	116	105	--	--	218	310	--	1,074
Silversides													
Jack and topsmelt	--	--	110	330	--	--	--	210	518	--	--	--	1,168
Lefteye flounders													
California halibut	195	--	--	435	--	--	--	100	--	--	103	--	833
Unidentified fish	--	--	120	113	--	--	--	--	--	--	--	--	233
Totals	22,768	14,332	27,220	39,144	33,257	19,077	24,659	14,248	7,612	21,813	6,691	4,853	235,693
S.E.[1]	--	--	8,038	8,064	9,854	6,015	8,242	5,026	2,223	6,156	2,273	1,449	

[1] In April and May the distribution of catch between the open coast and inland bays is only an approximation, thus no standard error of the estimate.

TABLE 8

Species Composition of the 1965–66 Sportfish Catch from the Southern California Shoreline-Open Coast

TABLE 9

Species Composition of the 1965–66 Sportfish Catch from Southern California Shoreline-Inland Bays

Species	April	May	June	July	August	September	October	November	December	January	February	March	Totals
Sharks, unidentified	--	--	264	347	--	50	--	--	--	--	--	--	661
Guitarfishes													
Shovelnose guitarfish	--	--	88	116	50	--	--	--	--	--	--	--	254
Rays, unidentified	--	135	44	--	50	50	--	--	--	--	--	--	279
Bonefishes													
Bonefish	--	135	88	231	--	--	--	--	--	--	--	--	454
Sea basses													
Kelp bass	161	136	169	809	50	660	115	809	44	--	--	44	2,997
Spotted sand bass	146	3,779	565	578	319	50	55	--	--	--	44	--	5,536
Sand bass	161	1,352	1,379	517	468	198	792	198	259	--	1,540	259	7,123

TABLE 9

Species Composition of the 1965–66 Sportfish Catch from Southern California Shoreline-Inland Bays

Jacks													
Jack mackerel	--	--	--	116	--	--	--	--	--	--	--	127	243
Grunts													
Sargo	146	--	--	55	99	347	1,293	149	44	--	110	--	2,243
Salema	--	--	--	--	50	--	--	--	--	--	--	--	50
Croakers													
Black croaker	--	--	792	517	--	149	--	347	--	--	--	--	1,805
White seabass	--	--	--	55	644	--	--	--	--	--	--	--	699
White croaker	5,138	11,179	20,475	28,292	4,961	7,524	5,154	5,313	2,756	110	132	2,244	93,278
California corbina	--	--	--	110	149	50	226	--	468	--	--	--	1,003
Spotfin croaker	6,278	407	205	330	990	1,947	831	--	176	110	--	385	11,659
Queenfish	161	135	264	45,650	1,018	--	--	--	--	--	--	--	47,228
Yellowfin croaker	292	--	--	165	50	396	165	--	--	--	--	--	1,068
Nibblers													
Opaleye	--	674	433	633	517	50	616	1,106	--	281	990	44	5,344
Surfperches													
Barred surfperch	161	--	176	55	--	50	116	330	--	330	660	--	1,878
Black perch	--	1,283	528	1,551	2,332	347	2,426	1,733	429	226	836	1,056	12,747
Walleye surfperch	321	394	242	556	121	215	--	99	726	1,133	88	--	3,895
White seaperch	1,183	543	403	605	--	1,287	1,386	726	941	726	330	853	8,983
Rubberlip perch	161	--	44	--	--	--	--	--	44	935	--	44	1,228
Pile perch	161	--	--	110	50	--	55	50	--	--	1,628	297	2,351
Perch unidentified	--	--	88	275	512	50	341	1,914	215	--	--	1,056	4,451
Mackerels and tunas													
Pacific mackerel	--	--	--	--	--	--	--	--	--	--	--	127	127
Pacific bonito	--	--	88	787	1,210	2,195	1,271	1,881	--	--	--	7,761	15,193
Sculpin													
Pacific staghorn sculpin	--	--	--	116	363	396	116	--	--	55	--	88	1,134
Cabezon	--	--	--	--	--	--	--	--	--	--	--	44	44
Clinids													
Giant kelpfish	--	--	--	--	50	50	--	--	--	--	--	--	100
Barracudas													
California barracuda	--	--	--	231	534	--	--	--	--	--	--	127	892
Silversides													
Jack and topsmelt	3,197	--	81	798	4,158	1,188	1,980	3,498	--	--	--	2,618	17,518
Lefteye flounders													
California halibut	1,022	--	249	2,932	2,486	149	281	149	--	--	110	44	7,422
Righteye flounders													
Turbots, unidentified	453	404	88	847	121	1,089	55	50	44	231	660	2,112	6,154
Totals	19,142	20,556	26,753	87,384	21,352	18,487	17,274	18,352	6,146	4,137	7,128	19,330	266,041
S.E.[1]	--	--	11,678	60,107	5,744	8,629	4,080	9,333	2,825	2,543	3,141	11,314	

[1] In April and May the distribution of catch between open coast and inland bays is only an approximation, thus no standard error of the estimate.

TABLE 9—Cont'd.

TABLE 10

Numerical Ranking of the 15 Most Important Sport-Caught Fish in Southern California Marine Waters, 1963–66

Rank Species	Numbers	Percent comp.
Party Boats (Annual Average, 1963–66)		
1. Kelp and sand bass	1,207,996	30.2
2. Pacific bonito	879,335	22.0
3. Rockfish species	604,601	15.1
4. California barracuda	530,688	13.3
5. Sculpin	192,369	4.8
6. Pacific mackerel	150,739	3.8
7. California halibut	116,489	2.9
8. Albacore	103,748	2.6
9. California yellowtail	45,834	1.2
10. Halfmoon	35,202	0.9
11. California sheephead	34,970	0.9
12. White croaker	23,359	0.6
13. White seabass	12,109	0.3
14. Ocean whitefish	10,608	0.3
15. Jack mackerel	10,161	0.3
Subtotals	3,958,208	99.0
Other fish	39,631	1.0
Grand totals	3,997,839	100.0
Private Boats (1964)		
1. Pacific bonito	401,575	42.0
2. Kelp and sand bass	132,150	13.8
3. California halibut	98,692	10.3
4. White croaker	84,641	8.8
5. Rockfish species	51,516	5.4
6. Pacific mackerel	24,173	2.5
7. Sculpin	21,025	2.2
8. Halfmoon	19,879	2.1
9. Black perch	19,558	2.0
10. California barracuda	16,235	1.7
11. Queenfish	15,939	1.7
12. Smelt, jack and top	5,936	0.6
13. Albacore	5,902	0.6
14. White seaperch	5,713	0.6
15. California yellowtail	4,926	0.5
Subtotals	907,860	92.5
Other fish	73,600	7.5
Grand totals	981,460	100.0
Piers and Jetties (1963)		
1. Queenfish	362,892	19.7
2. White croaker	342,002	18.5
3. Pacific bonito	283,068	15.3
4. Walleye surfperch	141,151	7.7
5. Shiner perch	132,968	7.2
6. Smelt, jack and top	72,187	3.9
7. Black perch	64,764	3.5
8. California halibut	56,933	3.1
9. Pacific mackerel	56,669	3.1
10. Kelp and sand bass	46,821	2.5
11. Opaleye	31,448	1.7
12. Northern anchovy	29,686	1.6
13. Barred surfperch	23,990	1.3
14. White seaperch	17,769	1.0
15. California barracuda	17,351	0.9
Subtotals	1,678,699	91.0
Other fish	166,271	9.0
Grand totals	1,844,970	100.0
Open Coast (1965–66)		
1. Barred surfperch	85,743	36.4
2. Opaleye	33,494	14.2
3. California corbina	29,644	12.6
4. Black perch	25,413	10.8
5. Walleye surfperch	12,405	5.3
6. Halfmoon	8,563	3.6
7. Yellowfin croaker	4,190	1.8
8. White seaperch	3,212	1.4
9. Cabezon	2,743	1.2
10. Sargo	2,659	1.1
11. Pacific staghorn sculpin	2,412	1.0
12. Pile perch	2,389	1.0
13. Wrasses, unspecified	2,380	1.0
14. Sharks, unspecified	2,310	1.0
15. Kelp and sand bass	2,231	1.0
Subtotals	219,788	93.3
Other fish	15,905	6.7
Grand totals	235,693	100.0

TABLE 10

Numerical Ranking of the 15 Most Important Sport-Caught Fish in Southern California Marine Waters, 1963–66

TABLE 10—Continued

Numerical Ranking of the 15 Most Important Sport-Caught Fish in Southern California Marine Waters, 1963–66

Rank Species	Numbers	Percent comp.	Rank Species	Numbers	Percent comp.
			Total All Southern California (Representative Annual Catch, 1963–66)		
Inland Bays (1965–66)					
1. White croaker	93,278	35.1	1. Pacific bonito	1,579,171	21.6
2. Queenfish	47,228	17.8	2. Kelp and sand bass	1,390,958	19.1
3. Smelt, jack and top	17,518	6.6	3. Rockfish species	661,220	9.1
4. Kelp and sand bass	15,656	6.0	4. California barracuda	565,166	7.7
5. Pacific bonito	15,193	5.7	5. White croaker	545,012	7.5
6. Black perch	12,747	4.8	6. Queenfish	426,592	5.8
7. Spotfin croaker	11,695	4.4	7. California halibut	280,369	3.8
8. White seaperch	8,983	3.4	8. Pacific mackerel	231,708	3.2
9. California halibut	7,422	2.8	9. Sculpin	220,129	3.0
10. Turbots, unspecified	6,154	2.3	10. Walleye surfperch	159,089	2.2
11. Opaleye	5,344	2.0	11. Shiner perch	133,386	1.8
12. Perch unspecified	4,451	1.7	12. Black perch	122,482	1.7
13. Walleye surfperch	3,895	1.5	13. Barred surfperch	113,599	1.6
14. Pile perch	2,351	0.9	14. Albacore	109,650	1.5
15. Sargo	2,243	0.8	15. Smelt, Jack and top	96,809	1.3
Subtotals	254,158	95.5	Subtotals	6,635,340	90.6
Other fish	11,883	4.5	Other fish	690,663	9.4
Grand totals	266,041	100.0	Grand totals	7,326,003	100.0

TABLE 10

Numerical Ranking of the 15 Most Important Sport-Caught Fish in Southern California Marine Waters, 1963–66

TABLE 11

Estimated 1965–66 Catch-Per-Man Hour of Fishing by Sportfishermen from the Southern California Marine Shoreline

Month	Open coast		Inland bays		Totals	
	Fish per hr.	S.E.[1]	Fish per hr.	S.E.	Fish per hr.	S.E.
April	---	---	---	---	0.282	0.04632
May	---	---	---	---	0.276	0.02876
June	0.301	0.05252	0.526	0.18115	0.382	0.05567
July	0.313	0.05244	0.517	0.13616	0.430	0.06049
August	0.199	0.04015	0.178	0.03476	0.190	0.02056
September	0.230	0.06999	0.299	0.13466	0.260	0.04968
October	0.516	0.10248	0.261	0.02250	0.365	0.04454
November	0.585	0.11801	0.321	0.05865	0.399	0.03614
December	0.279	0.06062	0.228	0.11590	0.254	0.04782
January	0.524	0.13398	0.227	0.09019	0.434	0.09457
February	0.254	0.08531	0.106	0.03691	0.147	0.02467
March	0.217	0.05161	0.248	0.07033	0.240	0.05516
Grand total	---	---	---	---	0.305	0.015

[1] S.E. = Standard error of the estimate.

TABLE 11

Estimated 1965–66 Catch-Per-Man Hour of Fishing by Sportfishermen from the Southern California Marine Shoreline

TABLE 12

Comparison of Ground Survey and Aerial Estimates of Pole Hours of Fishing in Southern California

Strata	Ground Survey				Aerial Survey				
	Inland bays		Open coast		Ground survey area		Areas outside ground survey		
Strata	Pole hours	S.E.[1]	Pole hours	S.E.	Adjusted count	Pole hours	Adjusted count	Pole hours	Total pole hours
April									
Weekdays	*(39,143)		*(46,184)		58	15,312			15,312
Sat. and Sun.	*(50,416)		*(35,857)						
May									
Weekdays	*(21,851)		*(20,018)						
Sat. and Sun.	*(36,243)		*(33,201)						
June									
Weekdays	24,176	3,174	32,666	7,280	116	35,728	10.6	3,265	38,993
Sat. and Sun.	28,657	14,483	42,310	2,870					
July									
Weekdays	111,410	64,022	58,471	10,315	114	33,516	12.6	3,704	37,220
Sat. and Sun.	54,105	26,684	55,881	10,375	230	32,220	67.4	9,436	41,656
August									
Weekdays	79,323	37,211	55,310	20,800					
Sat. and Sun.	36,769	12,337	81,318	25,801					
September									
Weekdays	12,192	8,517	18,612	4,123	†100	25,200	†19.1	4,813	30,013
Sat. and Sun.	58,774	33,750	57,313	19,983					
October									
Weekdays	30,323	7,132	18,937	3,647	†57	14,364	†10.0	2,250	16,884
Sat. and Sun.	39,538	3,386	26,076	8,917					
November									
Weekdays	34,940	25,579	9,427	3,816					
Sat. and Sun.	22,104	19,139	15,907	6,825					
December									
Weekdays	13,869	5,072	16,497	5,275	†83	19,090	†12.0	2,760	21,850
Sat. and Sun.	17,661	7,482	10,320	5,075					
January									
Weekdays	11,447	2,594	5,494	1,513	59	12,390	12.1	2,541	14,931
Sat. and Sun.	8,768	6,335	35,569	6,619	333	33,300	83.5	8,350	41,650

TABLE 12

Comparison of Ground Survey and Aerial Estimates of Pole Hours of Fishing in Southern California

February									
Weekdays	67,510	20,697	6,974	2,255					
Sat. and Sun.	12,723	5,590	17,299	6,874	310	24,800	106.7	8,536	33,336
March									
Weekdays	79,270	26,610	11,945	2,784					
Sat. and Sun.	20,784	7,693	9,555	4,559	414	39,744	61.8	5,933	45,677
Subtotals	---	---	‡315,165	---	1,874	285,664	395.8	51,858	337,522
Mean count					$\bar{x}$ = 170		$\bar{x}$ = 39.6		
Sub-estimate of pole hours	911,996		721,141			742,560		172,973	

Recapitulation: estimated pole hours	
Ground survey open coast	721,141
Aerial survey of areas outside ground survey	172,973
Sub-totals	894,114
Ground survey inland bays	911,996
GRAND TOTAL	1,806,110

* Figures in brackets are approximations.
† Average of two flights.
‡ Sum of strata covered by aerial flights.
[1] S.E. = Standard error of the estimate.

TABLE 12—Cont'd.

TABLE 13

Summary of Sportfishing Effort, Catch, Catch-per-Unit-of-Effort in Southern California Marine Waters

Fishery	Man or angler days	Man hours	Numbers of fish	Catch-per-man hour of fishing[1]
Party boats (average 1963–66)	570,477	2,797,250	3,997,839	1.429
Piers and jetties (1963)	1,404,079	5,090,523	1,844,970	0.362
Private boats (1964)	443,258	2,773,405	981,460	0.354
Shore line (1965–66)	551,151	1,646,289	501,734	0.305
Totals	4,379,203	12,307,467	7,326,003	0.595

[1] Calculated from adjusted estimates.

TABLE 13

Summary of Sportfishing Effort, Catch, Catch-per-Unit-of-Effort in Southern California Marine Waters

TABLE 14

Average Annual Catch (Numbers) by Party Boat, Pier and Jetty, Private Boat, Shoreline Fishermen and Their Combined Catch in Southern California 1963–66

	Party boat average of 1963–66	Pier and jetty 1963	Private boat 1964	Shoreline 1965–66	Totals
Sharks	100	754	3,687	2,971	**7,512**
Guitarfishes	---	650	900	680	**2,230**
Rays	---	---	120	2,216	**2,336**
Bonefish	---	---	---	---	**454**
Bonefish	---	---	---	454	454
Herrings	---	---	---	---	**1,699**
Pacific sardine	---	1,581	118	---	1,699
Anchovies	---	---	---	---	**29,686**
Northern anchovy	---	29,686	---	---	29,686
Salmons	---	---	---	---	**311**
Silver salmon	38	239	34	---	311
Lizardfishes	---	---	---	---	**124**
California lizardfish	---	---	124	---	124
Codfish and hakes	---	---	---	---	**2,237**
Pacific hake	---	---	2,237	---	2,237
Sea basses	---	---	---	---	**1,405,798**
Kelp and sand bass	1,207,996	---	---	---	1,207,996
Kelp bass	---	34,606	61,093	5,033	100,732
Spotted sand bass	---	---	6,544	5,536	12,080
Sand bass	---	10,399	64,513	7,318	82,230
Giant sea bass	519	---	425	---	944
Bass, unidentified	---	1,816	---	---	1,816
Tilefishes	---	---	---	---	**11,725**
Ocean Whitefish	10,608	---	1,117	---	11,725
Jacks	---	---	---	---	**65,843**
California yellowtail	45,834	---	4,926	---	50,760
Jack mackerel	10,161	4,030	649	243	15,083
Grunts	---	---	---	---	**19,452**
Sargo	---	8,145	1,388	4,902	14,435
Salema	---	4,967	---	50	5,017
Croakers	---	---	---	---	**1,089,996**
Black croaker	---	2,158	863	2,748	5,769
White seabass	12,109	8,551	3,350	699	24,709
White croaker	23,359	342,002	84,641	95,010	545,012
California corbina	---	7,595	71	30,647	38,313
Spotfin croaker	---	14,721	806	13,610	29,137
Queenfish	428	362,892	15,939	47,333	426,592
Yellowfin croaker	---	12,057	275	5,258	17,590
Croaker, unidentified	---	2,874	---	---	2,874
Halfmoons	---	---	---	---	**67,320**
Halfmoon	35,202	3,676	19,879	8,563	67,320
Nibblers	---	---	---	---	**73,587**
Opaleye	---	31,448	3,301	38,838	73,587
Surfperches	---	---	---	---	**616,423**
Barred surfperch	---	23,990	1,988	87,621	113,599
Shiner perch	---	132,968	418	---	133,386
Black perch	---	64,764	19,558	38,160	122,482
Walleye surfperch	---	141,151	1,638	16,300	159,089
Rainbow seaperch	---	933	195	120	1,248
White seaperch	---	17,769	5,713	12,195	36,677
Rubberlip perch	---	4,503	3,375	3,113	10,991
Pile perch	---	14,271	2,036	4,740	21,047
Perch, unidentified	---	12,387	79	6,438	18,904
Damselfish	---	---	---	---	**163**
Blacksmith	---	105	58	---	163
Wrasses	---	---	---	---	**39,405**
Rock wrasse	---	---	74	2,380	2,454
Señorita	---	---	156	---	156
California sheephead	34,970	---	1,450	375	36,795

TABLE 14

Average Annual Catch (Numbers) by Party Boat, Pier and Jetty, Private Boat, Shoreline Fishermen and Their Combined Catch in Southern California 1963–66

TABLE 14—Continued

Average Annual Catch (Numbers) by Party Boat, Pier and Jetty, Private Boat, Shoreline Fishermen and Their Combined Catch in Southern California 1963–66

	Party boat average of 1963–66	Pier and jetty 1963	Private boat 1964	Shoreline 1965–66	Totals
Mackerels and tunas	---	---	---	---	**1,931,094**
Bluefin tuna	875	---	---	---	875
Skipjack tuna	3,816	---	106	---	3,922
Pacific mackerel	150,739	56,669	24,173	127	231,708
Pacific bonito	879,335	283,068	401,575	15,193	1,579,171
Albacore	103,748	---	5,902	---	109,650
Mackerel, unidentified	---	5,768	---	---	5,768
Billfishes	---	---	---	---	**122**
Striped marlin	43	---	79	---	122
Rockfishes	---	---	---	---	**881,349**
Sculpin	192,369	6,735	21,025	---	220,129
Rockfish species	604,601	3,967	51,516	1,136	661,220
Sablefishes	---	---	---	---	**9,163**
Sablefish	3,398	3,523	2,242	---	9,163
Greenlings	---	---	---	---	**6,687**
Lingcod	5,463	---	1,224	---	6,687
Sculpins	---	---	---	---	**19,588**
Cabezon	3,634	5,070	2,831	2,787	14,322
Pacific staghorn sculpin	---	1,720	---	3,546	5,266
Clinids	---	---	---	---	**2,247**
Giant kelpfish	---	672	367	1,174	2,213
Onespot fringehead	---	---	34	---	34
Butterfishes	---	---	---	---	**7,887**
Pacific pompano	---	7,887	---	---	7,887
Barracudas	---	---	---	---	**565,166**
California barracuda	530,688	17,351	16,235	892	565,166
Silversides	---	---	---	---	**96,809**
Jack and topsmelt	---	59,465	5,936	18,686	84,087
Grunion	---	743	---	---	743
Silversides, unidentified	---	11,979	---	---	11,979
Lefteye flounders	---	---	---	---	**295,506**
Sanddab species	---	7,567	2,458	---	10,025
Bigmouth sole	---	459	1,005	---	1,464
California halibut	116,489	56,933	98,692	8,255	280,369
Fantail sole	---	1,032	2,616	---	3,648
Righteye flounders	---	---	---	---	**12,834**
Petrale sole	---	---	469	---	469
Diamond turbot	---	3,961	1,747	---	5,708
Rock sole	---	---	90	---	90
English sole	---	---	90	---	90
Hornyhead turbot	---	---	29	---	29
Turbots, unidentified	---	294	---	6,154	6,448
Flatfish unidentified	6,372	1,408	2,714	---	**10,494**
Molas	---	---	---	---	**29**
Mola	---	---	29	---	29
Cusk eels	---	---	---	---	**190**
Cusk eel, unidentified	---	190	---	---	190
Toadfishes	---	---	---	---	**458**
Specklefin midshipman	---	424	34	---	458
Other and unidentified fish	14,945	10,397	163	233	**25,738**
TOTALS	3,997,839	1,844,970	957,119	501,734	7,301,662

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TABLE 14

Average Annual Catch (Numbers) by Party Boat, Pier and Jetty, Private Boat, Shoreline Fishermen and Their Combined Catch in Southern California 1963–66