Title
Fish Bulletin 130. Ocean Sportfish Catch and Effort From Oregon to Point Arguello, California July 1, 1957–June 30, 1961

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Publication Date
1965

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME
FISH BULLETIN 130
Ocean Sportfish Catch and Effort From Oregon to Point Arguello, California
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By
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and
DANIEL GOTSHALL
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ACKNOWLEDGMENTS

A listing of all who contributed in the gathering, compiling, and analyzing of data, and typing and editing of this paper would encompass several pages. Among Department of Fish and Game employees, 19 were directly assigned field duties on the project, and several others aided in editing and offered advice and suggestions on specific problems. Those most directly involved with the preparation of the manuscript were H. G. Orcutt, John E. Fitch, Ann Gotshall, Joanne Poole, Bess Odes, Clare Moseley, and Lila Desmond.

Partyboat concessionaires and skippers went out of their way to give project samplers space on party boats and at the filleting tables on the dock, and in keeping accurate, valuable logs of their daily operations.

Many skiff concessionaires kept special records and logs of their daily operations, and some turned over their business records to the project. Without this information we could not have computed total effort and catch for this fishing method.

Skindivers were especially cooperative, many keeping records of their dives and initiating organized cooperative action in club activities and skindiving tournaments. Much of the success of gaining an adequate survey of skindivers was due to the efforts of the officers of the Central California Council of Skindiving Clubs.

State Beaches and Parks personnel at several coastal parks also kept records of fishing activity for the project in addition to performing their regular daily duties.

All these and tens-of-thousands of fishermen who gladly offered information are the ones responsible for the successful completion of this survey. We are grateful for the opportunity to assemble and present the information so eagerly offered by sincerely helpful and concerned fisherman and fellow workers.

DANIEL J. MILLER
DANIEL GOTSHALL

1. INTRODUCTION

This work was performed as Northern California Marine Sport Fish Survey, Dingell-Johnson Project F-12-R.

The State of California is responsible for regulating, protecting, enhancing, and assessing the fish and game resources of California. Estimating the existing and potential take of marine resources is one of the tasks of the Marine Resources Operations unit of the Department of Fish and Game. Basic life history information on important species, total catch estimates by species, and enumeration of boats, angler effort, and facilities are compiled and published by this unit. Commercial catch records are gathered, compiled, and published for each year, and give data by month and port of landing. All commercial landings are recorded by species or major groupings at the time of sale to fish buyers. These landings are submitted monthly to the Terminal Island statistical unit. The sport catch, however, has not been assessed except for the partyboat catch which is recorded on logs.

An ever-increasing demand placed on marine resources by expanding commercial and sport operations has necessitated a more complete evaluation of all segments of the sport fishery. Popular species such as king salmon,[1] striped bass, and lingcod were known to be important in central and northern California. Information on catch of all species was needed so research funds could be allocated more intelligently and recommendations could be made as to future marine sportfishing improvements projects.

Upon completion of the Ocean Salmon Study (Dingell-Johnson project F-12-R) the project was amended to assess total sport catch and effort from Oregon to Point Arguello.

Although a routine annual tabulation of catch and effort, as has been conducted on partyboat and commercial catches, could not be perpetuated, one "base" year's data were gathered. Thus, future surveys could reveal trends of effort and catch for any or all segments of the sport fishery. Short-cut methods could be adopted using basic data gathered during the base year survey.

The objectives of this assessment survey, the Northern California Marine Sport Fish Survey, were:

(1) To estimate the total average annual fishing effort, in angler days, for each fishing method (i.e. party boat, skiff, pier, skindiving, and shore fishing, including surf casting, rocky shore fishing, fishing from jetties, and surf netting).

(2) To estimate the total catch by numbers and species for each fishing method.

(3) To estimate the total catch by weight for certain fisheries. (This objective was added to the project in 1959.)

(4) To compute catch-per-unit-of-effort values for each fishing method.

[1] A complete listing of all common and scientific names of fish mentioned in the text appears in the Appendix.

(5) To record length composition of all species taken by partyboat fishermen, skiff fishermen, and skindivers.

(6) To enumerate and describe all marine sportfishing facilities.

(7) To develop sampling techniques and fish identification guides.

All catch and effort data were grouped by monthly intervals at each port or fishing locality, and then summarized into yearly totals for each unit of area.

Originally, the objectives included an economic survey of the sport fishery, including amount of money spent per trip, distance traveled, etc., such as was conducted in Florida (Ellis, Rosen, and Moffett, 1958). Also, a survey of San Pablo and San Francisco bays was included.

The first 6 months of shore coverage, wherein all fishing methods were sampled, revealed the usual array of ensuing problems, and led to re-evaluation of objectives and methodology. The economic survey was discontinued because, though valuable, it was not essential in a biological approach to management.

In addition to estimates of annual average effort and catch, biological information, usable in setting up research programs and as "base year" information, was needed. Since the total shoreline of the many bays of the study area was extensive, only skiff facilities, partyboat operations, and certain piers were included. Shore fishing, skindiving, and fishing from small piers were not surveyed in bays and estuaries. Night surf netting and night pier fishing were not included because the project was unable to provide coverage for night work.

The need to collect several series of data per fishing method precluded simultaneous survey of all fishing methods. A complete study in 1 year covering all methods was highly desirable, but our limited budget would not permit such an approach. Thus, pier, shore (primarily surf casting), and surf net fishing were surveyed in 1958; skiff fishing in 1959; and partyboat, rocky shore fishing, and skindiving in 1960–61. Some series' of data were collected throughout the 3 years to make it possible to evalute yearly variations in catch and effort.

No exceptional physical environmental changes, which may have materially altered biological relationships between species, occurred during the survey. The data from several consecutive years have been collated to represent average annual estimates for all parameters. Had this study been conducted during the 3 previous years (1955–1957), the sudden warming of ocean waters in 1957, and concurrent influx of southern forms, would have presented unique problems in treating the data in this way. From 1958–1961 there was gradual cooling and a return to a more normal physical environment, with consequent reduced occurrences of southern forms in central and northern California, such as barracuda which, in 1957, ranged as far north as Canada.

Results of this survey have been summarized in three different ways: (i) as an administrative report, which included a complete set of typed raw data tables along with a narrative description of each fishery and methods used at each locality; (ii) as this report, which includes much of the original data, but in several cases annual summaries[2] have

[2] Not all summary tables used for this report are included here. These annual summaries plus all the raw data tables of the original report are on file at the Portland, Oregon, Dingell-Johnson office, and at the Department of Fish and Game offices at Sacramento, Menlo Park, Terminal Island, and Eureka.

been given in lieu of monthly summaries, and length frequency data are summarized; (iii) as four fishing maps covering 10 counties from Oregon to Santa Barbara County, Calif. These maps list all fishing facilities, public camping sites, and areas where shore fishing, skindiving, clamming, abalone picking, and surf netting are conducted. Also included are details as to the best times of year to fish, gear and bait to use, and notes on life history and behavior of certain fishes.

2. METHODS

The study area, Santa Barbara County to Oregon, encompassed more than 800 miles of California's Pacific coastline.

The several fishing methods surveyed, and specific characteristics of each fishing locality had to be considered in devising a program to sample the sportfishing activity.

Some of the problems inherent in such a complete survey were revealed by Younger and Zamos (1955) who surveyed New Jersey's marine sport fishery.

Carlander, DiConstanzo, and Jessen (1958) state that, "Only when sampling is done according to some statistical scheme can reliability of the data be measured and certain biases be avoided." Abramson and Tolladay (1959) demonstrated that to achieve a 95 percent confidence interval for fishing effort at one fishing pier (Moss Landing, Calif.), about 54 proportional and 39 stratified (optimum) random sampling days per year would be required. If we assume the 27 piers of the study area are comparable to the Moss Landing pier, 1,458 man-days would be required for proportional random sampling, and 1,053 for stratified random sampling.

Although the other piers may have required somewhat less sampling effort, adequate sampling of shore fishing, skindiving, skiff fishing, and partyboat fishing would have required effort far exceeding that which was available to the project. Another approach had to be devised in order to survey the five fishing methods and the specific problems they presented at each locality along more than 800 miles of coastline.

The methods eventually used followed procedures of judgment or indiscriminate sampling. Preliminary data for a year were not available and manpower was not to be available continuously. Emphasis was placed upon ascertaining all possible biases and gathering data relatively free from these accumulative errors.

Whenever possible complete angler day samples were taken since incomplete angler day samples may not represent true species composition data. Weekend and weekday effort ratios were established so that sampling could be conducted on days when more anglers were present. This would yield more reliable species composition data, and was especially necessary in winter when weekday effort was often nil. However, a systematic procedure was adhered to, which included both weekend and weekday samples during summer months when adequate numbers of fishermen were encountered on all days.

No significant differences in species composition or catch-per-unit-of-effort values were disclosed between minimal and maximal effort days for any method except partyboat fishing.

When large numbers of fishermen were aboard, partyboat operators often plied shallower waters to avoid excess tangling of lines. This could occur either on weekdays or weekend days, but occurred mostly on weekend days, so proportional sampling was applied to this method during spring, summer, and fall. During winter there were not many crowded party boats, and sampling was conducted primarily on weekends to achieve adequate species composition data.

Complete censusing was available for partyboat effort and catch (by major categories of fish), for skiff effort at certain launching sites, for two piers, and at several shore-fishing localities. Systematic judgment and log sampling procedures were applied where each was considered most reliable for the remainder of the sampling parameters. Considering the doubtful reliability of post card and questionnaire data involving species identification and unknown biases, this method was not relied upon except in a special manner for certain skindiving catch information.

The cost to the project for part-time employees, auto-rental, and travel during our first 6 months of "shore-run" sampling of all fishing methods, made it apparent that the scope of the work needed to be curtailed and that short-cut methods of acquiring effort estimates should be developed. The number or piers to be surveyed was reduced to 16, eliminating all but five bay piers. Several small piers along the coastline were less intensively surveyed. Sampling was made more efficient by converting counts made by automobile and airplane into full-day estimates of effort, and by disseminating effort logs to skiff and shore concessionaires and to skindivers. Without the pure systematic random sampling approach, more days could be devoted to making instantaneous counts at beaches, piers, jetties, and rocky shoreline access areas. Thus, sufficient data were acquired to calculate total effort, but statistical confidence limits could not be calculated. The reliability of the data can be evaluated by comparing the sample sizes with total effort. Each table of catch-and-effort data includes information on sample size and total calculated catch and effort. In several instances we used two separate series of data to make estimates of effort for certain areas. Comparisons of these results also demonstrate the relative accuracy of each method. In all calculations minimal figures were retained. Thus, results are minimal estimates, and we know the least number of angler days and fish taken. These minimal figures probably are within 10 to 15 percent of the true figures for all fishing methods, and are even more accurate for some methods, such as the partyboat and skiff catches, at most localities.

The actual mechanics of sampling involved dividing the number of man-days available systematically among the areas to be sampled in respect to relative importance of each as revealed by data of the first 6 months. Since sampling procedures varied widely at each locality, only a general methodology could be applied to the different fisheries, of for that matter, to the same fishing methods at different localities along the coast. Thus, general goals were set, keeping in mind the areas of possible bias. Only by resourcefulness of field biologists were these goals achieved.

2.1. Definitions

General terms and our definitions for these are being listed to aid in understanding the methodology of this study. More specific terms defining aspects of certain fisheries will be given in sections on fishing methods.

Party boats: All boats regardless of size, operated by a hired skipper and carrying passengers for a fee.

Skiffs: All private and rented craft not involved in commercial fishing nor carrying paying passengers at the time of sampling.

Skindiver: A diver using at least swim fins and a face mask, but who may also be using a snorkel or SCUBA, and who is completely submerged when diving.

Shore fishermen: All anglers casting from the natural shore, or from artificially-constructed jetties and abutments.

Piers: All private and public structures on pilings which extend over the water and are used for fishing activities.

Surf netting: The use of A-frame nets, two-man jump nets, long-handled brails, and Hawaiian throw nets for taking surf smelt and night smelt on sandy ocean beaches.

Port or Port of Landing: A port is established by the fact that commercial landings have been recorded at the locality.

Launching site: A place where skiffs are launched, including mechanical lifts operated from piers or from trolleys extending from shore, improved launching ramps, and unimproved sections of beaches where it is calm and safe to launch a skiff.

Log: Written record submitted by skiff and pier concessionaires, partyboat operators, State Park personnel, private land owners, and skindivers.

Bottom fishing: Fishing generally at or near the bottom from a vessel not in motion except for possible movement caused by water currents or wind. Any skiff or party boat at anchor or drifting would fit this classification.

Trolling: Fishing from a craft that is underway by use of sail, oars, or motors.

Angler and *Angler day:* An "angler" was a "fishing pole" used throughout the fishing period during a day. For example, if two anglers used but one pole, this was one angler day, and if one angler used two poles simultaneously, this was considered two angler days. The unit-of-effort is the "pole day"; however, the term *angler day* is used throughout the text and in the tables. Ratios of anglers to poles will be given for each fishing method.

Effort: Specifically, an angler day or an angler hour.

Catch-per-day: (C/D). The average number of fish caught by one angler, regardless of the number of hours fished, during a calendar day.

Catch-per-hour: (C/H). The average number of fish caught by one angler in one hour.

Instantaneous count: A tally or complete count of the fishermen present at a certain location at a specific time.

Turnover: The computed total effort for a given day at a definite location, such as a pier or a section of coastline.

2.2. Sampling Methods

2.2.1. Species Identification

Our first problem of sampling involved rapid and accurate species identification. Three groups of fishes involving similar-appearing species presented special problems: (i) The rockfishes, embracing 50 species of which 29 appeared in the marine sportfish catch; (ii) the surf-perches embracing 19 species, of which 17 appeared in the catch; and (iii) the flatfishes consisting of 24 species, of which 14 appeared. A new field man needs several weeks to learn the sport-caught species, and even then a field guide should be at hand for reference. Because of this, whenever possible, we hired trained seasonal employees from year to year, and saved having to train new employees.

Field guides for identifying species were prepared by Miller (1960) and Miller, Gotshall, and Nitsos (1961). These were also valuable to skindivers who volunteered to keep logs of their activities for the project. More than 500 copies of these booklets were distributed to interested sportsmen.

2.2.2. Sampling Procedure

For each fisherman interviewed, we recorded the number of poles used, time spent fishing (to the nearest quarter hour), and number of each species taken. Fishing time included the total elapsed period from arrival to departure. For the various fishing methods this was measured between: (i) arrival at the pier and departure from it; (ii) departure of party boats and skiffs from the anchorage or launching site and their return to the site (minus hours spent in some other skiff activity such as water skiing); (iii) arrival of shore fishermen and surf netters on the beach until their departure; and (iv) time skindivers spent underwater fishing.

A portion of time in all these categories was not actual fishing time. Time for lunch, rest, baiting hooks, and various other activites were included in the angler or pole day. Finite criteria were not established for "pure" fishing time. Are activities such as baiting hooks, untangling lines, lifting anchors, changing fishing localities, treating wounds from hooks and fish spines, etc., fishing time? Such criteria, if established, would have to be subjectively interpreted, adding bias to the results.

Total lengths of fish in the sample were recorded for partyboat, skiff, skindiving, and rock shore fishing, but not for surf casting, surf netting, or pier fishing. A sampling table was devised for use where large numbers of fish were to be counted and measured, such as at party-boat landings, skiff launching sites, and at competitive skindiving meets. Bottomfish were usually kept in burlap sacks by skiff and partyboat fishermen. Small hooks were placed on the front edge of the sampling table for attaching the sack to which counted and measured fish were returned. An aluminim pan was used for small samples and for sampling in areas where the table could not be set up. In many instances, when sampling catches of shorefishermen and skindivers, only a sampling board (Figure 1) was used. On this board, fish were measured and

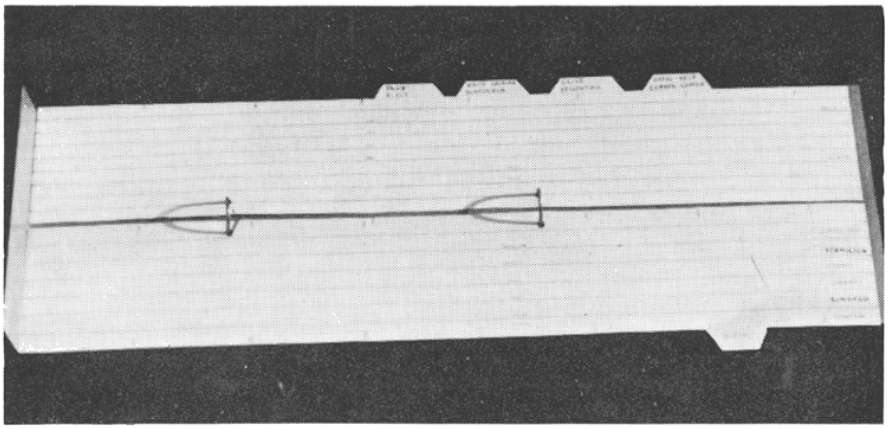

FIGURE 1. Sampling board used to record lengths of several species. The lengths are transcribed from this board onto ½-cm lined paper by species. *Photograph by Dan Gotshall.*

FIGURE 1. Sampling board used to record lengths of several species. The lengths are tran-scribed from this board onto ½-cm lined paper by species. Photograph by Dan Gotshall.

effort data were recorded. This sampling board was used to tabulate all length frequency data for partyboat, skiff, shorefishing, and skindiving catches. It was made of a sheet of 32- X 10-inch aluminum with 2 inches turned up at one end as a head-board for fish measuring, and ½ inch turned down along each side for rigidity. Six sheets of white vinyl plastic were attached by two binder-type rings fastened on the underside of the board. Each vinyl sheet was lined full length with black vinyl ink, with each line about ½ inch apart. Dots crossed the sheets at 10-cm intervals from the headboard. Fish lengths were recorded by marking on the sheet between two of the longitudinal lines. At the termination of sampling, paper sheets, lined at half-centimeter intervals, were placed on the plastic sheet and the number of marks appearing within each half-centimeter interval would be transcribed directly.

The number of length tallies for each species was recorded on the length frequency sheet and transcribed onto a daily sample summary sheet. When length frequencies were not taken, and the numbers of fish were recorded by fishermen, or by skiff or sack, the summation of all fish taken for the day was entered on a daily summary sheet.

A rule of sampling was not to hinder business or a hurried fisherman's departure. Poor public relations could not yield good interviews and reliable data. Efforts were made to accomplish sampling expediently and at the convenience of fishermen and concessionaires.

When checking party boats, the sampler went on the boat for the day and sampled while returning to port, or he sampled catches at dockside cleaning tables. The sampling board enabled the sampler to record in a few minutes the lengths of all fish caught by the most successful fisherman.

2.2.3. Converting Fish Numbers to Weight

It became evident in 1959 that weights of fish caught would be valuable for comparing fishing methods along certain areas of the coast. Numbers of fish were converted to weight in all partyboat catches, and in the skiff catches at the ports of Santa Cruz, Moss Landing,

and Monterey. Should need arise to convert numbers to poundage at all other skiff launching sites and for skindiving and rock shorefishing, it will be no problem because length frequency and weight-length data are available for each species.

2.2.4. Effort Determination

Total effort data were available for all partyboat fishing, Moss Landing and Seacliff Beach State Park piers, several shore localities where daily logs were kept, and at 15 skiff concessions where either logs or business records were maintained. At all other localities, total effort was calculated by fishing method, (i) from a series of daily effort counts made throughout the year, (ii) by deriving ratios between periodic aerial counts at one locality and counts made at another locality where the total effort for the year could be accurately determined, or (iii) for skindivers, from field sampling and questionaire data. In the first technique, a number of weekday and weekend counts were simply expanded into total effort for the month.

Complete series' of data from Moss Landing and Seacliff Beach State Park piers, total daily shorefishing effort at Point Lobos State Park, and complete daily skiff rental totals from several skiff concessions revealed reliable figures on the relationship between weekday and weekend effort. The ratios of weekdays to weekends for all of these methods remained fairly constant within a given period of time or season. However, there was some variation between seasons for each method, and even more variation between methods. The yearly average of weekday-weekend ratios for Moss Landing and Seacliff Beach State Park piers was 1:2.5; for skiff effort at Santa Cruz it was 1:6.8; and for shore fishing at Point Lobos it was 1:4.5. Not all holidays fell into the weekend magnitude. For instance, Thanksgiving and New Year's day were low in effort and were considered weekdays. However, the Friday following Thanksgiving fell into the weekend magnitude and was considered as a weekend day in calculations. Sunday figures were usually higher than Saturday figures, especially on piers, but the differences were not great for any fishing method. All weekdays and holidays falling into the weekend category, and Saturdays and Sundays, were grouped as weekend days. Whenever weekend samples were lacking but weekday estimates were available, the ratios of weekday-weekend were used to arrive at an average weekend figure.

The second method of calculating total effort involved using airplane counts made on 30 flights from March to December, 1958. On each flight counts were made at all localities within a 100- to 250-mile area. At certain key areas of fishing effort, intensive shore sampling was conducted to determine catch and effort. For these key areas total effort was computed by the weekday-weekend expansion method previously described. Counts made from the airplane at these key areas were added for all flights, and counts at each beach where shore sampling was not being conducted were treated similarly. Then using simple ratios of airplane counts at two areas, and the known total effort at one, total effort was calculated for the other. Most of the shorefishing effort figures were calculated in this manner.

The accuracy of this method was tested and found reliable (Table 1) . Thus, we calculated the total shorefishing effort of each beach by

using the airplane count ratio method whenever we lacked sufficient daily counts to compute by the weekday-weekend expansion method.

TABLE 1

Comparison of Calculated Effort of Eight Beach Areas With Effort Estimated by Means of Aerial Count Ratios to Baker Beach in 1958

	(1)	(2)	Number of each type of daily count for weekend-weekday calculation (Column 1)			
	Weekend-weekday calculation	Airplane count ratio to Baker's Beach	Turnover	Converted airplane count	Converted shore count	Total
Baker Beach	*22,380		28	29	13	70
San Francisco Ocean Beach	59,570	58,970	15	28	6	49
Sharp Park	19,020	18,240	17	27	28	72
Rockaway	7,360	6,700	14	27	28	68
Montara Beach State Park	17,390	17,630	13	29	30	72
Martin's Beach	14,640	17,300	7	28	1	36
Natural Bridges State Park to Santa Cruz Point	11,240	11,600	13	23	2	38
Rio Del Mar	4,200	5,150	22	25	2	49
Moss Landing Jetty	14,340	14,090	30	20	6	56
**Totals	**147,760**	**149,680**				

* Not included in totals.
** The difference between the figures in columns 1 and 2 was 1,920, for a 1.3 percent error.

TABLE 1
Comparison of Calculated Effort of Eight Beach Areas With Effort Estimated by Means of Aerial Count Ratios to Baker Beach in 1958

2.2.5. *Calculating Daily Effort*

Turnover: Early in 1958 when the survey of piers and beaches was initiated, making total counts of pier fishermen either as they were arriving or leaving, or both, was inpracticable most of the time, and impossible when large numbers of fishermen were coming and going. This turnover in fishermen necessitated developing other methods of determining daily effort. A clue to the solution of this problem was found in Carlander (1956:59–60). Total fishing time, in hours, can be determined by counting the number of anglers fishing at each hour. By totaling these hourly counts throughout the fishing day, and dividing by the number of hours in the avarage angler day, the number of individual fishermen or angler days can be arrived at. As an example, the turnover curve at San Francisco Municipal Pier demonstrated a general repetitive bell-shaped curve, with a mode usually between 11 AM and 2 PM (Figure 2). Similar fisherman behavior was demonstrated by turnover curves for all piers and shore areas in the study area. The period of modal peak may vary from one locality to another because of some local weather condition or physical attribute of the area, but it usually occurs around midday. A small mode, often present from 5 to 7 PM near centers of population, reflected fishing activities after working hours.

The average angler day in hours was determined by a sampler who remained at a locality for most or all of a fishing day. Whenever possible, small interview cards were handed to each fisherman when he started fishing. The number of people in the party, the number of fishing poles, and time of arrival were entered on the card by the sampler. The card was retrieved from the fisherman upon his departure, and the time, and number and kinds of fish were recorded. Daily summary

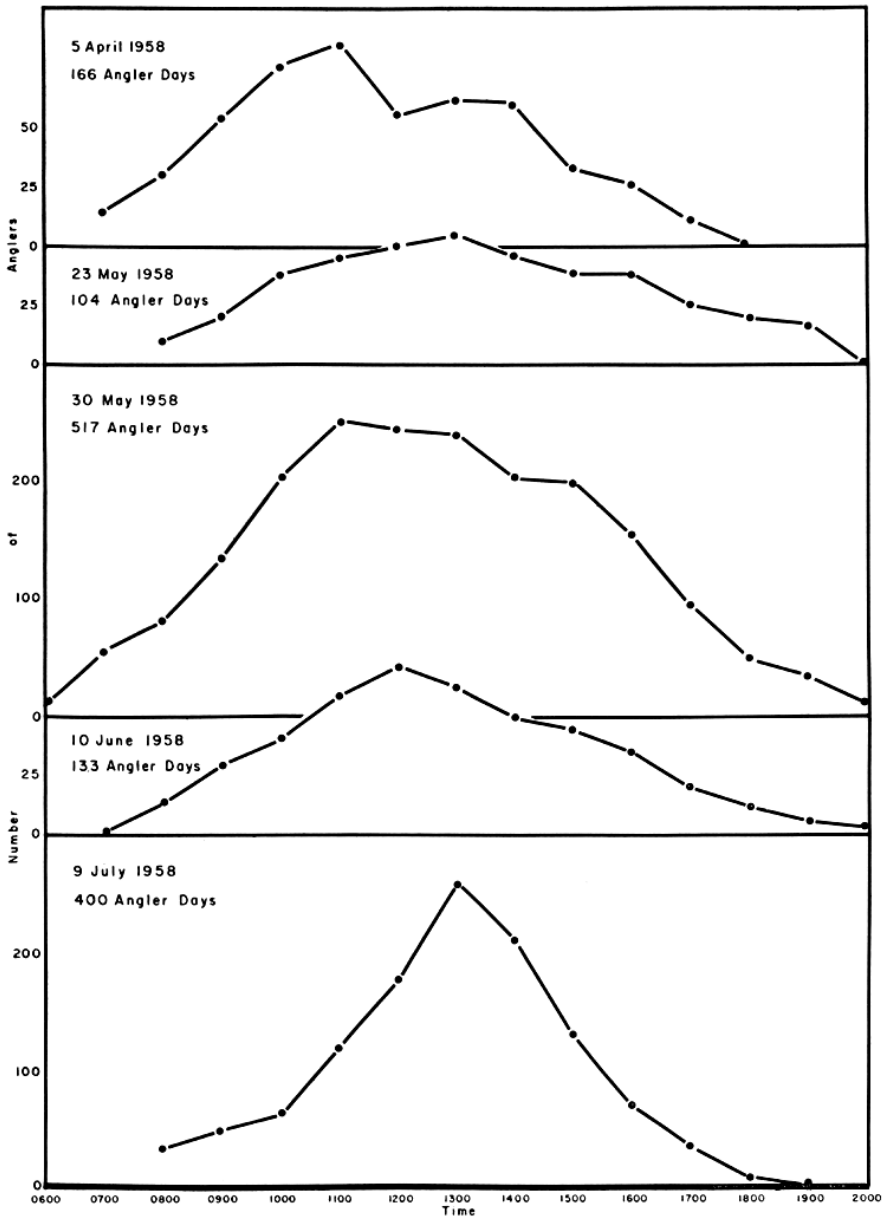

FIGURE 2. Turnover curves at San Francisco Municipal Pier, April–July, 1958.

FIGURE 2. Turnover curves at San Francisco Municipal Pier, April–July, 1958

sheets were made for each turnover and the average angler day, total hours of effort, total angler days, and total catch by species were entered. These data were then summarized by month for use in total catch and effort computations. Whenever an hourly count could not be made, the point on the turnover mid-way between the two adjacent hourly counts was considered as the hourly count. often it was not possible to hand out cards to all fishermen as they arrived. In such

cases, the time of arrival as remembered by the fisherman when he departed was entered. We tested the reliability of "remembered arrival times" early in 1958, and the error was not so large as to invalidate the sample. Those arriving to fish in the early morning proved quite accurate, but those arriving in mid-afternoon often showed a considerable variation in accuracy; the average, however, still yielded reliable starting times.

2.2.6. *Converting Instantaneous Counts to Total Daily Effort*

Parker (1956) and Rasmussen (1956), utilized factors to convert midday counts to total daily effort estimates. Turnover data collected for our project were treated statistically to derive conversion factors for each hour of the day for each turnover area. These factors were computed by summating the number of fishermen tallied at each hour for all samples, and dividing the results into the summation of total anglers for those sampling days. Factors were constructed to convert instantaneous counts, at beaches where no turnovers were made, from averages of factors from all turnover data in a given section of the coast.

All shore and airplane instantaneous counts were then converted to total daily counts.

2.2.7. *Total Catch Computation*

Total effort calculations were grouped by monthly or multi-monthly intervals depending on the number of samples taken during any one month or period. We calculated total catch by species from our total effort estimates by using a simple ratio of sample size to total effort. These monthly and multi-monthly catch estimates were then collated to arrive at yearly summaries.

2.2.8. *Catch-Per-Day (C/D) and Catch-Per-Hour (C/H) Calculations*

Catch-per-day and catch-per-hour figures were calculated for each monthly, multi-monthly, and yearly summary. To do this, we divided the total calculated number of fish by species, by the total calculated angler days and angler hours.

3. PIER FISHING

Fishing effort at 16 major piers in the study area amounted to 530,702 angler days during 1958 (Table 2 and 3) and yielded 1,-034,036 fish.

The principal species (by number) were surfperch (several kinds), white croaker, Pacific staghorn sculpin, striped bass, kelp greenling, jacksmelt, flatfish (several kinds), and sharks (Figure 3 and Tables 2 & 3). Most piers are constructed over sand or mud bottoms, so the dominant species are either surf-frequenting forms (such as surfperches and striped bass), bottom-dwelling forms (such as white croaker, Pacific staghorn sculpin, flatfish, and sharks), or surface-feeding forms (such as jacksmelt, true smelts, anchovy, herring, and young bocaccio). There are always debris and rocks under or near piers, so occasional rock-frequenting species are also taken. At some piers, such as at Trinidad and San Francisco Municipal piers, a large portion of the

TABLE 2

Number of Fish by Species, Angler-Days Sampled, and Total Annual Effort at Ten Piers During 1958

	Trinidad Pier	TPL and Paladini Piers	Lazio Pier	Berkeley Municipal Pier	San Francisco Municipal Pier	Princeton Pier	Santa Cruz Pier	Capitola Pier	Seacliff Beach State Park Pier
ROCKFISH	**182**	**401**	**0**	**1,240**	**4,921**	**168**	**237**	**24**	**40**
Blue	0	0	0	0	17	0	219	0	0
Black	172	361	0	0	1,430	0	0	0	0
Olive	0	0	0	0	523	0	0	0	0
Copper	7	40	0	0	0	0	0	0	0
Vermilion	0	0	0	0	34	0	0	0	0
Brown	0	0	0	172	1,374	66	0	0	0
Bocaccio	0	0	0	0	56	70	0	0	20
Black-and-yellow	0	0	0	0	0	0	0	0	0
Grass	0	0	0	483	111	0	0	0	0
Kelp	0	0	0	0	408	32	18	0	20
*Rockfishes	3	0	0	585	968	0	0	24	0
FLATFISH	**0**	**0**	**0**	**1,505**	**4,810**	**2,873**	**6,657**	**0**	**3,650**
Starry flounder	0	0	0	1,260	385	2,299	2,711	0	0
Pacific sanddab	0	0	0	53	3,413	10	1,032	0	0
Sand sole	0	0	0	0	122	564	1,509	0	0
*Flatfishes	0	0	0	192	890	0	1,077	0	3,650
English sole	0	0	0	0	0	0	308	0	0
SURFPERCH	**914**	**7,084**	**21,139**	**96,152**	**74,693**	**35,250**	**54,247**	**9,077**	**108,501**
Striped	216	281	36	28	377	153	410	0	0
Redtail	112	326	123	669	248	216	0	0	0
Barred	0	0	0	0	0	2,055	558	0	26,179
Calico	49	0	0	0	0	529	0	0	9,331
Silver	179	0	0	0	1,437	8,113	3,053	0	10,961
Walleye	306	874	15,812	6,778	8,667	12,595	16,988	0	11,868
Shiner	0	5,203	5,168	53,245	54,884	7,809	27,080	0	1,349
Pile	7	155	0	8,910	1,822	970	696	0	997
White	45	245	0	1,794	1,394	1,576	4,583	0	1,283
Rubberlip	0	0	0	0	93	0	78	0	3,030
Rainbow	0	0	0	0	75	217	249	0	394
Black	0	0	0	3,024	354	186	131	0	85
Spotfin	0	0	0	0	0	0	416	0	0
Sharpnose	0	0	0	0	0	0	5	0	0
Reef	0	0	0	0	17	0	0	0	0
Dwarf	0	0	0	15	361	0	0	0	0
*Surfperches	0	0	0	20,589	5,164	831	0	9,077	43,924
SHARKS, RAYS, SKATES	**19**	**50**	**0**	**514**	**3,505**	**107**	**857**	**0**	**40**
Leopard shark	0	0	0	45	1,867	72	19	0	0
Swell shark	0	0	0	0	0	0	0	0	0

TABLE 2
Number of Fish by Species, Angler-Days Sampled, and Total Annual Effort at Ten Piers During 1958

Spiny dogfish	0	0	0	186	0	0	0	0	0
Smoothhounds	0	50	0	125	436	35	34	0	0
*Sharks	0	0	0	106	81	0	244	0	0
California skate	0	0	0	0	185	0	18	0	0
Big skate	19	0	0	0	0	0	0	0	0
*Skates	0	0	0	0	936	0	542	0	40
Bat ray	0	0	0	52	0	0	0	0	0
Shovelnose guitarfish	0	0	0	0	0	0	0	0	0
COTTIDS	**202**	**173**	**475**	**4,598**	**5,393**	**272**	**1,530**	**61**	**1,790**
Cabezon	104	65	0	157	473	65	953	61	10
Pacific staghorn sculpin	0	108	475	4,426	4,889	207	631	0	1,780
Buffalo sculpin	70	0	0	15	28	0	0	0	0
Brown Irish lord	28	0	0	0	0	0	0	0	0
MISCELLANEOUS	**649**	**780**	**21,358**	**16,052**	**35,815**	**14,572**	**127,636**	**6,961**	**55,740**
Lingcod	9	0	0	0	447	182	511	0	40
Kelp greenling	422	256	0	100	265	20	0	0	0
Rock greenling	82	0	0	0	0	0	0	0	0
White croaker	13	0	0	57	2,567	11,413	73,259	5,162	35,160
Queenfish	0	0	0	0	0	0	0	0	0
Jacksmelt	13	500	15,728	12,254	27,238	2,703	14,430	1,799	17,460
Topsmelt	0	0	0	0	1,159	127	38,534	0	0
Pacific herring	14	0	0	0	31	0	238	0	0
Northern anchovy	0	24	5,630	0	727	10	0	0	3,040
Pacific tomcod	89	0	0	0	589	52	0	0	0
Jack mackerel	0	0	0	0	188	0	130	0	0
Pacific mackerel	0	0	0	0	0	0	0	0	0
Night smelt	0	0	0	0	122	0	136	0	0
Surf smelt	0	0	0	0	336	45	398	0	0
*True smelts	0	0	0	628	173	0	0	0	0
American shad	0	0	0	0	139	0	0	0	0
King salmon	0	0	0	0	0	20	0	0	40
California barracuda	0	0	0	0	0	0	0	0	0
Pacific pompano	0	0	0	0	0	0	0	0	0
Giant kelpfish	0	0	0	0	79	0	0	0	0
Striped bass	0	0	0	3,013	1,757	0	0	0	0
Wolf-eel	7	0	0	0	0	0	0	0	0
Mola	0	0	0	0	0	0	0	0	0
TOTAL FISH CAUGHT	**1,966**	**8,488**	**42,972**	**120,061**	**129,134**	**53,242**	**191,224**	**16,123**	**169,761**
Months covered	12	12	9	12	12	12	12	9	8
Angler days surveyed	3,180	2,622	5,470	104,720	76,350	30,240	80,000	7,210	58,500
Total angler days	3,180	2,622	5,780	104,720	76,350	30,240	80,000	8,000	73,500
Anglers sampled	294	131	345	7,635	6,057	1,949	5,965	337	4,036

* May include more than one species.

TABLE 12—Cont'd.

TABLE 3

Numbers of Fish by Species, Angler Days Sampled, and Total Annual Effort at Six Piers, and Total Catch and Species Composition of 16 Piers From Trinidad to Pismo Beach During 1958

	Moss Landing Pier	Monterey Pier Number 2	San Simeon Pier	Cayucos Pier	Avila Pier	Pismo Beach Pier	Totals**	Percent Comp.
ROCKFISH	**30**	**320**	**0**	**2,909**	**635**	**0**	**11,107**	**1.15**
Blue	30	297	0	0	0	0	563	0.06
Black	0	0	0	0	0	0	1,963	0.20
Olive	0	0	0	0	0	0	523	0.05
Copper	0	0	0	0	0	0	47	0.01
Vermilion	0	0	0	0	0	0	34	T
Brown	0	0	0	0	0	0	1,612	0.17
Bocaccio	0	0	0	2,901	635	0	3,682	0.38
Black-and-yellow	0	0	0	8	0	0	8	T
Grass	0	0	0	0	0	0	594	0.06
Kelp	0	0	0	0	0	0	478	0.05
*Rockfishes	0	23	0	0	0	0	1,603	0.17
FLATFISH	**746**	**70**	**23**	**158**	**261**	**494**	**21,247**	**2.20**
Starry flounder	0	0	0	47	69	24	6,795	0.70
Pacific sanddab	0	0	0	0	114	18	4,660	0.48
Sand sole	0	0	0	0	0	207	2,402	0.25
*Flatfishes	746	70	23	111	78	245	7,082	0.73
English sole	0	0	0	0	0	0	308	0.03
SURFPERCH	**10,155**	**1,320**	**211**	**7,279**	**10,702**	**28,770**	**465,494**	**48.13**
Striped	0	0	10	27	427	261	2,226	0.23
Redtail	0	0	0	0	0	0	1,694	0.18
Barred	0	0	85	767	1,560	16,876	48,080	4.97
Calico	0	0	47	214	1,765	149	12,084	1.25
Silver	0	0	69	1,525	1,002	4,372	29,811	3.08
Walleye	0	0	0	2,343	3,203	3,871	83,305	8.61
Shiner	0	0	0	1,533	2,058	1,946	162,275	16.78
Pile	0	0	0	23	235	254	12,969	1.34
White	0	0	0	0	68	569	11,557	1.19
Rubberlip	0	0	0	0	0	0	3,201	0.33
Rainbow	0	0	0	0	0	39	974	0.10
Black	0	0	0	13	0	33	3,826	0.40
Spotfin	0	0	0	102	0	0	518	0.05
Sharpnose	0	0	0	0	0	0	5	T
Reef	0	0	0	0	0	0	17	T
Dwarf	0	0	0	0	0	0	376	0.04
*Surfperches	10,155	1,320	0	732	384	400	92,576	9.57
SHARKS, RAYS, SKATES	**0**	**0**	**0**	**113**	**122**	**194**	**5,521**	**0.57**
Leopard shark	0	0	0	0	0	0	2,003	0.21
Swell shark	0	0	0	68	0	0	68	0.01
Spiny dogfish	0	0	0	0	0	0	186	0.02
Smoothhounds	0	0	0	0	0	0	680	0.07
*Sharks	0	0	0	0	88	0	519	0.05
California skate	0	0	0	0	0	0	203	0.02
Big skate	0	0	0	45	0	72	136	0.01
*Skates	0	0	0	0	34	0	1,552	0.16
Bat ray	0	0	0	0	0	0	52	0.01
Shovelnose guitarfish	0	0	0	0	0	122	122	0.01
COTTIDS	**279**	**0**	**0**	**827**	**377**	**0**	**16,034**	**1.66**
Cabezon	0	0	0	16	69	0	1,979	0.21
Pacific staghorn sculpin	279	0	0	811	308	0	13,914	1.44
Buffalo sculpin	0	0	0	0	0	0	113	0.01
Brown Irish lord	0	0	0	0	0	0	28	T
MISCELLANEOUS	**24,787**	**7,090**	**0**	**9,031**	**78,102**	**49,113**	**447,686**	**46.29**
Lingcod	0	10	0	27	0	0	1,226	0.13
Kelp greenling	0	0	0	0	0	0	1,063	0.11
Rock greenling	0	0	0	0	0	0	82	0.01
White croaker	7,695	0	0	2,680	61,984	3,941	203,931	21.09
Queenfish	0	0	0	2,611	503	890	4,004	0.41
Jacksmelt	17,092	7,075	0	3,185	14,279	43,538	177,294	18.33
Topsmelt	0	0	0	0	0	0	39,820	4.12
Pacific herring	0	0	0	25	0	0	311	0.03
Northern anchovy	0	0	0	0	0	0	9,431	0.97

TABLE 3
Numbers of Fish by Species, Angler Days Sampled, and Total Annual Effort at Six Piers, and Total Catch and Species Composition of 16 Piers From Trinidad to Pismo Beach During 1958

TABLE 3—Continued

Numbers of Fish by Species, Angler Days Sampled, and Total Annual Effort at Six Piers, and Total Catch and Species Composition of 16 Piers From Trinidad to Pismo Beach During 1958

	Moss Landing Pier	Monterey Pier Number 2	San Simeon Pier	Cayucos Pier	Avila Pier	Pismo Beach Pier	Totals**	Percent Comp.
Pacific tomcod	0	0	0	0	0	0	730	0.08
Jack mackerel	0	0	0	428	1,336	275	2,357	0.24
Pacific mackerel	0	0	0	50	0	0	50	0.01
Night smelt	0	0	0	0	0	0	258	0.03
Surf smelt	0	0	0	0	0	0	779	0.08
*True smelts	0	0	0	0	0	0	801	0.08
American shad	0	0	0	0	0	0	139	0.01
King salmon	0	0	0	0	0	0	60	0.01
California barracuda	0	0	0	0	0	449	449	0.05
Pacific pompano	0	0	0	25	0	0	25	T
Giant kelpfish	0	0	0	0	0	0	79	0.01
Striped bass	0	0	0	0	0	0	4,765	0.49
Wolf-eel	0	5	0	0	0	0	12	T
Mola	0	0	0	0	0	20	20	T
TOTAL FISH CAUGHT	**35,997**	**8,800**	**234**	**20,317**	**90,199**	**78,571**	****967,089**	**100.00**
Months covered	6	6	2	12	12	12		
Angler days in months surveyed	14,966	5,670	344	20,130	30,430	54,550	494,382	
Total angler days	28,200	11,000	2,000	20,130	30,430	54,550	528,080	
Anglers sampled	642	354	35	1,522	2,130	2,498	33,930	
Sample size: 6.86 percent**								

* May include more than one species.
** At Lazio, Capitola, Cement Ship, Moss Landing, Monterey, and San Simeon piers sampling was not conducted for a complete year. Adjusting to total annual catch and effort for the months not covered the catch would be 1,034,036 fish and effort 530,702 angler days.

TABLE 3

Numbers of Fish by Species, Angler Days Sampled, and Total Annual Effort at Six Piers, and Total Catch and Species Composition of 16 Piers From Trinidad to Pismo Beach During 1958

catch was of rock-dwelling species, including kelp greenling, cabezon, striped seaperch, and rockfishes.

Occasionally a large concentration of a certain species will enter the inshore area, and contribute added sport to pier fishermen who must depend upon fish coming near the pier. Large concentrations of young bocaccio (erroneously called tomcod or red snapper) occurred at all piers from Avila to Princeton in 1956 and 1957. Total effort figures for Seacliff Beach State Park and Moss Landing piers reflected increased fishing in 1956 and 1957 due to these phenomenal runs.

The greatest concentrations appeared in 1956, and by 1957 the larger individuals had emigrated into deeper waters; by 1958, all had left the inshore area. In 1948, Cox (1948) reported a heavy concentration of young sablefish at Monterey pier from July 11 to 25. This run attracted many thousands of anglers over and above the usual pier habitués. Approximately 5,000 anglers were on hand July 26, when the run disappeared. During our survey, no phenomenal runs occurred, but there were short-term runs of jacksmelt, California barracuda, king salmon, and barred surfperch at several piers. These exceptional concentrations added interest and importance to pier fishing, yet were secondary to the more-or-less resident species caught throughout each year.

Pier fishing owes its popularity to the fact that this is the only fishing method wherein children of all ages, for the most part unattended, can fish safely and cheaply in the ocean. A few older children can participate in other fishing methods, but not often in the company of the entire family, as is possible on piers.

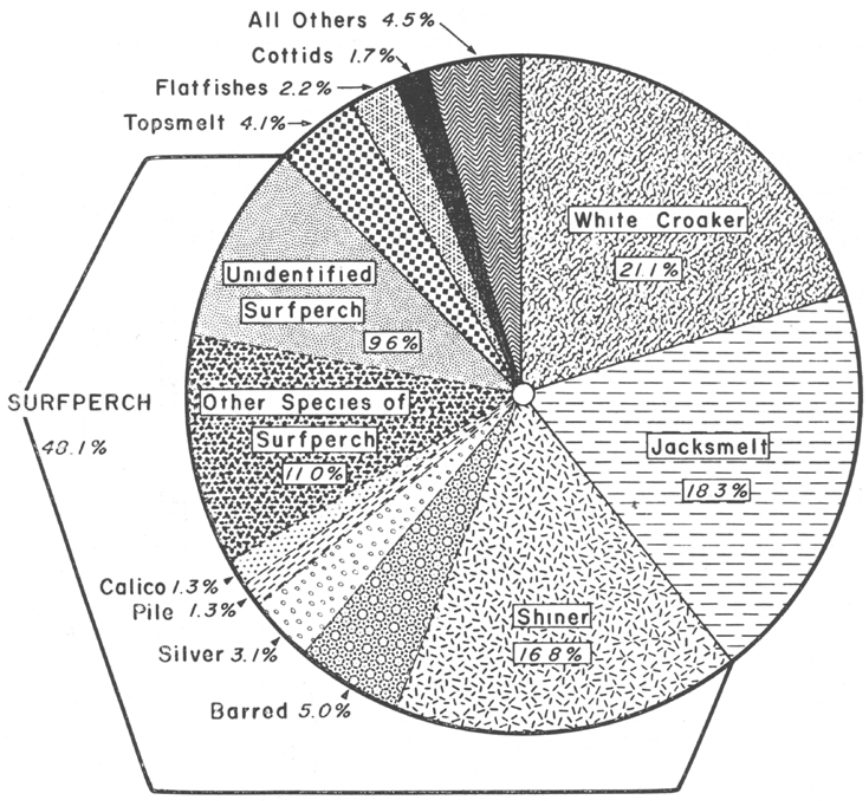

FIGURE 3. Species composition for piers surveyed from Trinidad to Pismo Beach, 1958.

FIGURE 3. Species composition for piers surveyed from Trinidad to Pismo Beach, 1958

Daily counts at Berkeley pier revealed that children under 16 made up 30 percent of the effort during winter and 52 percent during summer, averaging 42 percent yearly. At Seacliff Beach State Park pier, 36 percent of the total effort was by children under 12; for children under 16, the average was around 30 percent during winter, and over 50 percent during the summer vacation period. A coastal annual average of 40 percent was used as a general figure of fishing effort for children under 16 at all piers.

Piers are popular for older retired people who find the comfort of sitting on chairs or benches, or leaning on a rail and chatting, a splendid pastime and social activity. While the fish caught may be secondary to social activity, a good amount of status is achieved when a large fish such as a flounder, cabezon, striped bass, or lingcod is landed. Many older persons fish only for these larger species.

Numerous unemployed people find pier fishing is inexpensive, and a good way to pass time as well as obtain food. This was especially so during the 1958 recession. Field workers, during inclement winter weather, flocked to piers, and often caught enough fish to supply adequate protein for their families. The fact that no licenses were required was a help to these people of low income.

Pier fishing is popular to tourists in that no special equipment or skill is needed. The comforts of a clean, usually dry, place to fish near rest rooms, coffee shops, and bait and tackle supply appealed to tourists and local residents alike.

Success varied from slightly less than one fish-per-day at Trinidad pier to almost eight fish-per-day at Lazio pier, Humboldt Bay. At most other piers, the yearly average catch-per-day ranged from one to three fish.

Catch-per-day values varied considerably at most piers throughout the year. At San Francisco Municipal pier and Cayucos pier, there were only slight changes, but at all others there were periods of relatively high catches. At piers close to each other, there were varying differences not only in catch-per-day values, but in the species contributing to the fluctuating success. At Pismo Beach and Avila piers, which are about 5 miles apart, changes in availability of certain species occurred at one pier but not at the other. In January and February 1958, there was an influx of white croakers at Avila pier that did not appear at Pismo pier, although during that same period better than average catches of barred surfperch were landed at Pismo pier.

Some fish, especially shiner perch, walleye surfperch, silver perch, jacksmelt, and juvenile white croaker, are always present at piers throughout most of the year. Species which contribute to rapid changes in catch-per-day values are white croaker, jacksmelt, young bocaccio, barred surfperch, topsmelt, and northern anchovy. More rarely, inshore concentrations of sablefish, white seabass, striped bass, and barracuda occur for short periods.

High catches during summer at TPL and Paladini piers reflected the large numbers of shiner perch available then, as well as vacationing school children, who find this species desirable and easy to catch. High values during fall of 1957 at Berkeley Municipal pier resulted from numerous jacksmelt and Pacific staghorn sculpin. Shiner perch contributed to a January 1958 increase in catch.

Santa Cruz pier catches varied considerably over the year, with the poorest occurring during summer. High values in February and April 1958, were caused by a concentration of white croaker. A December 1958 peak resulted from an influx of topsmelt and jacksmelt.

Funds should be invested to improve existing piers and to construct new ones. Pier facilities are of prime importance among fishing methods in terms of numbers of anglers benefited. Even though catches may not be spectacular in numbers or size, the overall importance of pier accessibility to people of all ages and fishing ability makes fishing from them one of the major ocean and bay recreations.

All coastal piers were surveyed except Pt. Arena pier, the private commercial piers at Princeton and Avila, and Monterey Pier No. 1.

Many small piers inside Humboldt Bay, Noyo Harbor, Bodega Bay, Tomales Bay, San Francisco and San Pablo bays, Moss Landing harbor, and Morro Bay harbor were not sampled. Had all these smaller ocean and bay piers been surveyed, total pier angler days may have

exceeded the totals estimated for shorefishing effort. Linear fishing space on each pier and other physical data appear in Table 4.

TABLE 4

Total Yearly Angler-Days, Linear Fishing Space, and Facilities at 23 Piers From Crescent City to Pismo Beach (March 1962)

Pier	Total angler-days in 1958	Linear fishing space (feet)	Private skiff launching	Skiff rental	Party boat	Bait and tackle	Fish cleaning facilities	Auto parking on pier	Ownership	
									Public	Private
Crescent City	*2,500	800	x		x	x			x	
Trinidad	3,180	500	x	x	x					x
Lazio	5,470	600								x
TPL	*1,320	1,200								x
Paladini	1,300	570								x
Point Arena	*450	570	x	x		x	x			x
Bodega Bay	*4,500	200			x	x				x
Berkeley Muni.	104,720	6,000				x	x		x	
San Francisco Muni.	76,350	2,800				x			x	
Princeton (Hazel)	30,240	500			x	x	x			x
Princeton (Romeo)	(Pier fishing not allowed)			x	x					x
Princeton (County)	--	600	(New pier, facilities not established)							
Santa Cruz	80,000	2,300	x	x	x	x	x	x	x	
Capitola	8,000	500	x	x	x	x	x	x		x
Seacliff Beach S.P.	73,500	1,100				x	x		x	
Moss Landing	28,200	700				x				x
Monterey No. 1	*3,500	300	x	x	x	x	x		x	
Monterey No. 2	11,000	1,800	x	x	x	x		x	x	
San Simeon	2,000	500							x	
Cayucos	20,130	1,750			x	x	x		x	
Morro Bay	*8,000	650			x	x			x	
Avila	30,430	2,800	x	x	x	x	x		x	
Pismo Beach	54,550	2,000				x	x		x	
Total Angler Days	**549,340**									

* Not surveyed, rough estimate of angler days.

TABLE 4

Total Yearly Angler-Days, Linear Fishing Space, and Facilities at 23 Piers From Crescent City to Pismo Beach (March 1962)

Pier fishing effort was determined by two methods. For three piers (Berkeley, Seacliff Beach State Park, and Moss Landing) daily effort counts were adjusted for juveniles who were not included in our tallies, and to account for error in our counting methods. Data for each pier were compared to actual counts and adjusted by the difference. The other method involved expanding our weekday-weekend daily counts into monthly totals as previously discussed.

4. SKINDIVING

Skindiving is California's newest and, before this study, least known sportfishing method. New and more-efficient diving equipment is being developed constantly, and new adherents are rapidly joining the sport. Skindiving was more or less a rarity 10 years ago in central and northern California. The neoprene diving suit is the primary factor responsible for bringing this sport to waters which rarely rise above 62° F. and which can be as low as 45°.

Skindivers are, for the most part, youthful; the older adherents certainly must be youthful in spirit. Organized competition with various prizes at stake have attracted competitive-spirited individuals who spend many days training for these tournaments. of the estimated 2,207 individual skindivers in the survey area in 1960, approximately 120 entered competition meets.

Formation of skindiving clubs is a social phenomenon in itself. The nucleus of club formation is inherent in the necessity for skindivers

to dive with a companion for safety reasons. Another stimulant to formation of clubs, arises from the fact that to qualify for many competition diving meets, membership in an organized club is required. Some large well-organized clubs have 80 to 100 members. In 1960, the average membership of 64 clubs north of Bakersfield was 27, 20 of which were actual divers. Fifty-eight percent of all divers contacted in 1960 belonged to an organized skindiving club. The average diver participated in 20 diving days per year.

A questionnaire was sent to 64 clubs in 1961 to gather pertinent data on diver activity. Thirty-four usable returns represented 680 divers who collectively participated in 13,194 diving days in 1960. Ten percent of this time was spent from Pt. Conception to Mexico, 87 percent from Pt. Conception to Fort Bragg, and 3 percent from Fort Bragg to Oregon.

Our survey revealed that 44,100 diving days were expended in 1960, 39,700 in the area from Oregon to Pt. Arguello. The figure of 2,207 individual divers was calculated by expanding the number of known club members (1,280) by the ratio of organized to non-organized divers, as determined from random field sampling. These calculations were based upon the assumption that club members dive the same average number of days per year as non-club divers. Field sampling did not reveal trends contrary to this assumption.

The number of diving days expended in each of five major areas from Oregon to Pismo Beach was calculated from questionnaire data, field sampling data, and information submitted on volunteer log forms. No routine sampling was conducted from Oregon to Fort Bragg. Consequently, the total effort estimates were derived only from questionnaire data. Our remaining four areas were: Fort Bragg to San Francisco, Sharp Park to Santa Cruz, Monterey to Pt. Sur, and Pt. Sur to Pismo Beach. Volunteer log return data and random sampling data were biased due to incomplete sampling throughout the area, and to a disproportionate number of volunteer logs from clubs frequenting the north coast. Volunteer logs (Figure 4) were distributed to about 200 divers, and 623 diving days were reported during 1960. Thus, a collation of random field sampling data and volunteer log data yielded realistic estimates of the number of diving days expended in each of these major areas.

Field sampling was conducted on weekends when most divers were active. of 3,614 field samples taken, 2,996 were from random samples, and 618 were collected at competition meets. Length frequencies of all fish were recorded. Yearly summaries were made of all species, and monthly summaries for lingcod, blue rockfish, and kelp greenling. All activities were recorded and appear in a coastal summary (Table 5) .

4.1. General Skindiving Activities

The average diver spent 1.67 hours in the water each diving day when not in competition, and 2.78 hours when participating in a competitive 4-hour meet. Typically, about 20 divers at each meet remained in the water the full time; however, seasickness, gear breakage, fatigue, etc., brought in many divers before the meet terminated.

Name or No. Divers:

Date: Place:

NUMBER OF HOURS IN WATER

	Spearfishing	Abalone	Other (name activity)
SCUBA			
Skindiving			

Water Condition: Rough Calm Wind Visibility:

ABALONE: Red Black Greatest Depth Taken:

	NUMBER	LARGEST	ROCKFISH	NUMBER	PERCH	NUMBER
LINGCOD			Blue		Striped	
CABEZON			Black		Rubberlip	
Remarks:			Gopher		Black	
			China		Pile	
			Olive			
			Vermilion		GREENLING	
					SCALLOPS	

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FIGURE 4. Skindiving activity log.

FIGURE 4. Skindiving activity log

TABLE 5

Skindiving Activity From Fort Bragg to Pismo Beach, March 1960 Through February 1961

Activity	Hours			Percent comp. of SCUBA and free diving	Percent comp. of total
	Noncompetition	Competition	Total		
SCUBA	**13,499**	**0**	**13,499**	**99.99**	**21.62**
Fishing	8,487		8,487	62.87	13.59
Abalone	470		470	3.48	0.75
Urchin collecting	24		24	0.18	0.04
Shell collecting	280		280	2.07	0.45
Coral collecting	77		77	0.57	0.12
Photography	248		248	1.84	0.40
Anchor hunting	23		23	0.17	0.04
Practice	1,349		1,349	9.99	2.16
Observing	2,510		2,510	18.59	4.02
Diving for hire	8		8	0.06	0.01
Clamming	23		23	0.17	0.04
FREE DIVING	**47,220**	**1,716**	**48,936**	**100.01**	**78.38**
Fishing	21,757	1,716	23,473	47.96	37.60
Abalone	18,777		18,777	38.37	30.07
Urchin collecting	263		263	0.54	0.42
Shell collecting	71		71	0.15	0.11
Photography	77		77	0.16	0.12
Practice	2,538		2,538	5.19	4.07
Observing	3,621		3,621	7.40	5.80
Miscellaneous	93		93	0.19	0.15
Clamming	23		23	0.05	0.04
TOTAL HOURS	**60,719**	**1,716**	**62,435**		**100.00**
Diving days sampled	2,996	618	3,614		
Average hours-per-dive	1.67	2.78	1.68		
Total diving days	37,782	618	38,400		

TABLE 5
Skindiving Activity From Fort Bragg to Pismo Beach, March 1960 Through February 1961

Competition dives or meets as referred to in this paper include both intra- and inter-club competitions.

All data are grouped by freediving and SCUBA categories and again, under freediving, into competition and non-competition categories. Freediving made up 78.4 percent of the total time spent in the water, as opposed to 21.6 percent for SCUBA diving.

4.1.1. *SCUBA Diving*

SCUBA divers participated in 11 types of activities, including fishing, abalone picking, urchin collecting, shell collecting, coral collecting, photography, anchor hunting, practice diving, observing or sightseeing, diving for hire, and clamming (Table 5). Fishing was most popular with 62.9 percent of SCUBA time expended on this activity. Practice diving and abalone picking were next in importance. Abalone picking was legal for SCUBA divers south of Yankee Pt., Monterey County. SCUBA was not allowed in any competition dives in 1960. Most underwater photography activity was carried out by SCUBA divers, but in neither category, SCUBA or freediving, was photography a major activity.

of 6,623 fish speared by SCUBA divers, lingcod were most commonly taken, followed by striped seaperch, blue rockfish, black rockfish, kelp greenling, and cabezon. Lingcod were the main targets of SCUBA fishermen who took 1,611; freedivers speared 1,312 (Table 6).

4.1.2. *Freediving*

Most freediving activity was expended abalone picking and spearfishing. These two activities accounted for over 86 percent of freediving time: 48.0 percent fishing and 38.4 percent abalone picking. Other activities, in order of importance, were: observing, practice diving, urchin collecting, photography, shell collecting, and clamming. Miscellaneous activities include anchor hunting, and searching for lost articles and drowned persons.

of 14,992 fish taken by freedivers, 12,600 were in non-competition diving and 2,392 during competition. Blue rockfish were most frequently recorded, followed by striped seaperch, black rockfish, kelp greenling, kelp rockfish, lingcod, and cabezon (Figure 5). In all, 40 species were recorded in the 1960 skindiver catch. California halibut were taken at times at Tomales Bay and off Seaside, Monterey County, but they did not appear in our field sampling.

4.2. Oregon to Fort Bragg

Catch for this area was estimated from spot checks accomplished in 1958 and 1959, aided by 2 years of volunteer log data submitted by cooperating skindiving clubs at Eureka. A total effort of 1,300 diving days was determined from questionnaires. The dominant species for SCUBA and freedivers combined, was the black rockfish, followed by lingcod, kelp greenling, cabezon, and copper rockfish. In addition, 1,464 red abalones were taken in 1960.

Skindiving in this area is still at a relatively low level compared to more southerly coastal areas. The terrain is rugged and often the water is turbid from freshwater runoff. Fish and abalone catches are

TABLE 6

Number and Percent of Fish and Abalone by Species Taken by Skindivers From Oregon to Pismo Beach, March 1960 Through February 1961

	SCUBA		Free diving						Total	
			Noncompetition		Competition		Total			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
ROCKFISH	**2,520**	**38.05**	**5,841**	**46.36**	**1,429**	**59.73**	**7,270**	**48.49**	**9,790**	**45.29**
Blue	649	9.80	1,814	14.40	613	25.62	2,427	16.19	3,076	14.23
Black	597	9.01	1,500	11.91	279	11.66	1,779	11.87	2,376	10.99
Olive	70	1.06	265	2.10	100	4.18	365	2.43	435	2.01
Yellowtail	0		8	0.06	0		8	0.05	8	0.04
Copper	129	1.95	91	0.72	3	0.13	94	0.63	223	1.03
Vermilion	116	1.75	0		5	0.21	5	0.03	121	0.56
Brown	0		0		1	0.04	1	0.01	1	T
Gopher	110	1.66	63	0.50	14	0.59	77	0.51	187	0.87
Bocaccio	40	0.60	94	0.75	0		94	0.63	134	0.62
China	154	2.33	187	1.48	47	1.96	234	1.56	388	1.80
Black-and-yellow	320	4.83	258	2.05	34	1.42	292	1.95	612	2.83
Grass	86	1.30	473	3.75	20	0.84	493	3.29	579	2.68
Kelp	249	3.76	1,088	8.64	313	13.08	1,401	9.34	1,650	7.63
SURFPERCH	**1,541**	**23.26**	**2,947**	**23.39**	**435**	**18.18**	**3,382**	**22.56**	**4,923**	**22.78**
Black	175	2.64	225	1.78	41	1.71	266	1.77	441	2.04
Rubberlip	140	2.11	172	1.37	70	2.93	242	1.61	382	1.77
Pile	329	4.97	707	5.61	183	7.65	890	5.94	1,219	5.64
White	24	0.36	24	0.19	0		24	0.16	48	0.22
Striped	765	11.55	1,694	13.45	138	5.77	1,832	12.22	2,597	12.01
Rainbow	108	1.63	125	0.99	0		125	0.83	233	1.08
Sharpnose	0		0		3	0.13	3	0.02	3	0.01
FLATFISH	**8**	**0.12**	**24**	**0.19**	**0**		**24**	**0.16**	**32**	**0.15**
Starry flounder	8	0.12	8	0.06	0		8	0.05	16	0.07
Rock sole	0		8	0.06	0		8	0.05	8	0.04
Diamond Turbot	0		8	0.06	0		8	0.05	8	0.04
MISCELLANEOUS	**2,554**	**38.56**	**3,788**	**30.05**	**528**	**22.07**	**4,316**	**28.78**	**6,870**	**31.78**
Lingcod	1,611	24.32	1,228	9.75	84	3.51	1,312	8.75	2,923	13.52
Kelp greenling	439	6.63	1,327	10.53	327	13.67	1,654	11.03	2,093	9.68
Rock greenling	85	1.28	67	0.53	4	0.17	71	0.47	156	0.72
Cabezon	377	5.69	819	6.50	74	3.10	893	5.96	1,270	5.88
Buffalo sculpin	11	0.17	0		1	0.04	1	0.01	12	0.06
Round stingray	0		8	0.06	0		8	0.05	8	0.04
Pacific electric ray	0		8	0.06	0		8	0.05	8	0.04
Kelp bass	0		39	0.31	5	0.21	44	0.29	44	0.20
Sand bass	8	0.12	0		2	0.08	2	0.01	10	0.05
Mola	0		52	0.41	2	0.08	54	0.36	54	0.25
Wolf-eel	8	0.12	117	0.93	1	0.04	118	0.79	126	0.58
Monkeyface eel	0		8	0.06	3	0.13	11	0.07	11	0.05
Painted greenling	0		0		1	0.04	1	0.01	1	T
Opaleye	0		77	0.61	17	0.71	94	0.63	94	0.43
California sheephead	15	0.23	15	0.12	2	0.08	17	0.11	32	0.15
Giant kelpfish	0		23	0.18	1	0.04	24	0.16	24	0.11
Halfmoon	0		0		4	0.17	4	0.03	4	0.02
TOTAL	**6,623**	**99.99**	**12,600**	**99.99**	**2,392**	**99.98**	**14,992**	**99.99**	**21,615**	**100.00**
Percent of grand total	30.64		58.29		11.07		69.36		100.00	
Red abalone	1,670		51,969						53,639	
Black abalone			85						85	

TABLE 6

Number and Percent of Fish and Abalone by Species Taken by Skindivers From Oregon to Pismo Beach, March 1960 Through February 1961

above average, and there is a potential for a larger sport fishery. Most of the 200 miles of coastline are still inaccessible, so skindiving is limited to only a few localities.

4.3. Fort Bragg to San Francisco

This area received a large amount of skindiving effort in 1960. It encompasses about 160 miles of rugged coastline with several dozen easily accessible areas for divers. of 15,200 diving days expended

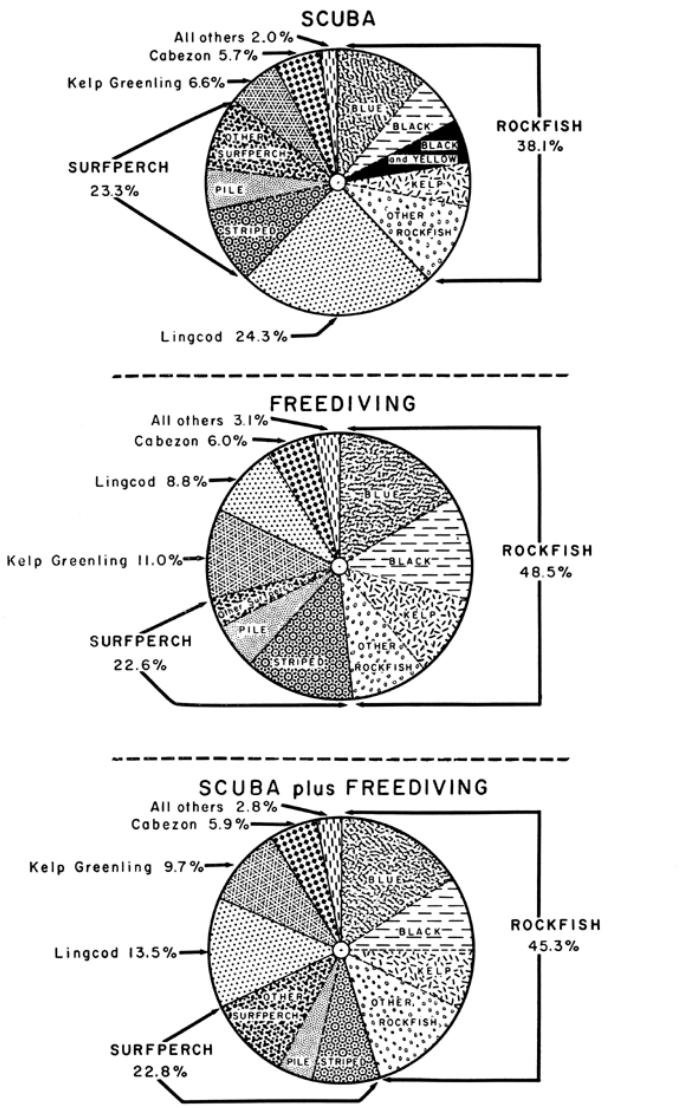


FIGURE 5. Species composition by major groups and individual species by freediving, SCUBA, and combined freediving and SCUBA, 1960.

FIGURE 5. Species composition by major groups and individual species by freediving, SCUBA, and combined freediving and SCUBA, 1960

in 1960, 891 (5.9 percent) were included in our random field sample. The principal activity, abalone picking, accounted for 54.0 percent of the freediving time. Water visibility, as determined by subjective skindiver estimates, was considered average for this area. Sixty-three percent of the time visibilty ranged from 0–10 feet, and 83 percent of the time it was 0–15 feet. Thus, on about 17 percent of the days, water visibility was greater than 15 feet; 16 to 20 feet 9 percent of the time and 21 to 40 feet during 8 percent.

SCUBA divers spent 78.8 percent of their time fishing, and freedivers, 40.2 percent. of 8,422 fish taken by both SCUBA and freedivers, the principal species were lingcod, blue rockfish, black rockfish, striped seaperch, kelp greenling, and cabezon. SCUBA divers alone speared 1,265 of the 1,935 lingcod. In addition, 33,774 red abalones were taken, by far the greatest harvest of this species by skindivers anywhere along the coast. Divers averaged 3.04 red abalones per hour. Freedivers spent 54.0 percent of their time in quest of abalones.

Although 22 species of fish were recorded in the skindivers catch, California halibut did not appear in our samples mainly because we did no routine sampling in 1960 at Tomales Bay where these fish were known to have been taken.

Competition meets have been held in this area each year beginning in 1958. The sites of the meets were at Van Damme Beach State Park, Fort Ross, Salt Point, and Anchor Bay.

4.4. Sharp Park to Santa Cruz

The coastline from Golden Gate Bridge to Sharp Park is mainly sandy beach and the water of the rocky area around Land's End and Sutro's is usually so turbid that no skindiving is conducted. The area from Sharp Park to Santa Cruz, about 80 miles of coastline, had been considered as the major skindiving area along this section of coast. However, along this section of coastline water visibility proved to be the poorest of any in the study area. Eighty-one percent of the observations reported to us gave water visibilities of less than 10 feet; only 10 percent of the time was visibility greater than 15 feet. The many fine-sand beaches and several stream outlets of freshwater runoff caused the poor visibility. Heavy swells also stir up the fine sediments along the coast.

Despite poor visibility, fair fish and abalone catches were recorded. Fishing was the main skindiving activity, followed by abalone picking, observing, and practice diving. SCUBA divers spent 56 percent of their time fishing, while freedivers spent about 35 percent fishing and 64 percent abalone picking.

In all, 8,692 red abalones were taken, averaging 2.08 per diving hour.

of the 1,087 fish speared, lingcod, cabezon, blue rockfish, kelp greenling, and black-and-yellow rockfish were the most important. SCUBA divers took 372 of these fish, with lingcod the most important. Freedivers speared cabezon, blue rockfish, and lingcod most frequently.

The areas favored by skindivers were: Pedro Point (when the visibility was good), Moss Beach, Princeton west jetty, Pigeon Point, Año Nuevo Island, Greyhound Rock, Davenport Landing, and Santa Cruz

Point. Most skindiving in 1960 was at Pigeon Point and Santa Cruz Point. Competition meets were held in this area each year of our survey.

4.5. Monterey to Point Sur

Although there are about 40 miles of shoreline between Seaside and Point Sur, nearly all skindiving activity was centered at four localities: Cannery Row, Pacific Grove, Point Piños, and San Jose Beach near Point Lobos.

Within this small area, 15,000 diving days were expended in 1960. Much of this activity was stimulated by the Pacific Coast Championship meet held at Cannery Row on June 12, 1960. Divers from the entire coast frequented this locality for several weeks prior to the meet, to become familiar with it. There were always relatively large numbers of skindivers in this area due to the quiet coves, abundant fish and abalone, and excellent visibility. Only 24 percent of the observations of water visibility were in the category of less than 10 feet and 58 percent of the time the visibility exceeded 15 feet.

SCUBA activity accounted for 26.5 percent of the total diving, with fishing, observing, and practice diving the most popular activities. A total of 2,319 fish was taken by SCUBA divers, with kelp greenling, lingcod, and kelp rockfish most frequently speared.

Freedivers spent most of their time fishing (62.6 percent of their time) followed by observing (13.5 percent), abalone picking (11.6 percent), and practice diving (10.2 percent). of 7,882 fish taken by freedivers, 1,348 were speared during competition meets. Kelp rockfish was the most frequently recorded species, followed closely by striped seaperch and blue rockfish. Competition meets have been held at Cannery Row, Point Piños, San Jose Beach, and Carmel Beach State Park.

Six of the 37 species of fish recorded in the skindiver's catch for this area, were not recorded for any other fishing method at any other locality; these six were: California sheephead, halfmoon, opaleye, painted greenling, diamond turbot, and Pacific electric ray. The latter three were brought ashore for identification purposes and were probably not eaten.

Freedivers spent 11.6 percent of their time in quest of abalones, taking 4,913 reds and 85 blacks; the average take was 2.12 per hour.

4.6. Point Sur to Pismo Beach

The area from Pt. Sur to Piedras Blancas was not surveyed, but volunteer logs were submitted by divers frequenting this area, and their data were included in our estimates. The area from Piedras Blancas to Pismo Beach, surveyed through 1960, covers about 180 miles of coastline which is sparsely populated and largely inaccessible. About 10 localities were frequented by skindivers, most between Morro Bay and Piedras Blancas. Only 2,300 diving days were expended in 1960. SCUBA diving for abalones was legal in this area, but most of the abalones were taken by freedivers. Most SCUBA activity was for abalones, with fishing and practice diving secondary. Freedivers spent most of their time in quest of abalones (74.5 percent of total effort) while fishing, observing, and practice diving were of lesser importance.

Water visibility was below the average for the coast, 63 percent of

the time visibility was less than 10 feet. It exceeded 15 feet only 1 percent of the time.

SCUBA divers took 322 of the 352 fish taken. Dominant among these were black perch, pile perch, blue rockfish, and black rockfish. No lingcod appeared in the samples. Kelp greenling and cabezon were taken in small numbers.

of 4,796 red abalones taken, 1,670 were by SCUBA divers, and 3,126 by freedivers. SCUBA divers took an average 3.38 abalones per hour, freedivers 2.67.

No competition meets were held in this area from 1958 to 1961.

4.7. Volunteer Log Results

At the onset of our survey, we did not know how large a field sample would be adequate to determine fishing activity. Volunteer log systems were not fully reliable for determining fishing activity. However, since many divers were interested in our project, and volunteered to keep records of their daily activity, about 200 log books (Figure 4) were distributed to individual divers; 623 diving days were reported on these logs.

Log data have been grouped into the same major areas we used in our random sampling series, and compared with field sampling results. The overall results were surprisingly similar to those of random field sampling, indicating a high degree of accuracy for both methods. For instance, the random sampling series showed 45.3 percent rockfish in the total catch, while 48.9 percent was indicated for volunteer log data. By species of rockfish, the black rockfish was most common on the volunteer logs, whereas the blue rockfish was most common in the random sampling data, but the actual difference was slight.

Blue rockfish made up 14.2 percent of the total catch of our random sampling series, and 14.6 percent of the volunteer log catch. Black rockfish comprised 11.0 percent of our random sample, and 17.8 percent of the volunteer log catch. There was a slight bias in the volunteer data in that a disproportionately larger number of northcoast divers submitted logs. Black rockfish are more commonly taken in this area than blue rockfish. Thus, a larger percentage of black rockfish was to be expected in the volunteer data, which further demonstrated the validity of these volunteer logs.

Surfperch comprised 22.3 percent of the random sampling catch, and 16.2 percent of the volunteer log data. Striped seaperch were first in importance in each data series.

Lingcod represented 13.5 percent of the random sampling catch figures, and 18.9 percent of the volunteer log data. Again northcoast diving bias was probably a factor, inasmuch as lingcod are more commonly taken along the north coast. Also, the divers cooperating with the project may have been above-average fishermen, able to take more favored fish such as lingcod. Catch-per-hour figures reveal this as a possibility. Random sample data yielded 0.63 fish-per-hour and volunteer log data yielded 0.86 fish-per-hour. Evidently there were no exaggeration on bias factors in the volunteer data, and the field sampling was adequate.

When we compared the freediving abalone catch-per-hour figures, we found an even closer correlation than the fishing data. The freediving

abalone catch-per-hour was 2.18 for our sampling data, and 2.22 for the volunteer logs. SCUBA abalone-per-hour figures were not as close, with 5.41 reported on volunteer logs, and 3.38 computed from random field data.

Forty fish species were recorded during random sampling, but only 26 were reported on logs. Most of the 16 species not reported on logs, but noted during our random sampling, were rarely taken. If any of these did appear in the volunteer's catch, it is possible they could not be identified and were not entered or were entered as miscellaneous species. Two species which appeared in volunteered data, but were not recorded by project field samplers, were turkey-red rockfish and sargo.

5. PARTYBOAT FISHING

5.1. Introduction

Partyboat sampling was conducted at Morro Bay, Cayucos, and Avila in 1958; at Cayucos, Morro Bay, Avila, and Santa Cruz in 1959; and at all partyboat ports from Crescent City to Avila in 1960. In 1960, all ports were sampled routinely except Crescent City, Eureka, Fort Bragg, and San Francisco Bay where only spot checks were made at places of landing.

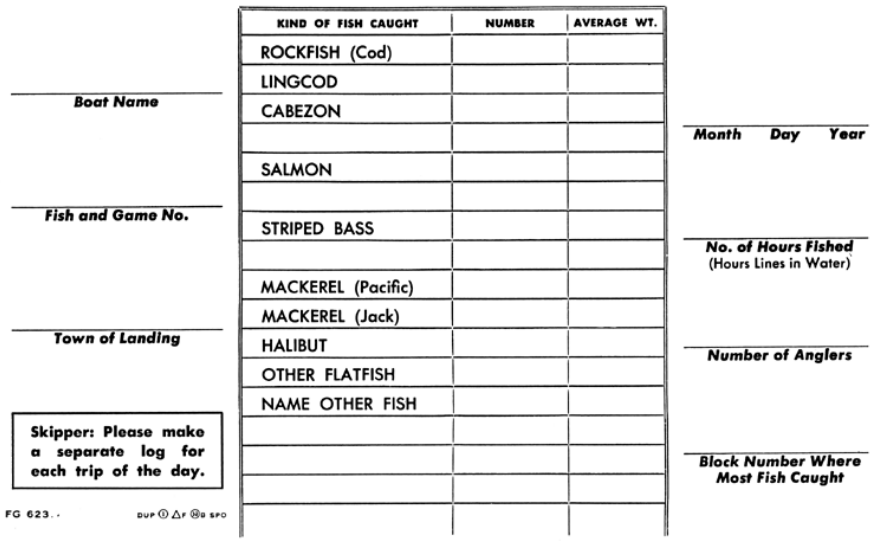
From August, 1957 through September, 1958, a survey of the Morro Bay—Avila area was conducted, in response to State Senate Resolution No. 150, calling for the Department of Fish and Game to undertake a survey of the trawl and sport fisheries in this area to determine if any serious interfishery competition existed. The results of this joint survey by the Department's trawl investigation and Dingell-Johnson Sportfish project (F-12-R) concluded that no interfishery competition existed (Heimann and Miller, 1958).

Partyboat species composition sampling was contined in this area and at Santa Cruz in 1959. Thus, by the time we needed to establish a routine censusing procedure in 1960, enough basic data had been gathered to permit adoption of adequate sampling procedures.

In 1960, partyboat sampling was conducted somewhat differently at each port, due to specific problems of each concessionaire's operation. Our overall procedure involved sampling as much of the catch as possible at each port. Skindiving and rock fishing methods were sampled concurrently in 1960, so only about 6 days per month per port could be allocated to partyboat sampling. All partyboat operators gave their full cooperation, thus enabling adequate sampling aboard boats as well as at the fish-cleaning tables on dock. No fish were cleaned on board, as was the custom in southern California, and only at one port was a pickup boat operated. This pickup boat operation was of small magnitude and did not present a serious problem to our sampling procedure.

5.2. Total Catch and Effort

Total catch and effort figures were available from partyboat logs (Figure 6). Law requires that logs be submitted to the Department for each trip. The number of paid fishermen on board, and a breakdown of the number of fish caught for certain species and major groupings is recorded on the log.



KIND OF FISH CAUGHT	NUMBER	AVERAGE WT.
ROCKFISH (Cod)		
LINGCOD		
CABEZON		
SALMON		
STRIPED BASS		
MACKEREL (Pacific)		
MACKEREL (Jack)		
HALIBUT		
OTHER FLATFISH		
NAME OTHER FISH		

FIGURE 6. Partyboat log used in central and northern California.

FIGURE 6. Partyboat log used in central and northern California

Bottom fishing and trolling catch-and-effort data were treated separately in our field sampling, except for ports within San Francisco Bay where bottom fishing was negligible. Trolling vessels were not sampled by project personnel, because adequate species composition figures were available from the Department's salmon samplers who were checking trolling catches for average weights and marked fish. Salmon samplers collected bottom fishing data for our project at Crescent City, Fort Bragg, and Bodega Bay.

Two special statistical reports were prepared for bottom fishing and trolling catch-and-effort. The first listed the catch of each boat by month at each port. Boats used only for bottom fishing or only for trolling were easily noted, but in several cases, party boats were used for both trolling and bottom fishing during the same month. The second report listed the daily catch of each of these boats. Trips made for bottom fishing or trolling only were differentiated.

In a few cases, where trip separations could not be made because both trolling and bottom fishing were involved, we used a third category termed "combination" fishing. In spite of this, there were probably several trips at each port where both bottom fishing and trolling had been conducted on the same trip that we failed to recognize. When only a small portion of the catch was of bottom fish, and salmon were also reported, we considered all fish as having been taken by trolling. If no salmon were reported, then the catch, regardless of the species of fish, was entered as bottom fishing. In our final analyses, all "combination" activities were included with trolling data. Most such trips were at Fort Bragg, Bodega Bay, and at all bay ports from Sausalito to San Francisco. They were usually planned as trolling excursions, but when fishing was poor some skippers made stops to catch bottom fish. Combination fishing amounted to less than 1 percent of the total catch and effort.

Salmon trollers usually land some rockfish and an occasional jack mackerel, lingcod, or flatfish. These incidental catches during salmon trolling trips varied considerably at each port. Fish other than salmon in the trolling catch amounted to 22.2 percent at Crescent City, 0.1 percent at Trinidad, 12.1 percent at Eureka, 26.0 percent at Fort Bragg, 29.7 percent at Bodega Bay, 28.0 percent at San Francisco (excluding salmon and striped bass), 1.9 percent at Santa Cruz, 0.2 percent at Monterey, and 2.9 percent at Morro Bay.

The miscellaneous fish at Crescent City, Fort Bragg, Bodega Bay, and San Francisco were primarily large black rockfish, commonly taken on trolling gear. The low percentage figure at Trinidad indicated skippers were neglecting to record this species on their logs, because our skiff data and observations of partyboat catches revealed that about the same number of incidental fish were taken at Trinidad as at Eureka. Large jack mackerel made up a fair amount of the incidental troll catch, especially at San Francisco where they contributed 11.0 percent.

To convert bottomfish catch totals of rockfish, flatfish, mackerel, and smelt to catch by individual species, we used proportions that we calculated from field samples. These proportions were applied to all the fish reported in the logs each month for each port. Numbers of troll-caught fish are as submitted in the logs, because no samples were taken by us to determine individual species caught in each of the miscellaneous categories. Personnel of the salmon project separated the salmon catch into kings and silvers.

At all ports, except Morro Bay and Avila, the numbers of miscellaneous fishes reported in the logs (kelp greenling, and flatfish, etc.) did not appear reliable. In most cases, total catch and catch-per-day values of these species on the logs was considerably lower than our field samples indicated they should be. often, several species were recorded in a field sample that did not appear on logs. Rockfish, lingcod, and cabezon were of about the same magnitude in both series, indicating reliable log reports for these three. To determine a valid catch for all other species, we used the proportion of "rockfish sampled" to "rockfish reported" to expand the number of each of the other species sampled.

Thus,

$$\frac{\text{Total rockfish reported on logs}}{\text{Number of rockfish sampled}} = \frac{\text{Total ``X'' caught}}{\text{Number of ``X'' sampled}}$$

FORMULA

We compared species composition, as determined from partyboat log data and from field sampling, for all major bottomfishing ports. Examples of the reliability of logged figures for rockfish, lingcod, and cabezon categories, and the unreliability of these reports for the other species and groupings, appeared in Bodega Bay data. At this port, percentage composition values for "sampling data" and "log data", respectively were: rockfish, 94.4 and 95.7; lingcod 3.4 and 3.0; cabezon 0.4 and 0.4. For miscellaneous (unreliable) categories these percentage values were: kelp greenling 0.34 and 0.07; jack mackerel 0.01 for each method; jacksmelt 0.06 percent and 0.00. For five additional species recorded in our samples, none was reported on the logs. Finally, two species (octopus and market crab) were reported on logs

that we never saw in our sampling; for these two, the total numbers logged were considered the actual catch and were not expanded by the method described above. If we had sampling data for miscellaneous species, we did apply expansion or weighting procedures.

At several ports, the number of fish we sampled exceeded the number reported on the logs for certain months. Obviously, either all trips were not reported or the logs had been mislaid. In these cases, we used our sampling figures as total catch figures. In several instances when lost logs came to the attention of project personnel, the total number of days involved (as reported to the sampler) and the probable catch (as determined from average fishermen catches for that period on other local boats), were entered into our total catch and effort data. For the above reasons (expansion of "miscellaneous" catch data, and inclusion of non-reported catch and effort), the Department's official reported partyboat figures of 115,111 angler-days and 788,759 fish for 1960, are slightly less than the 115,701 angler-days and 800,381 fish reported in this study (Table 7) . These figures are minimal estimates, because several hundred additional angler days may not have been reported that did not come to the attention of our samplers or statistical unit. Errors in log returns exemplify omissions rather than over-reporting. These errors include failure to list miscellaneous species accurately, lost logs, failure to fill out or send in logs, and failure to include nonpaying customers. Our log-sample comparisons indicated close correlation of catch-per-day and species composition; information on these logs probably reflects 97 to 98 percent of the paid customers' actual effort and catch. Nonpaying customers usually include friends, business contacts, and those on board who helped to anchor, untangle lines, etc. for a free ride; these seldom are entered on the logs even though they do fish, and comprise about 1 percent of the total partyboat effort. All factors considered, the partyboat logs probably report at least 95 percent of the actual effort and catch; they seldom overexaggerated on our logs.

5.3. Species Composition

Most party boats working out of a given port brought in about the same kinds and numbers of fish per fishermen. However, at each port, one or two partyboat skippers had certain preferences and at times caught different kinds and sizes of fish. Thus, it was necessary to sample routinely all the boats at each port consecutively so that our overall sample included a representative catch from each port. Where fish were filleted at the dock, samples were taken both at shore and at sea. Not all fish from each boat could be sampled at the fillet table, because many fishermen did not have their fish processed at dockside. However, cleaning-table samples provided a better series than the total one-boat sea sample, because sampling most fish from several boats each day yielded better species data for a port than sampling all fish from one boat. When only a portion of the fishermen from a boat were sampled on shore, the partial sample was not weighted to the total fishermen on board. The number of fishermen involved in the catch of fish sampled often could not be determined, and also it was not possible at all times to determine how many fishermen had been on board. All species

TABLE 7

Numbers and Pounds of Fish in Partyboat Catch, Crescent City to Avila, 1960

Species	Number				Weight in pounds			
	Bottom	Trolling	Total	Percent	Bottom	Trolling	Total	Percent
ROCKFISH	**674,678**	**7,806**	**682,484**	**85.3**	**1,149,512**	**13,864**	**1,163,376**	**62.6**
Blue	215,197	0	215,197	26.9	221,647	0	221,647	11.9
Black	19,132	0	19,132	2.4	40,051	0	40,051	2.2
Olive	42,687	0	42,687	5.3	82,746	0	82,746	4.5
Yellowtail	145,446	0	145,446	18.2	254,295	0	254,295	13.7
Copper	25,374	0	25,374	3.2	67,225	0	67,225	3.6
Vermilion	30,180	0	30,180	3.8	118,648	0	118,648	6.4
Brown	8,830	0	8,830	1.1	22,309	0	22,309	1.2
Bocaccio	38,251	0	38,251	4.8	130,209	0	130,209	7.0
Gopher	18,645	0	18,645	2.3	21,869	0	21,869	1.2
Rosy	22,785	0	22,785	2.8	10,650	0	10,650	0.6
China	2,321	0	2,321	0.3	4,393	0	4,393	0.2
Widow	21,094	0	21,094	2.6	35,742	0	35,742	1.9
Canary	34,067	0	34,067	4.3	57,253	0	57,253	3.1
Starry	16,996	0	16,996	2.1	23,832	0	23,832	1.3
Black-and-yellow	498	0	498	0.1	530	0	530	T
Stripetail	85	0	85	T	49	0	49	T
Flag	1,863	0	1,863	0.2	3,161	0	3,161	0.2
Speckled	2,926	0	2,926	0.4	4,476	0	4,476	0.2
Squarespot	1,377	0	1,377	0.2	495	0	495	T
Greenspotted	14,183	0	14,183	1.8	19,321	0	19,321	1.0
Greenstriped	2,425	0	2,425	0.3	1,672	0	1,672	0.1
Turkey-red	1,059	0	1,059	0.1	5,625	0	5,625	0.3
Quillback	187	0	187	T	421	0	421	T
Grass	1	0	1	T	1	0	1	T
Chilipepper	2,165	0	2,165	0.3	5,704	0	5,704	0.3
Cow	1,633	0	1,633	0.2	6,624	0	6,624	0.4
Kelp	122	0	122	T	196	0	196	T
Calico	94	0	94	T	119	0	119	T
Treefish	127	0	127	T	283	0	283	T
*Rockfishes	4,928	7,806	12,734	1.6	9,966	13,864	23,830	1.3
FLATFISH	**4,486**	**161**	**4,647**	**0.6**	**5,589**	**749**	**6,338**	**0.3**
Petrale sole	1,325	0	1,325	0.2	2,257	0	2,257	0.1
Rock sole	889	0	889	0.1	1,618	0	1,618	0.1
Pacific sanddab	1,946	0	1,946	0.2	674	0	674	T
Starry flounder	87	0	87	T	292	0	292	T
Sand sole	29	0	29	T	49	0	49	T
California halibut	62	82	144	T	457	593	1,050	0.1
Pacific halibut	1	1	2	T	10	2	12	T
Scaly-fin sole	14	0	14	T	32	0	32	T
English sole	1	0	1	T	3	0	3	T
Rex sole	40	0	40	T	20	0	20	T
*Flatfishes	92	78	170	T	177	154	331	T
SURFPERCH	**16**	**9**	**25**	**T**	**21**	**18**	**39**	**T**
Redtail	4	0	4	T	2	0	2	T
Striped	11	0	11	T	18	0	18	T
*Surfperches	1	9	10	T	1	18	19	T
SALMON	**167**	**37,768**	**37,935**	**4.7**	**1,998**	**299,002**	**301,000**	**16.2**
King salmon	50	35,273	35,323	4.4	648	282,584	283,232	15.2
Silver salmon	1	2,481	2,482	0.3	6	16,306	16,312	0.9
*Salmon	116	14	130	T	1,344	112	1,456	0.1
SHARKS, SKATES, RAYS	**37**	**4**	**41**	**T**	**274**	**40**	**314**	**T**
Blue shark	1	2	3	T	40	20	60	T
Spiny dogfish	10	0	10	T	7	0	7	T
*Sharks	17	2	19	T	174	20	194	T
*Skates	3	0	3	T	23	0	23	T
Shovelnose guitarfish	6	0	6	T	30	0	30	T
MISCELLANEOUS	**36,715**	**38,534**	**75,249**	**9.4**	**198,030**	**188,280**	**386,310**	**20.8**
Striped bass	0	30,767	30,767	3.8	0	159,988	159,988	8.6
Lingcod	25,240	355	25,595	3.2	182,102	2,587	184,689	9.9
Cabezon	1,654	42	1,696	0.2	8,806	224	9,030	0.5
Kelp greenling	521	0	521	0.1	771	0	771	T
Pacific mackerel	3,522	420	3,942	0.5	2,029	169	2,198	0.1
Jack mackerel	2,972	6,431	9,403	1.2	2,439	22,019	24,458	1.3

TABLE 7
Numbers and Pounds of Fish in Partyboat Catch, Crescent City to Avila, 1960

TABLE 7—Continued

Numbers and Pounds of Fish in Partyboat Catch, Crescent City to Avila, 1960

Species	Number				Weight in pounds			
	Bottom	Trolling	Total	Percent	Bottom	Trolling	Total	Percent
MISCELLANEOUS —Continued								
Jacksmelt	1,662	3	1,665	0.2	414	1	415	T
White croaker	750	274	1,024	0.1	545	171	716	T
Pacific tomcod	3	0	3	T	1	0	1	T
Buffalo sculpin	14	0	14	T	21	0	21	T
Red Irish lord	8	0	8	T	3	0	3	T
Pacific hake	17	2	19	T	34	6	40	T
Sablefish	115	2	117	T	280	3	283	T
Pacific albacore	0	176	176	T	0	2,640	2,640	0.1
Pacific bonito	34	34	68	T	283	219	502	T
Pacific sardine	56	0	56	T	14	0	14	T
White seabass	4	7	11	T	80	210	290	T
Wolf-eel	2	0	2	T	10	0	10	T
*Eels	3	0	3	T	11	0	11	T
*Smelts	5	5	10	T	3	1	4	T
Market crab	38	6	44	T	76	12	88	T
Octopus	3	0	3	T	16	0	16	T
California barracuda	0	5	5	T	0	20	20	T
Ocean whitefish	1	0	1	T	1	0	1	T
Unidentified	91	5	96	T	91	10	101	T
TOTAL	**716,099**	**84,282**	**800,381**	**100.0**	**1,355,424**	**501,953**	**1,857,377**	**99.9**
Total angler days	64,639	51,071	115,701					
Catch-per-day	11.07	1.65	6.92					

* May include more than one species.

TABLE 7

Numbers and Pounds of Fish in Partyboat Catch, Crescent City to Avila, 1960

data for a port from both sea samples and shore samples were collated by monthly intervals.

In 1960, blue rockfish was the most numerous species followed by yellowtail rockfish, olive rockfish, bocaccio, king salmon, canary rockfish, and striped bass (Figure 7 and Table 7). Rockfishes comprised 85.3 percent of the total catch.

King salmon and striped bass were important from San Francisco north, as well as at ports in San Pablo and San Francisco bays, but south of the Golden Gate, rockfishes dominated the catch at all ports except Moss Landing. Striped bass, taken principally in the Bay fishery, was tops numerically in the Bay area.

By weight, king salmon were most important, followed by yellowtail rockfish, blue rockfish, lingcod, and striped bass. By major groupings, rockfishes made up 62.6 percent of the catch, followed by salmon, 16.2 percent; lingcod and greenling, 9.9 percent; and the basses, 8.6 percent.

Partyboat catches are determined by several factors: types of fish present and their popularity for sport or food, distance from large population centers, and weather. The north coast from Fort Bragg to Oregon is sparsely populated and is plagued with heavy winter storms. Because both bottomfishes and salmon are available during summer months, fishing is primarily summertime trolling for salmon, and effort is relatively small compared to ports south of Fort Bragg. Even though bottomfishes are present at Crescent City, Trinidad, and Fort Bragg, they are not as popular as salmon and do not appear in large numbers in the catch. Catch-per-day values for bottomfish are from one-half to one-third the values at more-southerly ports where bottomfishing is a preferred fishery. Along the northern coastal area,

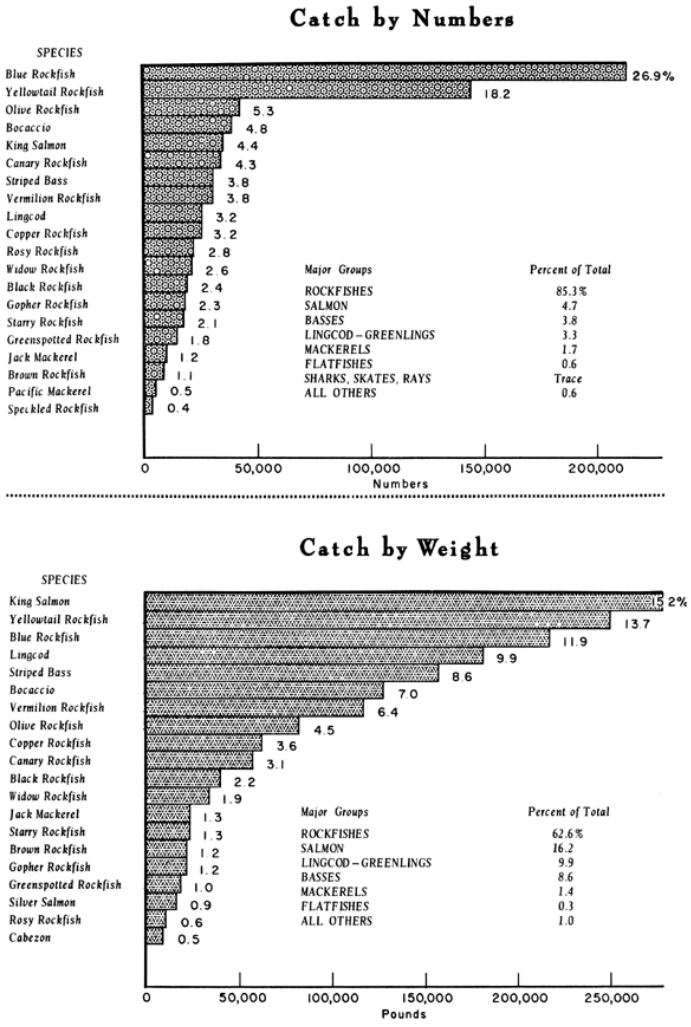


FIGURE 7. Total catch and percent composition by numbers and weight of the twenty most frequently recorded species landed by partyboat fishermen from Crescent City to Avila, 1960.

FIGURE 7. Total catch and percent composition by numbers and weight of the twenty most frequently recorded species landed by partyboat fishermen from Crescent City to Avila, 1960

larger bottomfishes such as lingcod, vermilion rockfish, turkey-red rockfish, and black rockfish are sought using large baited hooks or chrome-plated jigs. South of Fort Bragg bottomfishermen are more often in quest of the smaller, schooling blue rockfish, yellowtail rockfish, olive rockfish, etc., using many-hooked rigs. This increases the catch in numbers-per-hour.

In the area from Oregon to Fort Bragg (Noyo Harbor), salmon comprised over 64 percent of the catch by numbers, and over 80 percent by weight. Silver salmon were more numerous than kings. King salmon ranked first by weight (over 43 percent of the total catch) followed by silver salmon (37 percent). About half the rockfish and nearly all flatfish were taken while trolling. Most lingcod, cabezon, and other species were taken while bottomfishing.

From Bodega Bay to Princeton, three types of partyboat fishing are conducted: bottomfishing (the primary fishery at Bodega Bay and Princeton), salmon trolling (outside the Golden Gate), and striped bass trolling (inside San Pablo and San Francisco bays). There is good salmon trolling near Bodega Bay in some years, but generally bottomfishing is the mainstay of the fishery. Each year, runs of salmon and striped bass can be expected within easy reach of Bay area ports, and bottomfishing out of the Golden Gate has always been a minor operation. Bottomfishing grounds are at the Farallon Islands, off Pt. Bonita, and near Bolinas Bay.

When the port catches of Bodega Bay, San Francisco Bay, San Pablo Bay, and Princeton are combined, the smaller more numerous rockfish species dominate. Blue rockfish were first numerically, followed by striped bass, king salmon, and yellowtail rockfish. By groupings, rockfishes were most common, contributing 67.2 and 37.2 percent of the catch by numbers and weight, respectively. King salmon was first by weight, comprising over 30 percent of the catch. Striped bass accounted for over 20 percent by weight, and was followed by blue rockfish, lingcod, and yellowtail rockfish.

From [n] Nuevo to Monterey the catch was primarily rockfish, with the troll catch making up 1 and 4 percent of the total by numbers and weight, respectively.

Blue rockfish was the principal species by numbers, but was second to yellowtail rockfish in 1960, because they were relatively scarce near Santa Cruz throughout the year and at Monterey for several months. During periods of blue rockfish scarcity, partyboat operations were centered over the deeper banks (200–300 feet) where yellowtail rockfish, bocaccio, widow rockfish, and greenspotted rockfish are more common. A picture of inshore and offshore fishing changes is disclosed by percentage composition values for 1959 at Santa Cruz. In March, 1959, blue rockfish (the inshore indicator) made up 23.9 and yellowtail rockfish (the offshore indicator) 51.4 percent of the total catch indicating both inshore and offshore activity. During April, May, and June, blue rockfish were scarce in the inshore area (furnishing 1.3 to 4.4 percent of the catch) so most fishing was in the offshore area, and yellowtail rockfish contributed from 45.5 to 58.6 percent of the total catch. In July, blue rockfish appeared in large numbers in the inshore area and from July through October they contributed from 42.2 to 79.5 percent of the total catch. In November, blue rockfish again became

scarce, and yellowtail rockfish dominated as fishing shifted to offshore banks.

Sampling was conducted at Santa Cruz in 1959 and 1960. In 1960, the decrease in blue rockfish was more accentuated than in 1959. This species made up 52.4 percent of the 1959 catch, but in 1960 it contributed only 17.8 percent. Yellowtail rockfish increased from 17.4 percent in 1959, to 42.2 percent in 1960. This change was due primarily to a decrease in numbers of desirable-sized blue rockfish rather than an influx of yellowtail rockfish. Most party-boat fishermen prefer inshore fishing where there is less tangling of lines, less time is required to reel in, and lighter weights are required. The shift to offshore banks at all ports can be considered an indication of scarcity of preferred fish on the inshore banks.

Bottomfishing is conducted at Año Nuevo Island from boats operating out of Santa Cruz several days each week over most of the year. This fishery is primarily for lingcod, but blue rockfish are the most commonly-caught species. Bottomfishing near Santa Cruz is conducted at several inshore and offshore reefs. There are no rocky areas near Moss Landing, and the catch there is primarily of king salmon. Although there are extensive reef areas between Monterey and Pt. Sur, party boats are rarely operated farther south than Soberanes Point.

Salmon trolling is conducted each year from all ports in this area. The runs are usually early in the year (April and May), but an occasional run may appear at any time until the end of the season in the fall. The troll catch in 1960 amounted to 0.9 and 4.1 percent of total catch by numbers and weight, respectively.

The fishery from San Simeon to Avila is primarily for bottomfish with additional excursions for king salmon, white seabass, Pacific albacore, and Pacific bonito. Sampling was conducted at Morro Bay from July 1957 through 1960; at Avila in 1959 and 1960 and at San Simeon and Cayucos in 1960. At Morro Bay, blue rockfish comprised 50 percent of the catch by numbers in 1957 and 1958, but dropped to about 40 percent in 1959, and 18 percent in 1960. As at Santa Cruz, when the inshore species (in the case at Morro Bay apparently only blue rockfish) decreased there was a corresponding increase in take of deeper water species such as yellowtail rockfish, bocaccio, and starry rockfish.

In 1960, from San Simeon to Avila, vermilion rockfish was first by weight followed by bocaccio, olive rockfish, blue rockfish, and lingcod. Vermilion rockfish catches progressively increased over the 4 years at Morro Bay. This was the only area where this species contributed materially to the catch. Lingcod remained at about the same level of importance from year to year, but other shallow-water forms such as cabezon and jacksmelt exhibited considerable variations between years.

Trolling was of minor significance, contributing only 0.4 percent and 1.8 percent of the total catch by numbers and weight, respectively. Subsequent to compiling these data, we were informed that some Pacific albacore were taken while drifting, using live bait. This effort and catch had been inadvertently tallied in the trolling catch, however, the small magnitude (about 0.1 percent of the catch by numbers) did not make it necessary to change the tables.

5.3.1. Catch-per-unit-of Effort

Comparisons of catch-per-day as determined from partyboat logs and from field samples taken at sea were made for six ports. Summaries for the year at each port demonstrated a close correlation between the two series of data. The total fish-per-day values for log returns were higher than sea sample values at Bodega Bay, Monterey, and Morro Bay, but were lower at Princeton, Santa Cruz, and Avila. Only at two ports, Bodega Bay and Princeton, was the difference in values of the two series greater than 3.0 fish-per-day. Average partyboat catch-per-day values for bottom-fishing and trolling combined were several times higher than values recorded for any other method, (i.e. 6.9 fish-per-day for party boats as compared to 2.8 fish-per-day for skiffs, the second most productive method).

The average partyboat day, including both bottom and troll catches, was around 7 hours duration, and yielded 0.99 fish-per-hour. This average is still the highest of all fishing methods, with skiff, pier, and skindiving averages close to 0.64 fish-per-hour (Figure 8). Further analysis of partyboat angler success in 1960 revealed a considerable difference between bottom and trolling catches-per-day. Bottom success ranged from 5.3 fish-per-day in the Crescent City-Fort Bragg area to 14.8 fish-per-day in the Santa Cruz-Monterey area. The bottom fishing daily average for all ports was 11.7 fish-per-day in 1960. Troll catches on the other hand ranged from 0.9 fish-per-day in the Santa-Cruz-Monterey area to 1.7 fish-per-day in the Bodega Bay-Princeton area. The trolling daily average for all ports was 1.6 fish-per-day in 1960.

5.3.2. Discard of Fish at Sea

On all sea sampling days the samplers tallied, by species, all fish returned to the water. Inasmuch as many of these fish survived, the actual mortality was not known, so discard figures were not incorporated into our total catch and catch-per-day figures. Discard totals were recorded for Bodega Bay, Princeton, Santa Cruz, Monterey, Morro Bay, and Avila (Table 8) . The total observed number of fish discarded for the above ports in 1960 was 1,134 fish. This represented 6.3 percent of the fish retained, or 5.2 percent of the total fish caught on days sampled. Discard figures were not expanded into "total discard" for each port. By individual ports, the percentage of fish discarded was: Bodega Bay, 9.04; Princeton, 4.68; Santa Cruz, 5.60; Monterey, 5.48; Morro Bay, 4.53; and Avila 5.25. Rockfish were the principal species discarded. Small blue rockfish, yellowtail rockfish, rosy rockfish, greenstriped rockfish, Pacific hake, and Pacific mackerel were among the most frequently discarded.

Our discard values for cabezon and Pacific sanddabs were not considered valid inasmuch as they were seldom taken and even more rarely discarded. All other discard values are considered fairly representative. Undesirable species such as skates, rays, sharks, Pacific hake, Pacific hagfish, and sculpins (except for cabezon) are rarely taken home. Small rockfish species such as calico, squarespot, stripetail, greenstriped, and rosy are usually thrown back. Discards of such popular species as blue rockfish and yellowtail rockfish are usually small fish taken in shallow water, and they are normally alive when released.

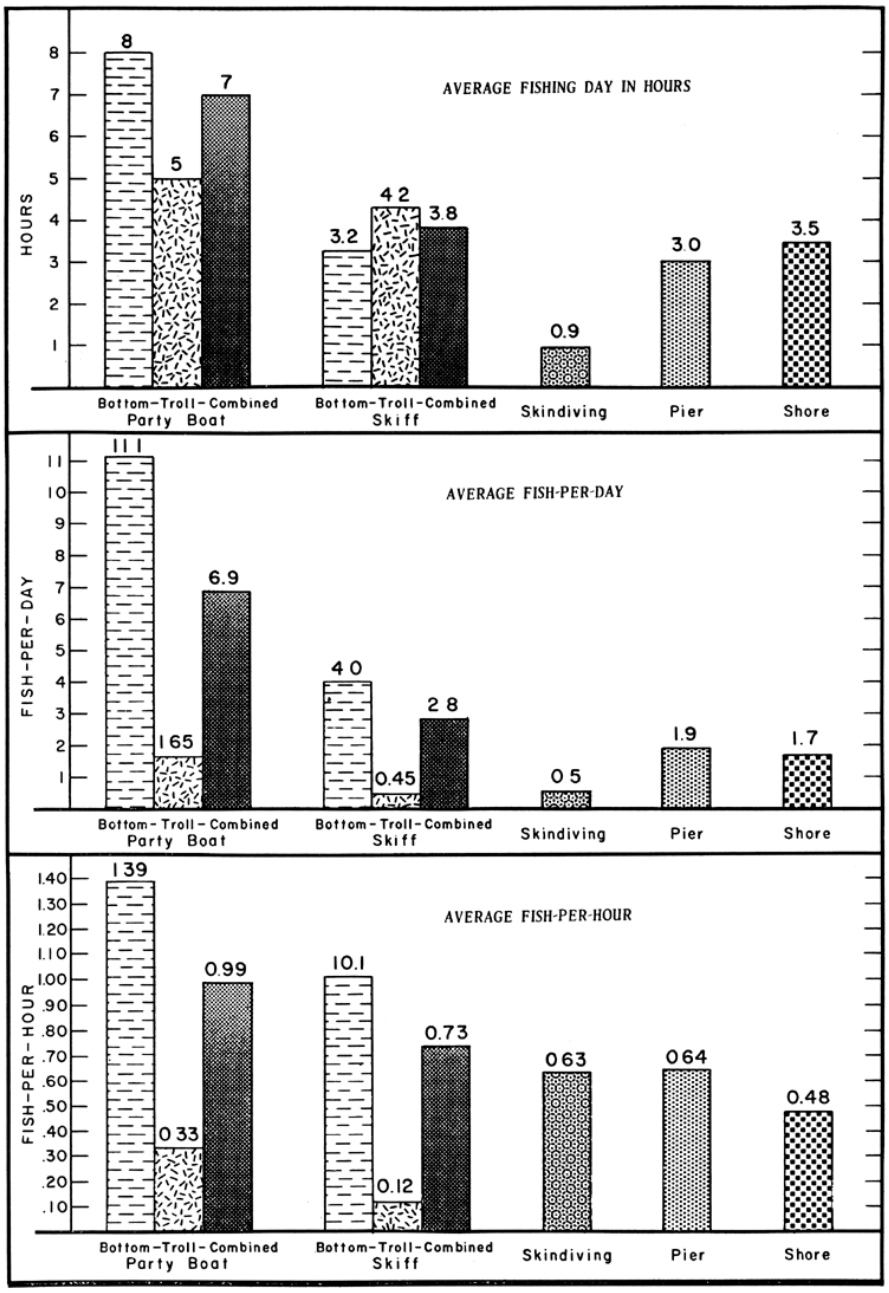


FIGURE 8. Average fishing day in hours, fish-per-day, and fish-per-hour of five fishing methods, Oregon to Point Arguello, 1958–1961.

FIGURE 8. Average fishing day in hours, fish-per-day, and fish-per-hour of five fishing methods, Oregon to Point Arguello, 1958–1961

5.3.3. Total Catch by Weight

Numbers of each species taken each month and for the year at each port were converted to weight. Length frequencies of all species caught bottom fishing were recorded on the sampling board both at sea and

TABLE 8

Discard at Six Ports From Bodega Bay to Avila. Data Collected at Sea During 1960

	*Total fish caught	Number discarded	Percent discarded
ROCKFISH	**17,661**	**1,042**	**5.9**
Blue	7,070	483	6.8
Black	496	15	3.0
Olive	671	3	0.4
Yellowtail	4,771	61	1.3
Copper	309	1	0.3
Brown	226	1	0.2
Bocaccio	244	4	0.2
Rosy	892	333	37.3
Widow	847	17	2.0
Canary	980	21	2.1
Starry	429	17	4.0
Greenspotted	410	19	4.6
Greenstriped	91	22	24.2
Stripetail	13	5	38.5
Squarespot	90	24	26.7
Speckled	111	8	7.2
Calico	11	8	72.7
FLATFISH	**96**	**6**	**6.3**
Pacific sanddab	96	6	6.3
MISCELLANEOUS	**284**	**86**	**30.3**
Red Irish lord	2	2	100.0
Buffalo sculpin	2	2	100.0
Wolf-eel	2	1	50.0
Cabezon	18	1	5.6
Sablefish	18	8	44.4
Kelp greenling	16	1	6.3
Pacfic hake	26	24	92.3
Jacksmelt	15	4	26.7
Pacific mackerel	91	24	26.4
Blue shark	12	12	100.0
Spiny dogfish	1	1	100.0
Skates	1	1	100.0
Pacific hagfish	1	1	100.0
White croaker	79	4	5.1
TOTAL	**18,041**	**1,134**	**6.3**

Percent discarded of all fish caught on sampling days was 5.2.

* Includes only those species for which there were discards.

TABLE 8

Discard at Six Po. ts From Bodega Bay to Avila. Data Collected at Sea During 1960

at shoreside cleaning tables. All length frequencies have been tabulated for each species in monthly and yearly summaries for each port.

6. SHORE FISHING

Most shore fishing requires casting ability which limits this sport to those persistent enough to learn. New types of spinning gear and casting reels have enabled more people to enjoy this sport each year, but loss of hooks and sinkers in rocky areas is still a problem. Shore fishing most often entails a family outing with usually one or two members of the family fishing while the others remain on the beach or at a nearby camping or picnic area. Most shore fishing areas are too rugged and dangerous for small children.

Shore fishermen frequented all accessible areas along the coastline. Each of the several forms of shore fishing is typified by different species. Surf casting, rocky shore fishing, and surfnetting were the three general methods encountered during our survey. Surf casters are usually in quest of surfperches or striped bass. The gear is uniform for a long pole and heavy line are essential in the surf-breaking area where the fish are located. Rocky shore fishing is quite varied in

that very quiet inlets and coves, rock jetties, and rugged rock out-crops are frequented, each area requiring specific types of gear. Pokepolers use 8 to 12-foot bamboo poles to fish for blennys in exposed coastal tidepools, but inside bays and more protected areas a 3- to 4- foot broomhandle is used. Jetty and rock fishermen use anything from long surf-casting poles and reels to small spinning outfits, or an occasional handline.

Surf netting is a completely separate type of fishery because of the gear used, being specialized to capture one species at a time in a specific habitat. Both night smelt and surf smelt are fished this way. The criterion of catch is in poundage rather than numbers of fish. The limit per sport license was 25 pounds per day during the survey period. A complete description of surf netting appears later in a separate section. Effort data for surf netting were included in our shore fishing tables, only as supplemental information (Table 9).

More anglers were recorded shore fishing than for any other fishing method, although had all piers been surveyed, pier effort may have exceeded shore fishing.

6.1. Methods

Shore fishing was the most complex fishery to survey. Not only were radically different types of gear used, but all the physical differences between expansive sand beaches, tide pool shelf areas, rugged rocky outcrops, overhanging cliffs, jetties, and quiet bays presented unique sampling problems. Data for each jetty were maintained separate from each other jetty. Those surveyed were: Buhne Point, Humboldt south jetty, Noyo north jetty, Bodega Bay jetty, Princeton east and west jetties, and Moss Landing jetty.

Most of the major beaches were kept as separate entities, and either a full year or at least a major portion of a year's sampling was conducted at these beaches. Other stretches of beach and rocky coastline were sampled only intermittently, and still others were not surveyed for species composition. Instantaneous counts from shore or from an airplane were made for all areas between Fort Bragg and Pismo Beach. The area from Fort Ross to Point Sur was intensively surveyed by airplane in 1958.

Our first attempts to sample shore fishermen were made in July, 1957 when the routine shore run was initiated. Coastal trips were made about every 2 weeks and data were recorded at all easily-accessible points of contact of road and coastline. Many out-of-the-way areas were not covered because time did not permit long hikes from the road to where fishermen may be found. Empty cars in parking areas normally used by shore fishermen were not always left there by fishermen, and long hikes down cliffs to beaches were sometimes of no avail.

During our first 6 month survey, the time each fisherman had spent fishing was not recorded, thus catch-per-unit-of-effort data were not available. Also, we did not distinguish between rock fishermen and surf fishermen, although surf-netting data were kept separate. All rock and surf fishing was grouped into 17 sub-areas, and species composition data were determined for each. Data for several areas were not considered reliable because of the small sample involved. About the only general statement these data will allow, is that surfperches

TABLE 9

Total Annual Effort of Shore Fishermen and Surf Netters From Smith River, Del Norte County to Point Arguello, Santa Barbara County (1957–1961 Data)

County	Area	Rock fishermen	Surf fishermen	Total	Surf netters
Del Norte		*	**5,830+**	**12,380**	**300+**
	Smith River—Crescent City	*	*	6,550	300
	Crescent City So. Jetty—Klamath R.	0	5,830	5,830	†
Humboldt		**12,500+**	**17,260+**	**32,110**	**16,800+**
	Gold Bluff—Big Lagoon	0	6,280	6,280	360
	Patrick's Point—Trinidad	*	*	610	0
	Luffenholtz Beach	*	*	1,570	7,710
	Moonstone Beach—Clam Beach	0	580	580	†
	Mad River Beach	0	5,010	5,010	3,580
	North Spit, Humboldt Bay	0	1,580	1,580	†
	Buhne Point, Humboldt Bay	4,770	0	4,770	0
	South Jetty, Humboldt Bay	7,730	0	7,730	0
	South Spit, Humboldt Bay	0	1,660	1,660	990
	Centerville Beach	0	2,150	2,150	4,160
	Cape Mendocino—Shelter Cove	*	*	170	†
Mendocino		**17,310+**	*	**52,700**	**19,990**
	Bear Harbor—MacKerricher St. Pk.	*	*	15,430	19,360
	Noyo Jetty	13,510	0	13,510	0
	Noyo River—Point Arena	*	*	19,960	630
	South of Point Arena—Anchor Bay	3,800	0	3,800	0
Sonoma		**41,828**	**12,442**	**54,270**	**1,260+**
	Gualala—Jenner	10,476	654	11,130	†
	Russian River—Salmon Creek	11,914	9,396	21,310	1,260
	Bodega Bay East Jetty	16,460	0	16,460	0
	Bodega Bay—Estero Americana	2,978	2,392	5,370	†
Marin		**10,146**	**13,539**	**23,685**	†
	Dillon's Beach—Point Reyes	0	345	345	†
	Drakes Bay Beach	0	690	690	0
	Double Point	0	300	300	0
	Bolinas Beach—Muir Beach	6,457	3,393	9,850	0
	Tennessee Cove—Fort Baker	3,689	8,811	12,500	0
San Francisco		**20,000**	**81,950**	**101,950**	**0**
	Baker Beach	1,840	22,380	24,220	0
	China Beach—Sutro's	18,160	0	18,160	0
	San Francisco Ocean Beach	0	59,570	59,570	0
San Mateo		**30,172**	**104,980**	**135,152**	**3,090+**
	Sharp Park	0	19,020	19,020	0
	Rockaway Beach	830	7,360	8,190	0
	Pedro Valley	760	3,500	4,260	0
	Montara State Beach	2,810	17,390	20,200	0
	Moss Beach	580	610	1,190	0
	Pillar Point	2,670	1,150	3,820	0
	West Princeton Jetty	6,952	0	6,952	0
	East Princeton Jetty	2,470	0	2,470	0
	Half Moon Bay Beach	40	24,000	24,040	1,030
	Purisima Beach	610	3,350	3,960	†
	Martin's Beach	900	14,640	15,540	2,060
	Tunitas Beach	110	830	940	†
	San Gregorio State Beach	220	2,990	3,210	†
	Pomponio State Beach	0	1,550	1,550	†
	Pescadero State Beach	2,160	3,860	6,020	0
	Pebble Beach	1,870	180	2,050	0
	Bean Hollow	2,310	1,230	3,540	0
	Bolsa Point	2,240	1,230	3,470	0
	Pigeon Point	1,950	760	2,710	0
	Gazos Creek Beach	0	900	900	0
	Franklin Point	470	70	540	0
	Ano Nuevo State Reserve	220	360	580	0
Santa Cruz		**28,670**	**27,490**	**56,160**	**1,030+**
	Waddell Creek Beach	580	970	1,550	†
	Greyhound Rock	790	580	1,370	†
	Scott Creek Beach	430	1,660	2,090	1,030
	Davenport Landing	1,510	870	2,380	†
	Davenport—Table Rock	4,790	290	5,080	0
	Natural Bridges St. Beach—Santa Cruz Pier	11,240	0	11,240	0
	San Lorenzo River—Marina Cliffs	3,790	240	4,030	0
	Twin Lakes State Beach	4,420	520	4,940	0
	Capitola Beach	1,080	310	1,390	0
	New Brighton State Beach	40	1,770	1,810	0

TABLE 9
Total Annual Effort of Shore Fishermen and Surf Netters From Smith River, Del Norte County to Point Arguello, Santa Barbara County (1957–1961 Data)

County	Area	Rock fishermen	Surf fishermen	Total	Surf netters
Santa Cruz —Continued	Seacliff State Beach	0	4,970	4,970	0
	Manresa State Beach	0	5,530	5,530	0
	Sunset State Beach	0	4,770	4,770	0
	Palm Beach—Pajarro River	0	5,010	5,010	0
Monterey		**25,550**	**67,590**	**93,140**	†
	Beach north of Moss Landing Jetty	0	6,570	6,570	†
	Moss Landing Jetties	14,340	0	14,340	0
	Beach south of Moss Landing Jetty	0	13,980	13,980	†
	Salinas River mouth	0	9,010	9,010	0
	Marina (Fort Ord)	0	27,820	27,820	0
	Seaside Beach	0	9,810	9,810	0
	Monterey Pier—Point Pinos	3,000	200	3,200	0
	Asilomar—San Jose Beach	3,230	200	3,430	0
	Point Lobos State Reserve	3,980	0	3,980	0
	Yankee Point—North of Piedras Blancas	1,000	0	1,000	0
San Luis Obispo		**11,020**	**27,130**	**38,150**	**0**
	Point Piedras Blancas	2,420	2,800	5,220	0
	South of Piedras Blancas—San Simeon	820	950	1,770	0
	Little Pico Creek	900	1,050	1,950	0
	Pico Creek	500	580	1,080	0
	Leffingwell Creek	920	1,070	1,990	0
	Cambria	670	780	1,450	0
	Cambria—Morro Rock	810	940	1,750	0
	Point Buchon—Point San Luis	200	0	200	0
	Avila—Shell Beach	3,780	570	4,350	0
	Pismo Beach—Oceano	0	15,140	15,140	0
	Guadalupe Beach	0	3,250	3,250	0
Santa Barbara		**1,560**	**1,840**	**3,400**	**0**
	Surf Beach	1,560	1,840	3,400	0
TOTAL		**198,756+**	**360,051+**	**603,097‡**	**42,470+**

* Rock and surf fishing not separated.
† Surf netting known to be present in small amount but not surveyed.
‡ Includes effort not separated into rock and surf fishing and does not include surf netting effort.

TABLE 9—Cont'd.

dominated the shore catch and kelp greenling were also important north of San Francisco.

In 1958, we revised our shore-fishing sampling techniques. The new approach was to sample certain key areas more intensively, and thus obtain more representative species composition data by seasons, as well as catch-per-unit-of-effort information. A survey of all sandy beaches and rocky areas along 800 miles of coastline proved impractical, so species composition data for key areas was applied to neighboring beaches which were less-utilized and either partly or not surveyed. Even then we did not survey as many of these major areas in 1958 as we had planned, because of the phenomenal run of striped bass at most beaches from San Francisco to Monterey. Additional sampling effort was required at these bass fishing beaches to survey adequately the large numbers of fishermen. This disproportionate sampling effort often yielded inadequate species composition and catch-per-unit-of-effort data for rocky areas in 1958. Consequently, in 1960 rock-fishing effort was surveyed from Fort Bragg south to Pismo Beach.

Shore sampling in 1958 was primarily to determine turnover, and involved making hourly counts to obtain an effort curve for the day at a particular beach. Sampling cards were handed to as many fishermen as possible to insure reliable average-day values for computing total effort. Complete day samples were taken during 1958, but incomplete day samples were made in 1960. These data were totaled for

each day on a compilation sheet, then collated by month for each fishing locality surveyed.

No shore-caught fish were measured in 1958, but lengths of most species taken by rock fishermen were tallied in 1960. In 1960, no turnover determinations were made. Instead, certain sections of the coast were covered on each weekend to survey both rock fishermen and skindivers. For instance, a sampler would start at Pillar Point at about 10 AM and proceed south interviewing all rock fishermen, jetty fishermen, and skindivers at all access points. By 2 or 3 PM he would arrive at Santa Cruz pier and sample the party-boat catch. The shore fishermen interviews would include data on the number of poles, the number of hours spent fishing, and the catch by species. Fish lengths were recorded. The fishermen present at each locality were counted, and the hour of the observation was noted. In this way, our instantaneous counts could be converted into total day counts using turnover conversion factors. In areas where effort data were lacking in 1958, the 1960 data were used to compute total yearly effort.

Thirty airplane flights were made from Fort Ross to Point Sur between March and December, 1958 to obtain instantaneous counts for that area.

Reliable species composition data for surf fishing were gathered at most beach areas in 1958, yet rock-fishing species composition and catch-per-unit-of-effort data were inadequate. In 1960, rock fishermen were interviewed at most rock fishing areas from Fort Bragg to Pismo Beach, and the species data and catch-per-hour values obtained were used in lieu of our inadequate 1958 data. Thus, the shore fishing data in this paper were derived and collated from several sources: the shore-run interview data combining surf and rock fishing activities from July 1, 1957 to January, 1958; the 1958 turnover data for sandy beaches and rock jetties; instantaneous counts made in 1957, 1958, and 1960 including the airplane counts of 1958; and 1960 rock fishing data on species composition and catch-per-unit-of-effort.

Our shore-fishing data are probably the least reliable in terms of completeness of all our data. Several assumptions had to be made which have not been statistically checked, although results now indicate these assumptions were generally valid.

One of these assumptions was that adjacent beaches with similar habitat would yield about the same types and numbers of fishes. When lightly-used beaches were checked, the species composition generally was the same as at a larger nearby beach where intensive sampling was undertaken. Likewise, adjacent rocky, tide pool-type areas yielded similar species. However, at widely-separated areas such as Eureka, Monterey, and Pismo Beach, the catches were significantly different. Thus, when we used species composition and catch-per-unit-of-effort data from key locations to estimate total catch for a sub-section the sections were limited to as small a unit as possible. The six subsections we established were: Oregon border to Centerville Beach, Centerville Beach to Fort Bragg, Noyo River to the Golden Gate Bridge, San Francisco to Monterey Pier, Monterey Pier to Point Piedras Blancas, and Piedras Blancas to Point Arguello.

Another assumption we made was that species composition in the rocky areas did not undergo a significant change between 1958 and 1960. This is an important assumption in that the 1960 rock fishing catch was collated with 1958 effort figures to determine total catch. At two areas 2 years' data, 1958 and 1960, indicated our major groupings maintained about the same magnitutde of importance, but there were some slight variations in the species involved. The shallow areas along the shoreline are frequented by such forms as kelp greenling, surfperches, cabezon, and grass rockfish. of the species caught in large numbers along the shore, only striped bass showed significant changes in numerical distribution from year to year. Some species such as striped seaperch and jacksmelt showed fluctuations in both years occurring during the same period.

A third assumption we made was that rock-fishing effort did not vary greatly between 1958 and 1960. Thirty airplane flights in 1958

TABLE 10

Total Annual Catch (by Numbers and Percent) for Shore Fishermen (Surf and Rock Fishing Combined), Oregon to Point Arguello

Species	Number	Percent Comp.	Species	Number	Percent Comp.
SURFPERCH	**742,668**	**72.45**	COTTIDS	**29,661**	**2.90**
Redtail	163,311	15.93	Cabezon	28,051	2.73
Calico	39,656	3.87	Buffalo sculpin	198	0.02
Barred	222,036	21.66	Red Irish lord	168	0.02
Walleye	68,992	6.73	Brown Irish lord	75	0.01
Shiner	18,309	1.79	Pacific staghorn sculpin	484	0.05
Silver	110,561	10.79	*Cottids	685	0.07
Striped	66,340	6.47			
White	15,046	1.47	SHARKS, SKATES, RAYS	**1,293**	**0.13**
Black	5,272	0.51			
Rubberlip	761	0.07	Bat ray	46	T
Rainbow	6,239	0.61	*Stingray	23	T
Pile	6,643	0.65	Big skate	23	T
Dwarf	414	0.04	*Skates and *rays	139	0.01
Reef	246	0.02	Spiny dogfish	37	T
Spotfin	184	0.02	Leopard shark	273	0.03
*Surfperches	18,658	1.82	*Sharks	724	0.07
			Pacific angel shark	28	T
FLATFISH	**14,456**	**1.41**			
			MISCELLANEOUS	**201,521**	**19.66**
Starry flounder	4,333	0.42			
Rock sole	19	T	Green sturgeon	8	T
Sand sole	8,536	0.83	Pacific herring	48	T
Pacific sanddab	1,135	0.11	King salmon	16	T
California halibut	19	T	Silver salmon	174	0.02
Scaly-fin sole	23	T	Steelhead rainbow trout	45	T
Pacific halibut	287	0.02	Pacific tomcod	7,487	0.73
Rex sole	17	T	Kelp bass	59	0.01
C-O turbot	58	0.01	Striped bass	38,840	3.79
*Flatfishes	29	T	White seabass	6	T
			White croaker	14,899	1.45
ROCKFISH	**35,317**	**3.45**	Senorita	1,137	0.11
			Kelp greenling	49,341	4.81
Blue	14,239	1.39	Rock greenling	15,897	1.55
Black	10,887	1.06	Lingcod	3,045	0.30
Olive	55	0.01	Giant kelpfish	159	0.02
Copper	352	0.03	Onespot fringehead	104	0.01
Brown	53	0.01	*Clinids	819	0.08
Gopher	70	0.01	Monkeyface eel	710	0.07
Bocaccio	46	T	Rock eel	64	0.01
China	24	T	Topsmelt	57	0.01
Black-and-yellow	1,048	0.10	Jacksmelt	68,606	6.69
Grass	7,665	0.75			
Kelp	328	0.03	TOTAL	**1,024,916**	**100.00**
Canary	96	0.01			
*Rockfishes	454	0.04	Total angler days	603,097	
			Average fish-per-day	1.70	

* May include more than one species.

TABLE 10
Total Annual Catch (by Numbers and Percent) for Shore Fishermen (Surf and Rock Fishing Combined), Oregon to Point Arguello

demonstrated that each beach area was frequented by a relative number of fishermen, compared to each other beach. These relationships remained fairly constant throughout the March-December period. Six flights were made in 1960 on dates which were nearly identical to flight dates in 1958. In this way, we could compare counts for the same weekend each year. Surf-fishing effort was significantly lower on each flight in 1960 for the striped bass area beaches. This was fully expected because the run was not as strong as in 1958. Rock-fishing effort, however, was slightly lower during the first 1960 flights, and nearly equal to 1958 during the later flights. Effort calculations, computed from 1958 and 1960 turnover data and instantaneous counts for the Natural Bridges State Park-Santa Cruz Pier rocky shore area, yielded 11,320 and 11,240 angler days for the two years, respectively. Our 1960 data were more complete in that monthly effort data were available, so these figures were used in lieu of 1958 data. Also, 1960 species composition data were more complete and accurate.

6.2. Oregon to Point Arguello

6.2.1. Effort and Catch

Approximately 603,100 angler days were expended in one year between Oregon and Pt. Arguello (Table 9), but our sampling only covered areas where 192,620 angler days were spent. Catch data obtained for the 192,620 angler days were used to estimate the total coastal catch by calculating values for each of our sub-sections. Species composition

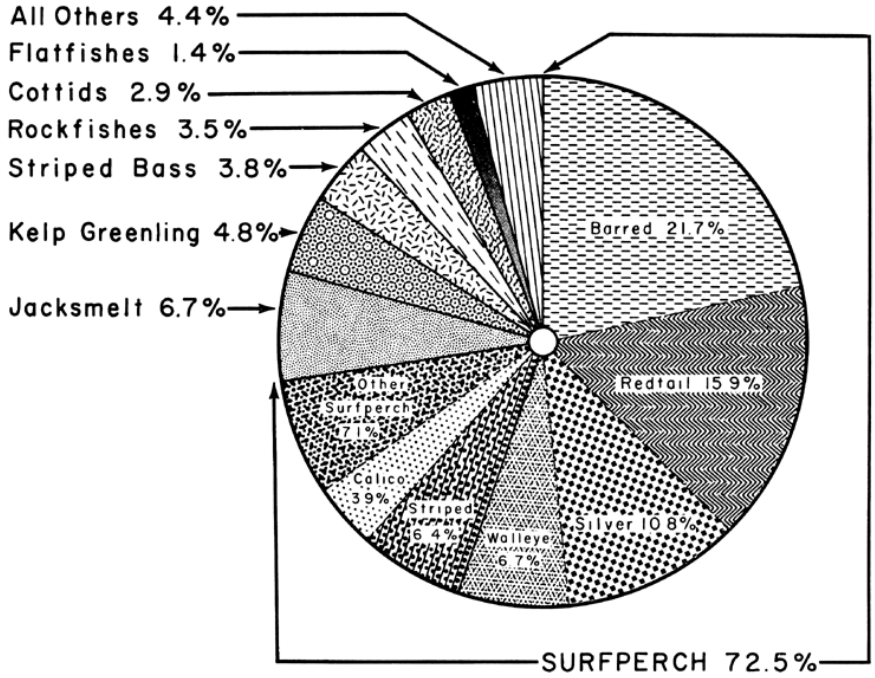


FIGURE 9. Species composition of shore fishing catch by major groupings and principal surfperch species, Oregon–Point Arguello.

FIGURE 9. Species composition of shore fishing catch by major groupings and principal surfperch species, Oregon-Point Arguello

and catch-per-unit-of-effort data were recorded from interviews with 12,416 shore-fishing anglers. Thus, our shore-fishing sample represented 6.5 percent of the effort at the beaches sampled, and 2.0 percent of the total shore-fishing effort.

of the 1,024,916 fish caught, over 742,600 or 72.5 percent were surfperch, with barred, redtail, and silver surf-perch the principal species (Table 10 and Figure 9). Barred surfperch were first in numbers, followed by redtail surf-perch, silver surfperch, walleye surfperch, jacksmelt, and striped seaperch. In all, 67 species were recorded in the shorefishing catch. Redtail and barred surfperch were first and second, respectively, by weight, followed by striped bass. (We used 1.8 pounds for an average redtail perch, 1 pound for a barred surfperch, and 5 pounds for striped bass.) The blue rockfish was the most frequently recorded rockfish, followed by black rockfish and grass rockfish. Sand soles were the most common flatfish, followed by starry flounders and Pacific sanddabs. Important species, other than jacksmelt and striped bass, were the kelp greenling, rock greenling, white croaker, and Pacific tomcod.

The highest effort for one year for a single locality was at San Francisco Ocean Beach where 59,570 angler days were expended in 1958. Over 80 percent of these anglers were fishing for striped bass, although a large number of redtail surfperch were landed that year. Other beaches where fishing activity was high were Baker Beach, Half Moon Bay beaches, Marina beach area (Fort Ord), Montara Beach State Park, Sharp Park, Pismo-Oceano beach area, Martin's beach, Moss Landing jetty, Bodega jetty, and the area between Natural Bridges State Park and Santa Cruz Pier.

6.2.2. Oregon to Centerville Beach

This sparsely-populated area has only two major cities, Eureka and Crescent City. Much of the 110 miles of shoreline is privately-owned and access is limited. Within this 110-mile section, there are approximately 87 miles of sandy beach and 23 miles of rocky shoreline. Approximately 42,170 angler days were expended here per year.

This is the major surf-netting area of the north coast, and redtail surfperch were commonly taken by hook-and-line at all sandy beaches surveyed. Kelp greenling, rock greenling, and grass rockfish were taken at rocky areas. California's principal razor clam beaches are near Crescent City. Salmon fishing is actively pursued during the fall run at the mouths of five large streams and rivers that empty into the ocean—these are the Smith River, Klamath River, Little River, Mad River, and Eel River.

In 1962, the principal public access areas were Pelican Beach State Park, Clifford Kamph Memorial Park (County), Pebble Beach County Access area (a Wildlife Conservation Board purchase), the jetties at Crescent City, the Gold Bluffs area at Prairie Creek State Park, Dry Lagoon Beach State Park, Patrick's Point Beach State Park, Little River Beach State Park, Mad River County access area, Humboldt north and south jetties, Humboldt south spit, and the Centerville Beach County access area. Luffenholtz Beach, Buhne Point jetty, and private lands at Gold Bluff were the three major private beaches

where the public had access. Sampling was conducted in 1958 at Luffenholtz Beach, Mad River Beach, Buhne Point, and Humboldt south jetty.

The fisheries of these areas are described because they represent shore fishing at other physically-similar beaches in this northern section.

The northernmost beach area we intensively surveyed was Luffenholtz beach. This sandy beach is bordered by rocky outcrops. Surf netting was the principal sport fishery, surf casting being of secondary importance and usually pursued by surf netters awaiting runs of surf smelt. Both sandy-surf and rock-frequenting species were recorded. Redtail and silver surfperch were the most common surf species, and lingcod, greenlings, and cabezon were representative of the rocky areas. The best hook-and-line catches occurred in June when large numbers of redtail surfperch were present. Silver and walleye surfperch were most common during fall.

At Mad River beach where there are no rocky areas, the hook-and-line catch was nearly entirely redtail surfperch. The highest catch-per-day values were recorded from March through June. Daytime surfnetting was also popular here but was secondary to hook-and-line effort. However, night smelt fishing was not surveyed, so if this fishery had been included, surf-netting effort may have exceeded that of hook-and-line at this beach. The same may have been true at most other beaches along the north coast where both surf-netting and hook-and-line fishing were pursued. At Luffenholtz beach, daytime surf-netting alone was about five times greater than hook-and-line fishing effort (Table 9).

Shore fishing inside Humboldt Bay is typified by Buhne Point jetty data. This jetty is actually a long rock-reinforced bank on the east side of the bay. When casting from this jetty, catches are made on fine sand bottom. Consequently, the catch consisted mostly of redtail surfperch, walleye surfperch, silver surfperch, and flatfish representing sandy bottom forms. Jacksmelt, shiner perch, and pile perch represented the more or less wandering pelagic or bay forms, and an occasional rock-frequenting form such as striped seaperch, kelp greenling, or rockfish would be landed. The best catches were recorded from October through May when redtail surfperch and jacksmelt were most available.

At Humboldt south jetty, rock-frequenting species dominated the catch, with kelp greenling, striped seaperch, and black rockfish accounting for over 64 percent of the annual total. Redtail surfperch were also taken from December through August.

Thus, throughout this northernmost section of the study area, shoreside sport activity was primarily for surf and night smelts with Aframe nets, and for redtail surfperch with hook-and-line. Rocky shore fishing, primarily from jetties, was of lesser magnitude, with kelp greenling, jacksmelt, and black rockfish the principal species. Included in the shore fisheries of the area, but not described here, were fishing for salmon and steelhead at the mouths of rivers, razor clam digging, abalone picking, and in some years, surf-netting for eulachon.

6.2.3. *Centerville Beach to Fort Bragg*

This area involved about 110 miles of coast (50 miles of sandy beach and 60 miles of rocky shoreline), and was mostly inaccessible because the shoreline highway bordered the coast for only about 19 miles. Approximately 17,750 angler days were expended in this area per year. Most access was by dirt roads from Juan Creek north to Centerville. One partly-paved road extended about 20 miles from near Garberville to Shelter Cove. There were only three public-owned access areas: Westport-Union Beach State Park, Kesibilla County access area (a Wildlife Conservation Board purchase), and MacKerricher Beach State Park. The Matolle and Ten Mile Rivers are the only large streams entering the ocean in this section of the coast. No beaches were surveyed intensively during 1958, but some spot checks of fishing success were made in the latter half of 1957.

The best surfperch areas were at Mackerricher Beach State Park, Shelter Cove, and at the mouth of Juan Creek. Surf smelt and night smelt were taken at Jackass Creek, Usal, Cottoneva Creek, Juan Creek, Wilson Creek, Abalobadiah, and MacKerricher Beach State Park. Abalones were taken at all rocky areas where there was access.

6.2.4. *Noyo River to the Golden Gate Bridge*

This sparsely-populated section of the coast is close enough to large population centers to the south and inland. that it receives a relatively large shore-fishing effort each year. The 190 miles of coastline (90 miles of sandy beach and 100 miles of rocky shoreline) in this section, contain some of the best abalone, skindiving, and rock fishing areas of the state. Approximately 115,230 hook-and-line angler days were expended here annually. The Shoreline Highway follows the area's coastline for nearly the entire distance. The major areas that were not accessible to the public were the Ohlsen Ranch, Stillwater Cove properties, the area between Bodega Bay and Dillon Beach, the area between Drakes Bay and Bolinas Bay, and parts of Fort Cronkite and Fort Baker.

In 1962, public-owned lands used by sportfishermen were: Noyo jetty, Heeser Drive Public access area (a Wildlife Conservation Board purchase), Russian Gulch Beach State Park, Van Damme Beach State Park, Fort Ross State Historical Monument, Sonoma County Coast State Park, Doran Beach County Park, and Stinson Beach State Park.

Several private ranches and beach concession areas that were open to the public for access fees were: Agate Beach, Woody's Little River, Albion River, Stewarts Point Ranch, Salt Point Ranch, Kruse Ranch, Ocean Cove, Timber Cove, Fort Ross Ranch (now State Park property), Dillon Beach Resort, and Muir Beach. Eight large streams and rivers that enter the ocean in this section of the coast are: Noyo River, Big River, Albion River, Navarro River, Garcia River, Gualala River, Russian River, and Salmon Creek. Sampling at Noyo and Bodega jetties and our rock-fishing survey from Russian Gulch State Park to the Golden Gate Bridge typify shore fishing in this area.

At Noyo jetty, the fishery was primarily during summer and fall; however, a striped seaperch spawning concentration during May and June attracted many anglers. Over 64 percent of the May through

August catch was of striped seaperch. Flatfishes, redtail surfperch, shiner perch, black rockfish, kelp greenling, and cabezon were taken in small numbers throughout the sampling period. The catch was comparable to that of Humboldt south jetty where rock-dwelling forms living in and around the jetty, wandering pelagic forms, such as the jacksmelt and shiner perch, and sandy-bottom forms, such as redtail surfperch and flatfishes, can all be taken at the same locality. As at Humboldt south jetty, rock-dwelling species were most commonly taken.

The species taken at rocky areas and jetties between Oregon and Fort Bragg and between Fort Bragg and the Golden Gate Bridge were similar, except that fewer redtail surfperch and more cabezon and blue rockfish were caught in the latter area. The kelp greenling was consistently important throughout both areas. From Anchor Bay to Jenner, kelp greenling and blue rockfish were especially abundant, and comprised over 65 percent of the total catch.

Surveys were made at Bodega Bay jetty (Doran Beach County Park) in 1958 and 1960. Surfperches made up nearly half the catch in both years. Other groups including jacksmelt, rockfishes, sculpins (cottids), and flatfishes also showed similar relative contributions to the catch each year. By species, the shiner perch was dominant in 1958, whereas the white seaperch was most common in 1960. Bodega Bay jetty was the only area along the coast where the white seaperch was consistently important.

Some minor variations in species composition were apparent at Bodega Bay jetty. Starry flounders contributed to 3.4 percent and 10.7 percent of the total catch in 1958 and 1960, respectively. No cottids (except for cabezon) were caught in 1958, but small numbers were present in 1960. About twice as many fishermen were interviewed in 1960 as in 1958 (668 to 359), possibly accounting, in part, for the fewer species recorded in 1958.

From Bodega Bay to the Golden Gate Bridge, rock fishing was more popular than surf fishing except in years, such as 1958, when striped bass migrated northward in large numbers. The sandy beaches at Fort Cronkhite, Fort Barry, Stinson Beach, and Bolinas Bay received relatively heavy fishing pressure during 1958. Aerial observations showed less at these beaches during 1960. Redtail and silver surfperch were taken consistently at all sandy beaches north of San Francisco.

Poke-poling is a specialized rocky tidepool fishery which utilizes long bamboo poles equipped with a short piece of wire and large hook to catch monkeyface eels, and sometimes small cabezon, kelp greenling, and rock eels. One of the most popular poke-poling areas of the state lies between Bodega Bay and Dillon Beach. We did not survey this area in either 1958 or 1960, so the catch of this small, but important, fishery is not included in our shore fishing summaries. Poke-poling is also conducted at Stinson Beach, Muir Beach, and near the Golden Gate Bridge. Short poles, such as broom handles, are used for poke-poling inside the Golden Gate where surf action is slight.

Surf-netting from Noyo to the Golden Gate is of less magnitude than to the north of Fort Bragg. The most popular surf-netting beaches

were at Russian Gulch (near Fort Ross), at the mouth of the Russian River, and at several beaches in Sonoma Coast State Park.

6.2.5. *San Francisco to Monterey Pier*

This section of the coast was sampled intensively in 1958 and 1960. Turnover determinations, shore counts, and airplane flights were made throughout 1958, and in 1960 rock fishermen and skindivers were sampled from shore on each weekend from Pedro Point to Santa Cruz Pier. Estimates of total effort, catch-per-unit-of-effort, and species composition are available for all major shore-fishing areas. The nearly 120 miles of coastline include 95 miles of sandy beach and 25 miles of rocky shoreline. This section was relatively heavily used by abalone pickers, skindivers, and shore fishermen, and surf netters took surf smelt and night smelt at Half Moon Bay beaches, Martin's Beach, Greyhound Rock, and Scott Creek. Night smelt were taken at Moss Landing.

Much of the shoreline is public property, including most of the important striped bass and rock fishing areas. In 1962, these public beaches were Baker Beach (partly State Park and partly Federal Gov't.); James D. Phelan Beach State Park; Seal Rocks Beach State Park; San Fransico Ocean Beach (city and county of San Francisco); San Mateo Beaches State Park, which includes Thorton Beach, Sharp Park, Montara Beach, Half Moon Bay, San Gregorio Beach, Pomponio Beach, Pescadero Beach, Pebble Beach, and Arroyo de Los Frijoles (Bean Hollow); Princeton west and east jetties; Añno Nuevo Beach State Park; Greyhound Rock and Gazos Creek Public access areas (Wildlife Conservation Board purchases); Natural Bridges Beach State Park; Santa Cruz Beach (city owned); Twin Lakes Beach State Park; Capitola Beach State Park; New Brighton Beach State Park; Seacliff Beach State Park; Manresa Beach State Park; Sunset Beach State Park; Zmudowski Beach State Park; Moss Landing jetties; Salinas River Beach State Park; and Monterey Beach State Park.

Several private beaches open to the public were Rockaway Beach, Pedro Point, Martin's Beach, a picnic area near Gazos Creek, Pigeon Point, Davenport Landing, and several ranches between Davenport and Santa Cruz. The large streams and rivers entering the ocean in this section are Pescadero Creek, Waddell Creek, Scott Creek, San Lorenzo River, Aptos Creek, Pajaro River, Elkhorn Slough outlet, and the Salinas River.

Approximately 374,790 angler days were expended from Golden Gate Bridge to Monterey Pier annually. Striped bass appeared in the surf each year from San Francisco to Martin's Beach, and occasional good runs appeared in Monterey Bay. In 1958, striped bass were taken at practically all sandy beaches south to Monterey. Besides these annual striped bass migrants in the surf area, there are good numbers of surfperch residents in both the surf and rocky areas, as well as jacksmelt, cabezon, kelp greenling, blennys, and rockfishes.

Three areas between Golden Gate Bridge and Monterey Pier differ in physical appearance and in the types of fish taken. From the Golden Gate to Martin's Beach, extensive sandy beaches are interspersed

with a few rocky points and smaller beaches. The principal fishery in this area is the summertime striped bass run, but better-than-average redtail surfperch and silver surfperch catches are also made. Approximately 211,590 angler days were expended in 1958 from the Golden Gate to and including Martin's Beach. of this total, 172,970 days (82 percent) were expended by surf casters, and the remainder by rock fishermen. Some rock-fishing effort was for stiped bass, especially near Land's End, San Francisco, where special poles and long-handled brails are used to catch and land bass off high rocks and cliffs.

From Martin's Beach to Santa Cruz Pier, the shoreline is made up of small, half-moon-shaped sandy beaches nestled between extensive rocky, tide-pool areas. of the 49,220 angler days expended in this area, 63 percent were by rock fishermen. Consequently the dominant species were calico surfperch, rainbow surfperch, kelp greenling, walleye surfperch, and cabezon.

From Santa Cruz Pier to Montery Pier, 113,980 angler days were expended in 1958. Surf fishermen expended 79 percent of these in quest of barred surfperch, walleye surfperch, and striped bass. A continuous sandy beach makes up almost the entire area.

Throughout the area from the Golden Gate to Monterey Pier, species composition and catch-per-unit-of-effort values varied. Some beaches were frequented by striped bass each year in a more or less regular pattern, other beaches were frequented only occasionally each year, and at still others only rarely did bass appear. At some beaches, redtail surfperch were dominant from year to year, but at others barred surfperch, silver surfperch, calico surfperch, or jacksmelt were more important. Catches in rocky areas varied less. Apparently rocky area species are more static and less subject to abrupt changes resulting from storms, an influx of a large school of predatory fish, runs of surf smelt, etc.

The effect that movements of fish can have on surf fishing was exemplified at Baker Beach in 1958. From January through March, surfperch (mostly silver, striped, walleye, and calico) made up 4.0 percent of the total catch, and monthly effort averaged around 500 angler days. From April to May, surfperch made up 66.8 percent of the catch, but by fall they were contributing less than 10 percent. Effort averaged about 3,000 angler days per month during summer, and 2,250 in the fall until the striped bass run was over. About 3,800 striped bass were taken on this beach in 1958.

At San Francisco Ocean Beach, redtail surfperch were the most common species taken (66.1 percent of the total catch by numbers), followed by striped bass, silver surfperch, and walleye surfperch. As at Baker Beach, striped bass did not appear in large numbers until late May. Unlike Baker Beach, however, the surfperch contribution did not fall below 30 percent during any month of the year.

The redtail surfperch was also the principal species at Sharp Park and Rockaway beaches. South of Rockaway this species diminished considerably in numbers. At Montara Beach State Park, redtail surfperch made up only 5.4 percent of the annual catch. At Martin's Beach, the southernmost beach where they were recorded in 1958, they contributed

to only 0.2 percent of the annual catch. In 1960, a redtail surfperch was taken at Santa Cruz Point, the southernmost locality we recorded this species during the study period.

Baker Beach was the northernmost beach at which barred surfperch were taken throughout the survey area. This species is the most important surf-frequenting fish south of Montara, and ranked first by numbers in the total shore catch and third by numbers of all fish taken by all methods. Barred surfperch made up 1.2 percent and 0.5 percent of the catch at San Francisco Ocean Beach and Montara Beach State Park, respectively. In Monterey Bay, they made up over 70 percent of the surf-fishing catch.

The best average annual catch-per-hour values for surf fishermen between the Golden Gate and Monterey Pier in 1958 were at Seacliff Beach State Park, San Francisco Ocean Beach, and Martin's Beach with 0.6, 0.5, and 0.4 fish-per-hour, respectively. Monthly variations at San Francisco Ocean Beach ranged from 0.5 fish-per-hour in May and June to 0.1 fish-per-hour in September. The higher catch values were during periods when both surfperch and striped bass entered the catch.

6.2.6. Monterey Pier to Piedras Blancas

There are 36 miles of sandy beach and 70 of rocky shoreline in the coastline of this section. There is good access for fishermen around Monterey and south to Pt. Lobos, but only limited access from Pt. Lobos to Point Piedras Blancas. The Coastal Highway does not adhere closely to the shoreline south of Pt. Lobos, and the area between the highway and the shoreline is mainly comprised of steep, impassable cliffs. Public access areas in this section of coast were Pacific Grove beach, Point Piños (Federal property), Asilomar Beach State Park, Carmel River Beach State Park, Pt. Lobos Reserve State Park, several National Forest camping and picnic areas at Kirk Creek (camping and picnic), Mill Creek (picnic), Plaskett Creek (camping and picnic), Willow Creek (picnic) and Spruce Creek (picnic).

This coast offers a variety of fishing habitats and physical shoreline features. Adjacent to Cannery Row, Monterey, it is calm and protected, and kelp grows profusely near shore. Most of the area from Cannery Row to Carmel is granite boulder outcrops exposed to heavy surf. The flat beaches at Asilomar and Carmel Beach are of fine white sand, and do not yield surf fishes. Carmel River beaches, on the other hand, are of coarse-grained sand and are steep. From Pt. Lobos to Piedras Blancas features rugged cliffs and tide pools, with an occasional sandy beach. Most shore fishing is conducted from rocky areas throughout this section of the coast. of the 11,610 angler days expended annually, only 400 (3.4 percent) were by surf fishermen.

Spearfishing was not allowed in Pacific Grove between Hopkins Marine Station and Pt. Piños or in Pt. Lobos Reserve State Park. Part of Pebble Beach properties is closed to both shore fishing and spearfishing, and taking of any live form is prohibited at Hopkins Marine Station.

Only certain areas of this section were surveyed during 1958 and 1960. For discussion, we have divided this section into three subsections: Monterey Breakwater to Asilomar, Point Lobos Reserve State Park, and Yankee Point to Piedras Blancas.

6.2.6.1. Monterey Breakwater to Asilomar

Only a few samples were taken here in 1958, hence a concerted effort was made to sample on each weekend of 1960.

The cabezon was the principal species taken in 1960, followed by striped seaperch, blue rockfish, kelp greenling, and señorita.

Our weekend counts in 1960 indicated a decided increase in effort from 1958 to 1960. Total effort from April 1960 through March 1961 was 5,049 angler days, a considerable gain over 1958's 3,200 angler days.

6.2.6.2. Point Lobos Reserve

Daily effort figures were kept by State Park personnel from 1958 through 1960. During our 1960 shore run, the area was sampled nearly every weekend from April 1960 through March 1961. In this "natural reserve," shore fishing is allowed only from certain sections: about 0.5 miles of rocky area on the south shore, and Whaler's Cove. Within this section, 3,249 angler days were expended in 1960–61. We compared fisherman counts made at the entrance station with counts made by our sampler and found that the park personnel were missing about 40 percent of the shore fishermen. At the entrance station, Park visitors were not asked whether they were going to fish, and only the fishing poles in sight were tallied. If fishing poles were in sight, visitors were asked if fishing was to be undertaken in the Reserve.

The shore catch was primarily of blue rockfish followed by kelp greenling, cabezon, black rockfish, black-and-yellow rockfish, and grass rockfish. The striped seaperch was the only surfperch taken here by shore fishermen. The large rockfish catch reflects the terrain, which is of deep water with dense kelp beds growing close to shore. During 1960, fishing was difficult because of the kelp, but if the fishermen managed to get hooks to the bottom catches were good.

6.2.6.3. Yankee Point to Point Piedras Blancas

Along these 95 miles of rugged cliffs, there are several extensive sandy beaches and an occasional protected inlet, but only about 1,000 angler days were expended in 1958. From Yankee Point to Pt. Sur, several miles of rocky and sand areas were accessible, yet fishermen did not often fish here, probably because of the rugged trails down to the shoreline and partly because there were equally good places to fish closer to Monterey.

From Point Sur to Piedras Blancas, such areas as at Partington Canyon, Limekiln Creek, Kirk Creek, Jade Cove, Willow Creek, and the cove north of Point Piedras Blancas, involve about 6 miles of accessible coastline.

No catches were sampled, but fishermen interviews revealed that cabezon were plentiful, especially at Jade Cove. Rockfish were reported abundant from Yankee Point to Point Sur.

6.2.7. Point Piedras Blancas to Point Arguello

There are about 110 miles of coastline in this section 68 miles of sandy beach, and 42 of rocky shoreline. It is generally comprised of flat coastal plains and extensive, flat, rocky submerged areas. There are sandy beaches at the mouths of all streams, and, in the Pismo Beach to Pt. Arguello area, there are continuous sand dunes of semi-coarse, light-colored sands. of 41,550 angler days expended annually, 70 percent were by surf fishermen.

There is good public access at most of the beaches; only in the areas from Baywood Park (south of Morro Bay) to Point San Luis and inside Vandenburg Air Force Base is the public not allowed. In 1962, the public-owned beach access areas were: San Simeon County Park, San Simeon Beach State Park, Cayucos Beach State Park (county operated), Morro Strand Beach State Park, Morro Bay State Park, Avila Beach State Park (county operated), Pismo Beach State Park, and Point Sal Beach State Park (now closed to the public). Popular private lands where access was allowed were: the area between San Simeon and Cambria, the area for several miles north of Cayucos, Standard Oil Pier beach area, Hazard Canyon, Shell Beach, and Guadalupe Oil Field.

6.2.7.1. Piedras Blancas to Cambria

The shoreline throughout this subsection lies at the edge of an uplifted sandstone and mudstone shelf. Extensive flat mudstone reefs extend into the water between sandy beaches at the mouths of several small streams. Shorefishermen have access to nearly all of this area, which encompasses about 15 miles of shoreline. The major fishing areas were: the coves immediately north and south of Piedras Blancas, several flat areas between Piedras Blancas and San Simeon, Little Pico Creek, Pico Creek, San Simeon Creek State Park, and Leffingwell Creek.

Rock fishermen were surveyed on each weekend from April through November of 1960, and 573 were interviewed during the period. Calico surfperch were taken most often, followed by cabezon, silver surfperch, barred surfperch, striped seaperch, and grass rockfish. of the 13,460 angler days expended in 1960, 6,230 were by rock fishermen and 7,230 by surf fishermen.

6.2.7.2. Cambria to Morro Rock

From Cambria to Morro Rock, involving about 18 miles, 8 miles of shoreline are inaccessible, 6 are sandy beach, and 4 are rocky. The principal rock-fishing areas were from Pt. Estero to Cayucos, and at Morro Rock. At Morro Rock, most fishing was on the north side at the steam plant outfall. Some fishing was conducted on the south side of Morro Rock adjacent to the breakwater. The breakwater was unsafe for fishermen and was not utilized. The sandy area from Cayucos to Morro Rock was popular, particularly near the Standard Oil dock. of the 3,200 angler days expended in 1960, 1,480 were by rock fishermen and 1,720 by surf fishermen. The rock fisherman's catch was comparable to that made between Cambria and Piedras Blancas, with calico surfperch, silver surfperch, and cabezon the principal species. Surf fishermen caught mostly barred surfperch, along with silver surfperch. cabezon, and Pacific staghorn sculpin.

6.2.7.3. Morro Rock to Point San Luis

Most of this area was inaccessible, and in 1958 only 200 angler days (estimated) were spent here, almost all between Point Buchon and Point San Luis. There was some surf fishing at Hazard Canyon, but no effort estimates were available. About half of the 20 miles of shoreline between Morro Rock and Point San Luis is sandy beach, and half is steep rocky shoreline.

6.2.7.4. Avila to Point Arguello

Within this 50 miles of coastline, lie the most utilized fishing areas between Monterey and Point Arguello. Most of this area is extensive sandy beach with access at three locations, Pismo-Oceano, Guadalupe Oil Field, and Surf. The rocky area from Avila to Pismo Beach is partially accessible. The beach at Pismo-Oceano is the most popular fishing area, followed by Guadalupe Oil Field beach and Surf. The shoreline from Point Sal to Point Arguello is closed to fishing, except for about one-half mile near Surf. An estimated 26,140 angler days were expended between Avila and Point Arguello in 1958.

6.2.7.5. Pismo-Oceano Beach Area

Sampling was conducted here from April through September in 1958, where an estimated 15,136 angler days yielded 30,342 fish, 21,993 of which were barred surfperch. All other species were considered as incidental due to the popularity of the barred surfperch, these included jacksmelt, silver surfperch, and calico surfperch. Several steelhead rainbow trout were reported for the beach near the mouth of the creek at Oceano. During May, the best month for barred surfperch, an average hourly catch of nearly one fish was recorded.

6.2.7.6. Guadalupe Oil Field

This is near the southern end of the 16-mile-long sandy beach between Shell Beach and Point Sal. The sand is much coarser than to the north near Oceano, and consequently the beaches are steeper and more difficult for walking. Barred surfperch were the main attraction. of the 16,279 fish taken in 1958, 14,347 were barred surfperch. The average catch-per-hour was 1.07 fish from May through November.

Although 3,250 angler days were expended here in 1958, effort would have been higher if access had been available to more fishermen.

7. SURF-NET FISHERY

The surf-net fishery in central and northern California is a highly specialized sport fishery in which osmerid smelt are caught with nets in the surf along certain sandy beaches. There are two separate fisheries: one during daylight hours for surf smelt, and the other at night, often on the same beaches as the day fishery, for night smelt. Rarely are surf smelt caught at night or night smelt caught during the day. Whitebait smelt may also be caught by the fisheries but we have not observed any in their catches since 1957. All three, surf smelt, night smelt, and whitebait smelt are members of the family Osmeridae.

The surf-net fishery is one of the oldest in California. Indian tribes in northern California were using A-frame nets and dip nets when the area was first occupied by the white settlers. Surf-net fisheries have existed on beaches such as Luffenholtz Beach for hundreds of years. Kroeber and Barrett (1960) give an excellent description of the early California Indian fisheries.

The standard net used in northern California to catch both surf smelt and night smelt is the A-frame (Kroeber and Barrett, 1960; Bonnot, 1930). South of San Francisco, fishermen use two-man jump nets and Hawaiian throw nets, along with A-frame nets.

During our survey, surf smelt were taken from Smith River Beach south at least to Scott Creek Beach. Night smelt were netted between Smith River Beach and Moss Landing Beach.

The numbers of surf smelt and night smelt spawning on a given beach reportedly fluctuate from year to year, which seriously affects total surf-netting effort on any given beach. In 1958, good runs of surf smelt occurred at Luffenholtz Beach, and an estimated 5,140 net-days were expended there. In 1959, instantaneous counts were made at Luffenholtz throughout the summer, and the observed effort failed to exceed 100 net-days from May through September. Similar fluctuations of effort have been reported by Fish and Game Wardens and commercial surf-net fishermen throughout the project area, and are assumed to reflect abundance and/or availability of fish. The fluctuations are probably due to natural causes, although disturbances of the beach habitat may cause populations to shift to more suitable beaches.

Instantaneous counts were made of surf netters between July and December 1957 at most beaches in the project area. Species composition was also ascertained, but no catch-per-unit-of-effort data were collected. Two beaches extensively surveyed during 1958 were Luffenholtz Beach and Mad River Beach. South of San Francisco, we made instantaneous counts of surf nets from an airplane during 1958.

A total of 42,470 net-days was estimated for the surf-smelt fishery from July 1957 through June 1958 (Table 9). Four million surf smelt weighing approximately 400,000 pounds were taken in this period.

From May through October 1958, we sampled 845 surf nets at Luffenholtz and Mad River beaches, representing 1,200 to 1,600 fishermen. Surf smelt made up over 99 percent of the daytime surf-netters' catch at these beaches. The only other species observed in their catches were Pacific herring and jacksmelt. Three nights were spent sampling surf netters at Mad River Beach during March 1959, and their catches consisted of over 99 percent night smelt. The other species we observed were surf smelt, Pacific herring, and redtail surfperch.

7.1. Sampling Methods

The surf-net fishery was sampled at Luffenholtz and Mad River beaches in conjunction with our shore and pier sampling program in 1958. The methods we used to sample surf fishermen were modified and used for the surf netters.

The total number of surf nets on each beach was determined by conducting a turnover tally. Hourly counts were made of nets observed on the beach, whether they were being used at the time of the count or not. Interview cards were handed to each party of surf netters as they arrived on the beach, and mail boxes were set up for departing fishermen to deposit their cards if the sampler was not present.

Once each day 100 surf smelt would be sampled from the catch and weighed with a hand scale to obtain the average number of fish per pound. This figure was used to calculate numbers in the catches sampled during the rest of the day. Surf smelt averaged 10 fish to the pound during 1958 at Luffenholtz and Mad River beaches, ranging from 9 to 11 per pound. Night smelt averaged 20 per pound at Mad River Beach during March 1959. Each party's catch was examined, and the species recorded. "Total hours fished" for each net was the difference between the time of arrival on the beach and the time of departure. We computed catch-per-hour by dividing the total fish in the sample by the total net-hours in the sample. A net was considered to be fishing whether it was being fished or lying on the beach. Surf netters usually wait for a run of smelt to appear before they start fishing. Occasionally, a fisherman would fish for a few minutes even though there were no signs of smelt in the surf (the activity of seagulls was a good indicator, and occasionally the fish could be seen in the waves just before they broke). Once a run starts, fish will remain in the surf from a few minutes to all day. If the fishermen did not catch their limits (25 lbs.) during any one run, they would usually await the next appearance of fish. Time spent on the beach watching and waiting for fish was considered as fishing time. In 1958, we based catch-per-hour and catch-per-day on surf nets, and not on fishermen. No attempt was made to determine the number of fishermen per net. The Fish and Game Wardens we interviewed estimated that the average number of fishermen-per-net ranged from 1.5 to 2.0; we used an estimate of 1.5 to calculate total surf-net fishermen (Table 9).

7.2. Total Effort

Total surf-net effort for the daytime surf-smelt fishery was calculated for all the beaches from Smith River Beach to Moss Landing Beach where nets were observed in 1957 and 1958.

The estimates of total surf netters were made for the beaches from Smith River to Salmon Creek (July 1957 through June 1958), and for the beaches from Half Moon Bay to Scott Creek (May through October 1958). These estimates were based on a turnover curve we made up from all our daily turnover curves taken at Luffenholtz Beach and Mad River Beach, and from instantaneous counts of surf netters made at all beaches in the project area from July through December 1957. These 1957 counts were of fishermen, thus the calculated total effort for this period was in fishermen-days rather than net-days.

8. SKIFF FISHERY

8.1. Introduction

The skiff fishery in northern California has grown considerably during the past 20 years. Three factors contributing to this growth were: population increase, improved outboard motors, and use of plastics in the manufacture of small boats. Small-craft harbor construction and new electronic safety equipment for skiffs should encourage continued expansion of the skiff fishery.

Sampling of the skiff fishery began in 1955 (Ocean Salmon Investigation DJ F-12-R) and, until 1957, emphasis was placed on determining total effort and catch in the sport salmon fishery. In 1957, emphasis was shifted to include all species. Our early sampling did not include all skiff-launching sites. Information was collected concerning skiff facilities throughout the study area and in 1959, sampling was designed to determine total effort and total catch at these facilities.

Results of our 1959 and 1960 sampling are included here, and grouped into major fishing areas of the coast. After 1955, sampling was conducted at 26 of the 40 launching sites in the study area.

8.2. Sampling Technique

Sampling equipment and techniques were generally as described earlier. In addition, bottom and trolling effort were kept separate, the number of poles and fishermen per skiff were tallied, and type of skiff (rental or private) was recorded. At Tomales Bay, Moss Landing, and Morro Bay separate catch-and-effort data were obtained for fishing conducted inside and outside the harbors. The skiff-sampling year was from March 1959 through February 1960. The number of days we sampled at a particular area was limited by the number of man days available, by whether total effort had to be calculated from sample counts, and by the time of year.

8.3. Total Effort

To obtain total daily effort at a port, a record was made of all skiffs returning from sea on a sample day, including skiffs not sampled for catch.

Total effort was also calculated from two types of voluntary logs maintained by skiff concessionaires. One type was a daily log consisting of a page for each day of the month. For each skiff rented, the concessionaire listed number of people aboard, departure and arrival time, amount and types of additional gear rented, and remarks on the catch. Space was reserved to record number of private skiffs launched. Sometimes concessionaires listed each private skiff separately by registration number, and recorded the same information they did for rental skiffs. The second type of log contained a page for each month upon which daily data concerning the total number of skiffs rented, and the total number of private skiffs launched could be recorded. In our computations of total effort, we were able to rely on 15 of the 20 logs maintained for us. At some launching sites, effort was obtained directly from business records of concessionaires.

There were often several launching sites within a fishing port or section of the coast and log records would be available at only a portion of these. To compute total skiff effort for all launching sites the following ratio was applied:

$$\frac{\text{Sample count}}{\text{Log count (on sample days)}} = \frac{\text{Total skiffs fishing}}{\text{Log count (total for month)}}$$

FORMULA

The same method was used in computing total effort for launching sites at river mouths or fishing ports where no logs were kept at one locality but kept at an adjacent one.

The total effort figure calculated by all three methods was in terms of skiff days; we converted this figure into angler days (poles) by multiplying by the mean poles-per-skiff for each month. The ratios of fishermen to poles were computed.

8.3.1. *Catch-Per-Unit-of-Effort and Total Catch*

It was necessary to separate "bottom" and "troll" catch-and-effort in 1959 to understand the significance of catch-per-hour and catch-per-day figures for each species. In 1959, to calculate catch-per-hour and catch-per-day for each species, the total catch for each species was divided by the total hours spent bottom fishing or trolling.

The total catch for each species was derived by weighting the partial sample to the whole sample by simple ratio, which we applied equally to troll catch and bottom catch. When we grouped data from more than one month to estimate total catch, it was because (i) we had too few samples during one or both months, (ii) too few fish were sampled in one or both months, or (iii) the total effort was known for both months, but no samples were taken during one of the months. The grouping of two or more launching areas was to keep individual business records confidential.

Skiff sampling was not conducted inside the Golden Gate because of the complexity of the bay fishery. All other bay fishing areas were surveyed, except for skiff launching sites in part of Tomales Bay.

8.3.2. *Total Catch and Effort*

The total skiff catch from March 1959 through February 1960 was 337,171 fish. of 121,038 angler days expended, 19,054 (16 percent) were sampled. Several sites were not sampled, and at several others only partial-year samples were obtained. At the launching sites we sampled, 113,985 angler days were expended to catch an estimated 318,667 fish: 285,173 by bottom fishermen and 33,494 by trollers (Table 11) . The bottom catch was largest in the area from Tomales Bay to Point Lobos. More time was spent trolling, and more fish were caught by trolling, north of Tomales Bay than between Pedro Point and Avila; however, skiff fishermen averaged more fish-per-hour bottom fishing and trolling from Pedro Point to Monterey.

By major grouping, rockfish contributed the most in numbers, over 53 percent of the catch being in this group (Figure 10). Blue rockfish were the most numerous, contributing about 22 percent to the catch.

White croaker, black rockfish, Pacific sanddab, copper rockfish, and lingcod were next numerically, furnishing 16.3, 8.9, 5.7, and 5.5 percent

TABLE 11

Total Catch (Numbers and Species) Made by Skiff Fishermen (Bottom and Trolling) in 18 Skiff-Fishing Areas From Crescent City to Avila, March 1959 to February 1960 **

Species	Bottom		Trolling		Total	
	Total catch	Percent comp.	Total catch	Percent comp.	Catch in numbers	Percent comp.
ROCKFISH	**157,257**	**55.14**	**13,908**	**41.52**	**171,165**	**53.71**
Blue	67,310	23.60	1,472	4.39	68,782	21.58
Black	19,004	6.66	9,509	28.39	28,513	8.95
Olive	4,035	1.41	292	0.87	4,327	1.36
Yellowtail	4,062	1.42	318	0.95	4,380	1.37
Copper	17,187	6.03	844	2.52	18,031	5.66
Vermilion	4,066	1.42	377	1.12	4,443	1.39
Brown	6,190	2.17	395	1.18	6,585	2.07
Gopher	9,342	3.28	41	0.12	9,383	2.94
Bocaccio	1,228	0.43	125	0.37	1,353	0.42
Rosy	3,422	1.20	82	0.24	3,504	1.10
China	1,519	0.53	33	0.10	1,552	0.49
Widow	54	0.02	0	0.00	54	0.02
Canary	9,481	3.32	301	0.90	9,782	3.07
Starry	589	0.21	6	0.02	595	0.19
Greenspotted	32	0.01	0	0.00	32	0.01
Flag	39	0.01	0	0.00	39	0.01
Black-and-yellow	3,648	1.28	6	0.02	3,654	1.15
Turkey-red	1,137	0.40	86	0.26	1,223	0.38
Cow	33	0.01	0	0.00	33	0.01
Grass	3,530	1.24	12	0.04	3,542	1.11
Kelp	554	0.19	9	0.03	563	0.18
Treefish	86	0.03	0	0.00	86	0.03
Quillback	570	0.20	0	0.00	570	0.18
Chilipepper	7	T	0	0.00	7	T
Squarespot	121	0.04	0	0.00	121	0.04
*Rockfish	11	T	0	0.00	11	T
SURFPERCH	**7,650**	**2.68**	**77**	**0.23**	**7,727**	**2.43**
Redtail	139	0.05	12	0.04	151	0.05
Calico	3	T	61	0.18	64	0.02
Barred	17	0.01	4	0.01	21	0.01
Silver	130	0.04	0	0.00	130	0.04
Walleye	2,839	1.00	0	0.00	2,839	0.89
Rainbow	5	T	0	0.00	5	T
Black	691	0.24	0	0.00	691	0.22
Rubberlip	184	0.06	0	0.00	184	0.06
Pile	508	0.18	0	0.00	508	0.16
White	1,567	0.55	0	0.00	1,567	0.49
Striped	1,443	0.51	0	0.00	1,443	0.45
Pink	10	T	0	0.00	10	T
Shiner	114	0.04	0	0.00	114	0.04
FLATFISH	**27,371**	**9.60**	**983**	**2.94**	**28,354**	**8.90**
Sand sole	1,270	0.44	240	0.72	1,510	0.47
Starry flounder	2,145	0.75	317	0.95	2,462	0.77
Pacific sanddab	19,777	6.94	164	0.49	19,941	6.26
English sole	51	0.02	0	0.00	51	0.02
Rock sole	1,921	0.67	59	0.18	1,980	0.62
Petrale sole	1,436	0.50	142	0.42	1,578	0.50
Scaly-fin sole	66	0.02	32	0.10	98	0.03
California halibut	643	0.22	22	0.06	665	0.21
Pacific halibut	8	T	7	0.02	15	T
Dover sole	45	0.02	0	0.00	45	0.01
Curlfin turbot	9	T	0	0.00	9	T
MISCELLANEOUS	**92,895**	**32.57**	**18,526**	**55.31**	**111,421**	**34.96**
Ratfish	3	T	0	0.00	3	T
Big skate	9	T	0	0.00	9	T
Longnose skate	5	T	0	0.00	5	T
Shovelnose guitarfish	24	0.01	0	0.00	24	0.01
Round stingray	61	0.02	0	0.00	61	0.02
Bat ray	23	0.01	0	0.00	23	0.01
Spiny dogfish	25	0.01	11	0.03	36	0.01
*Smoothhounds	62	0.02	12	0.04	74	0.02
Leopard shark	54	0.02	18	0.05	72	0.02
Pacific angel shark	7	T	0	0.00	7	T
Blue shark	0	0.00	32	0.10	32	0.01

TABLE 11
*Total Catch (Numbers and Species) Made by Skiff Fishermen (Bottom and Trolling) in 18 Skiff-Fishing Areas From Crescent City to Avila, March 1959 to February 1960***

TABLE 11—Continued

Total Catch (Numbers and Species) Made by Skiff Fishermen (Bottom and Trolling) and 18 Skiff-Fishing Areas From Crescent City to Avila, March 1959 to February 1960 **

Species	Bottom		Trolling		Total	
	Total catch	Percent comp.	Total catch	Percent comp.	Catch in numbers	Percent comp.
California barracuda	15	0.01	117	0.35	132	0.04
Pacific bonito	110	0.04	353	1.05	463	0.15
Lingcod	14,874	5.22	2,652	7.92	17,526	5.50
Kelp greenling	3,267	1.14	92	0.27	3,359	1.05
Rock greenling	198	0.07	0	0.00	198	0.06
Cabezon	4,882	1.71	184	0.55	5,066	1.59
Pacific staghorn sculpin	132	0.05	0	0.00	132	0.04
Buffalo sculpin	289	0.10	21	0.06	310	0.10
Brown Irish lord	9	T	0	0.00	9	T
Red Irish lord	19	0.01	0	0.00	19	0.01
*Cottids	5	T	0	0.00	5	T
White croaker	51,618	18.10	210	0.63	51,828	16.26
White seabass	48	0.02	0	0.00	48	0.02
Jacksmelt	9,449	3.31	210	0.63	9,659	3.03
Pacific mackerel	4,938	1.73	17	0.05	4,955	1.55
Jack mackerel	1,653	0.58	114	0.34	1,767	0.55
Pacific hake	37	0.01	22	0.06	59	0.02
Sablefish	30	0.01	12	0.04	42	0.01
Kelp bass	24	0.01	0	0.00	24	0.01
Sand bass	13	T	0	0.00	13	T
Giant sea bass	4	T	0	0.00	4	T
King salmon	813	0.28	8,099	24.18	8,912	2.80
Silver salmon	68	0.02	6,249	18.66	6,317	1.98
Pink salmon	0	0.00	4	0.01	4	T
Steelhead rainbow trout	11	T	6	0.02	17	T
Mola	25	0.01	6	0.02	31	0.01
Wolf-eel	22	0.01	34	0.10	56	0.02
*Fringeheads	26	0.01	0	0.00	26	0.01
Pacific tomcod	5	T	0	0.00	5	T
Striped bass	0	0.00	26	0.08	26	0.01
Ocean whitefish	9	T	0	0.00	9	T
Senorita	14	T	0	0.00	14	T
Monkeyface eel	9	T	0	0.00	9	T
Pacific sardine	6	T	0	0.00	6	T
California yellowtail	0	0.00	25	0.07	25	0.01
TOTAL	**285,173**	**99.99**	**33,494**	**100.00**	**318,667**	**100.00**

* May include more than one species.
** In some cases these figures do not represent total catch for the 12 month period.

TABLE 11

*Total Catch (Numbers and Species) Made by Skiff Fishermen (Bottom and Trolling) in 18 Skiff-Fishing Areas From Crescent City to Avila, March 1959 to February 1960***

of the catch, respectively. Surfperch contributed but 2.4 percent of the total catch by numbers, and, except for the Pacific sanddab, flatfish were equally low in numbers. California halibut are a favored species but their numbers were few.

By weight, lingcod was the most important, with blue rockfish, black rockfish, and king salmon following. Weights were not calculated for all species in the skiff catch. Weight comparisons were figured for the most important species, using an average size for each as computed from skiff sampling data.

The white croaker was dominant at several ports, mainly from Pedro Point to Moss Landing (Figure 11). Lingcod were important throughout but made their greatest contribution in catch-per-day and in species composition from Bodega Bay north to Fort Bragg. Blue rockfish and Pacific sanddabs were numerous in the Monterey Bay ports, and blue rockfish and gopher rockfish were important in the Morro Bay-Avila area. California halibut, Pacific bonito, California barracuda,

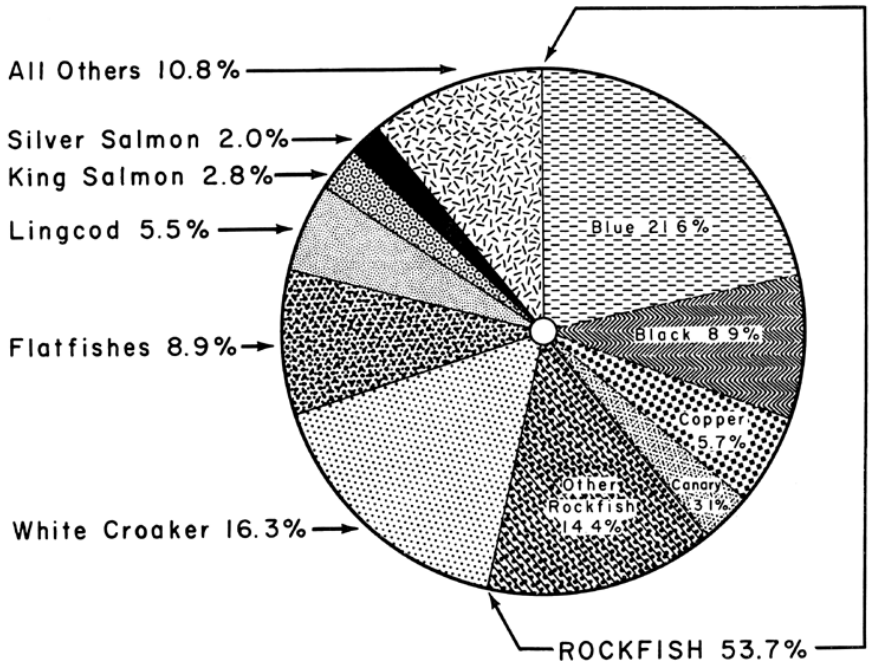


FIGURE 10. Species composition of skiff catch, bottomfishing and trolling, Crescent City to Avila, 1959.

FIGURE 10. Species composition of skiff catch, bottomfishing and trolling, Crescent City to Avila, 1959

and California yellowtail also entered the skiff fishery at Morro Bay and Avila.

Bottom fishermen landed, on the average, about 1.0 fish-per-hour and 4.0 fish-per-day. Trollers landed about 0.1 fish-per-hour and 0.5 fish-per-day. Trolling was for lingcod, California barracuda, and Pacific bonito, as well as for king salmon and silver salmon. Most trolling north of San Francisco was for salmon, the most sought-after fish in that area.

To describe the skiff fishery best, we grouped our data into three sub-areas: Crescent City to Tomales Bay, Pedro Point to Point Sur, and Point Sur to Avila.

8.4. Crescent City to Tomales Bay

At least 20 skiff-launching sites were utilized by ocean fishermen in this area. Sampling was conducted in 1959 at nine of the major fishing areas, namely: Crescent City, Trinidad, Humboldt Bay, Shelter Cove, Fort Bragg (Noyo Harbor), Albion, Point Arena, Bodega Bay, and Tomales Bay. In 1960, species and catch-per-unit-of-effort data were obtained at four additional sites: Salt Point Ranch, Ocean Cove, Timber Cove, and Fort Ross Ranch.

The greatest amount of skiff fishing time was spent trolling for salmon, especially from Noyo Harbor northward (46 percent trolled, 36 percent bottom-fished, and 18 percent trolled and bottom-fished the

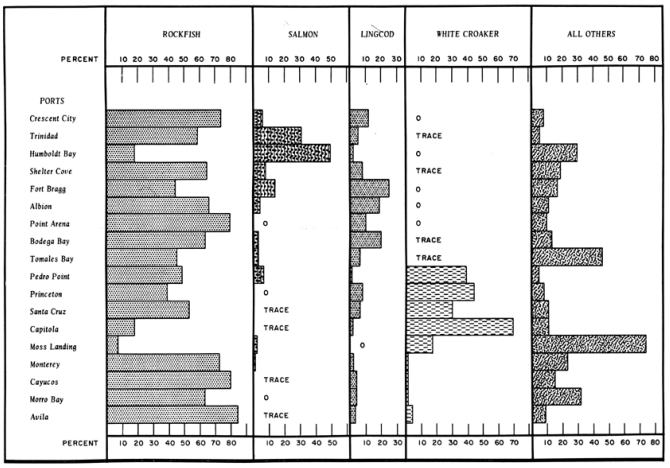


FIGURE 11. Skiff catch composition by numbers of salmon, rockfishes, white croaker, lingcod, and all others (miscellaneous), Crescent City–Avila, March 1959–February 1960.

FIGURE 11. Skiff catch composition by numbers of salmon, rockfishes, white croaker, lingcod, and all others (miscellaneous), Crescent City—Avila, March 1959—February 1960

same day). Most effort was expended during May through September. Not only are winter storms frequent and dangerous to skiff fishermen, but salmon runs take place during summer and fall. The only launching sites where skiff fishing effort was recorded during winter were at Crescent City, Point Arena, Bodega Bay, and Tomales Bay—ports where bottom fishing is popular. The fishery at Tomales Bay was both inside and outside the bay. Most winter fishing was inside the bay.

Humboldt Bay not only had the largest recorded skiff effort in this area, but more skiff fishermen were recorded fishing out of Humboldt Bay than at any of the other skiff areas. A total of 16,799 angler days, involving 6,488 skiff-days were recorded here in 1959. Bodega Bay and Trinidad were the second and third most active skiff ports in the area with 5,151 and 4,918 skiff-days, respectively. The largest catch was recorded at Bodega Bay where 23,669 fish were landed. The data on the catch by species in the trolling, bottom, and combined troll and bottom catch were not weighted to total effort for the entire fishing year or season when only partial-year samples were obtained.

The estimated annual effort for this area was 67,977 angler-days and 26,913 skiff-days. Our samples involved 8,478 angler-days and 3,483 skiff-days, amounting to 12.9 percent of the total effort.

Except at Point Arena, Bodega Bay, and Tomales Bay, most fishing effort was expended trolling for salmon. Even though less effort was spent bottom fishing than trolling, 74 percent of the catch by numbers was of bottomfish. Fifty-eight species were recorded in the bottom catch. The 39 species in the troll catch made up 26 percent of total catch by numbers.

8.4.1. Species Composition

Rockfishes were the most important numerically, as well as species-wise, and by weight. This was particlarly true in the bottom fishery where 19 species of rockfish were recorded. of these, black rockfish, copper rockfish, and blue rockfish made up 17.3, 17.0, and 6.8 percent of the catch. Lingcod, the third most numerous species, made up 15.7 percent of the bottom catch. If we assume an 8-pound average for the lingcod, this fish then becomes the most important species in the bottom catch by weight. Lingcod was the most sought-after species by bottom fishermen, except at Humboldt Bay where 18.2 percent of the king salmon and 1.6 percent of the silver salmon were caught by bottom fishing or "mooching" in the entrance to the bay. In fact, the average catch-per-hour for king salmon was higher in the bottom fishery than in the troll fishery at Humboldt Bay, amounting to 0.05 per hour for trollers, and 0.07 for bottom fishermen.

Salmon were the most numerous fishes in the troll catch and contributed the highest poundage.

The availability of salmon to the skiff fishery had a noticeable effect on total effort at most launching sites. During 1957 and 1958, when the catch-per-day for salmon dropped significantly from the high values recorded during 1956, total effort also decreased. This decrease in the catches of salmon in 1957 and 1958 was paralleled by a change in species composition. During 1955 and 1956, king salmon were dominant, but during 1957, 1958, and, to a certain extent, 1959, silver salmon became dominant.

In all, 6,617 king salmon, 6,232 silver salmon, 4 pink salmon, and 6 steelhead rainbow trout were landed by trollers. Combining these gives 12,859 salmon and trout, or 47.2 percent of the troll catch. Assuming a 7-pound average weight for these fish, and adding the 875 king and silver salmon caught by bottom fishermen, yields 97,138 pounds of salmon and trout landed by skiff fishermen in this area. By weight, lingcod were second in the combined troll and bottom catch with approximately 87,000 pounds.

California halibut were the object of most of the troll fishery at Tomales Bay, which is the only place significant numbers of these fish were landed.

A small fishery for surfperch existed inside Humboldt Bay during the winter.

Several species caught by skiff fishermen at various launching sites were not observed in our sampling. Pacific halibut were reported at Shelter Cove every year, and 1959 was no exception. At least four of these large flatfish were reported, each weighing in excess of 50 pounds. One of the halibut weighed 108 pounds. A California halibut was also caught at Shelter Cover in 1959, but was not sampled (Gunderson, 1960). At least one sturgeon was caught at the entrance to Humboldt Bay during 1959, probably a green sturgeon.

Although we found pink salmon only at Trinidad during 1959, they may have entered the catches of skiff fishermen at some of the other launching sites. Pink salmon are known to have been caught in California ocean waters only during odd-numbered years, i.e., 1955, 1957, 1959 (Fry, 1960).

During the warm-water period of 1957 and 1958 (Radovich, 1961), several white seabass were caught at Humboldt Bay and Trinidad. Pacific albacore also were available during these years, ranging to within 10 to 15 miles of Humboldt Bay. A few of the more adventuresome skiff fishermen who made the trip offshore reported fair success.

All of the launching sites, except Humboldt Bay, were near accessible rocky reefs where bottom fishermen could fish. The only rocky habitat within reach of Humboldt Bay skiff fishermen were the two jetties at the bay's entrance. Except on the calmest days, these jetties were unsafe to fish because of swift tidal currents and unpredictable swells. The species composition of the Humboldt Bay skiff fishery reflected this lack of rocky habitat.

8.4.2. Catch-Per-Unit-of-Effort

Bottom fishermen at all of the launching sites not only caught more fish of more species than the trollers, but they also had a higher catch-per-hour. Bottom fishermen averaged 0.7 fish-per-hour, while trollers averaged 0.1.

The average catch-per-hour in the bottom fishery ranged from 0.2 inside Tomales Bay to 1.9 at Point Arena. In the troll fishery, Humboldt Bay had the lowest catch-per-hour value (0.06) while Tomales Bay (inside) had the highest (0.31). Using our catch-per-hour figures as an index, bottom fishermen generally made better catches during late summer and fall (August–October), while trollers had better luck during the early part of the summer (June and July).

8.4.3. 1960 Sampling

Sixty-six skiff fishermen at four additional launching sites (Salt Point, Ocean Cove, Timber Cove, and Fort Ross) were sampled during 1960. Effort data were not collected in 1960, but from airplane counts, ground observations, and discussions with the concessionaires, an estimated 600 skiff-days and 1,500 angler-days were computed for these four sites.

Most of the effort was directed toward bottom fishing; only one skiff trolled. A total of 324 fish, representing 19 species, was observed in the samples from bottom fishermen. Blue rockfish, lingcod, and copper rockfish were the most numerous, contributing 32.1, 21.6, and 15.1 percent by numbers.

Skiff fishermen were contacted from April through September, but each launching site was not sampled during every month. We sampled skiff fishermen at Salt Point during June, July, and September; at Ocean Cove during July and August; at Timber Cove during August; and at Fort Ross during July and September.

8.5. Pedro Point to Point Sur

The only protected, calm-water harbor in this area was at Moss Landing, the other launching sites were on the lee sides of headlands or at piers in semi-protected harbors. In 1962, there were three additional calm-water, small-craft harbors: Princeton (Half Moon Bay small-craft harbor), Santa Cruz (Twin Lakes small-craft harbor), and Monterey where a retaining wall has been constructed to form a calm-water harbor.

Skiff fishing was carried out throughout the year at all launching sites except at Pedro Point, which was closed from December through March. There were 10 skiff-fishing areas in this section of the coast. In 1959, sampling was conducted at six of these, namely: Pedro Point, Princeton, Santa Cruz, Capitola, Moss Landing, and the several launching sites in the Monterey-Pacific Grove area. In 1960, an additional two sites were sampled at Pigeon Point and Point Lobos Reserve State Park.

Bottom fishing was the primary skiff activity; however, salmon fishing had hit an all-time low for Monterey Bay during the survey period. About 69 percent of all skiff effort was for bottom fishing, 21 percent for trolling, and 10 percent for both bottom fishing and trolling on the same day. The average bottom-fishing day was 4.4 hours. The highest monthly catch-per-hour (0.3 fish) for salmon in the entire survey area was recorded at Pedro Point in July 1959. However, since 1959 was a poor salmon year, this figure may not represent true relative success between areas, or for that launching site.

8.5.1. Total Effort and Catch

More fish were landed in this area by skiff fishermen during 1959 than in either the area from Crescent City to Tomales Bay or from Point Sur to Avila. Most of the fish were caught by bottom fishermen. A total of 39,274 angler-days yielded an estimated 197,297 fish from March 1959 through February 1960. This total catch figure is a projection of the total catch estimate for the months we actually sampled; we did not sample all launching sites each month. We sampled 7,669

angler-days and 40,973 fish at six fishing areas, amounting to 19.7 percent of total effort. The estimated catch for the months we sampled was 189,752 fish, and of these, 184,830 were caught by bottom fishermen. The total weight of the fish landed at Santa Cruz, Capitola, Moss Landing, and Monterey was 169,028 pounds. Weights were computed for species in these areas to provide a comparison between the sport catch and commercial otter-trawl catch in Monterey Bay.

Monterey had the second largest total effort (14,307 angler-days), and the largest number of fish (78,625) recorded at all of the skiff-fishing areas sampled in 1959.

In 1959, the total effort for unsampled sites between Pedro Point and Pt. Sur probably did not exceed 200 skiff-days with a total catch of 4,000 fish.

A decrease in total skiff-days from 1956 to 1959 was probably due in part to a reduced availability of salmon at Capitola, Moss Landing, and Monterey. In 1956, there was an estimated catch of 13,000 salmon at these three launching sites, and total effort equaling 13,736 skiff-days. In 1959, less than 1,500 salmon were landed, and total effort at the three sites had dropped to 8,995 skiff-days.

8.5.2. Species Composition

Blue rockfish was the most numerous species landed in this area, and probably contributed the largest poundage. Monterey bottom fishermen caught 44,291 blue rockfish. King salmon dominated the troll catch, followed by blue rockfish, and lingcod. White croaker and Pacific sanddab were the second and third most numerous species landed by bottom fishermen. White croaker was the species most numerous in landing of bottom fishermen at Pedro Point, Princeton, Santa Cruz, Capitola, and Moss Landing (Figure 11).

Bottom fishermen landed 71 species, and troll fishermen 33.

Striped bass were observed in the skiff catch only at Pedro Point, but they probably also were caught at Princeton, and Moss Landing. The Moss Landing total catch does not include the catches made by skiff fishermen participating in the annual shark derby in Elkhorn Slough (Herald, Schneebeli, Green, and Innes, 1960).

As at Humboldt Bay, Moss Landing lacked rocky reefs; the jetties at the entrance to the harbor were probably the only rocky areas within reach of skiff fishermen. Pacific sanddabs were the most numerous species caught by bottom fishermen outside the slough, but white croaker and sablefish, both sandy-bottom species, were also important.

Monterey skiff fishermen caught a greater variety of species (54) than skiff fishermen at any of the other launching sites sampled. Opaleye, California sheephead, California barracuda, bluefin tuna, giant sea bass, blacksmith, sharpnose seaperch, halfmoon, and California halibut were in the Monterey area during 1957 and 1958, and some of these may have been caught by skiff fishermen even though they did not appear in our routine sampling.

8.5.3. Catch-Per-Unit-of-Effort

Bottom fishermen and trollers averaged more fish-per-hour along this section of coast than skiff fishermen to the north of San Francisco, or to the south of Point Sur.

Bottom fishermen at Pedro Point recorded the highest catch-per-hour of any of the launching sites sampled (3.5 in July, 4.0 in September, and 4.9 in October). Santa Cruz anglers had the highest catch-per-hour for the year in the troll fishery. Throughout this area, bottom fishing was best during July, August, and September, and trolling was best during July, August, December, and January. July and August were usually good for salmon, whereas December and January were best for lingcod trolling.

At Santa Cruz, trollers recorded a higher average catch-per-hour for lingcod than did bottom fishermen, averaging 0.1 lingcod per hour, as compared to the bottom fisherman's 0.04.

8.5.4. *1960 Sampling*

In 1960, 22 skiff fishermen sampled at Pigeon Point and Point Lobos had spent 86 hours bottom fishing and caught 126 fish representing 17 species.

Since 1958, park personnel at Point Lobos Reserve State Park have kept records of the number of skiffs fishing each day. These tallies showed in 99, 102, 59, and 108 skiff-days, respectively, for 1958 through 1961. Because we sampled so few skiff fishermen here, we have not attempted to derive total catch estimates from our data. From observations made during airplane flights and shore counts, we believe the total skiff effort originating from Pigeon Point did not exceed 50 days in 1960.

All samples at Pigeon Point and Point Lobos were of bottom fishing; little, if any, trolling was done at either area.

Lingcod were the most numerous of the 15 species caught at Pigeon Point, while blue rockfish outnumbered all other species at Point Lobos. Skiff fishermen at Point Lobos recorded a higher average catch-per-hour (2.0) than skiff fishermen at Pigeon Point (0.9).

8.6. Point Sur to Avila

We found no evidence of skiff fishing between Point Sur and San Simeon, but a few skiffs may have been launched in the Plaskett Rock area. Some skiffs were launched through the surf at San Simeon during summer, but we did not sample here.

The first site south of Monterey where rental skiffs could be obtained, and private skiffs launched, was at Cayucos. The skiff fishery at Cayucos was restricted to the months of May through September because there was no protection from offshore winter storms.

Eighty-eight percent of the annual skiff-fishing effort at Morro Bay and Avila was expended from March through November in 1959. Morro Bay, which is similar to Humboldt Bay in many respects, was the only completely enclosed, protected harbor along this section of coast. At Cayucos, Morro Bay, and Avila, we sampled a greater percentage (20.2) of total skiff effort than at any other area.

8.6.1. *Total Effort and Catch*

We sampled 2,815 angler-days and 8,924 fish from March through November 1959 at the three launching sites. During this period, total effort amounted to 12,341 angler-days and 4,642 skiff-days. Estimated

total effort from March 1959 through February 1960, was 13,787 anglerdays and 5,206 skiff-days, yielding an estimated 44,431 fish.

Eighty-two percent of the skiff fishermen went bottom fishing, 13 percent trolled, and 5 percent went bottom fishing and trolled on the same day. The average bottom fishermen spent 4.5 hours and the average troller, 2.9 hours. No trolling effort was recorded inside Morro Bay. Bottom fishermen caught 96.7 percent of the fish landed during the sampling period.

8.6.2. *Species Composition*

Fifty species of fish were recorded in the bottom catch. Blue rockfish contributed 20.3 percent of the catch, followed by gopher rockfish (16.7 percent), and copper rockfish (9.7 percent). More cabezon were caught by skiff fishermen along this section of coast than in either the central or northern section. In fact, cabezon were more numerous in the catch than lingcod.

The bottom fishery inside Morro Bay was primarily for California halibut. This species made up 17.17 percent of the bay catch. Even though California halibut was the most sought for species, starry flounder and jacksmelt were the principal species taken, contributing 41.3 and 19.9 percent of the catch, respectively. Bottom fishermen had fair success catching Pacific bonito in this area, 20 being caught off Morro Bay and 81 off Avila.

Very little trolling was recorded at Cayucos, only 281 hours being devoted to this method. Probably most of the trolling was for salmon, but only 9.7 percent of the Cayucos troll catch was king salmon. Salmon were not recorded at Morro Bay during 1959; Pacific bonito were the dominant fish in the troll catch. Most trolling at Avila, at least through the early part of summer, was for salmon. Evidently the sport salmon fishery has developed since 1956. Actually, 1958 was a better salmon fishing year at Avila then 1959; in 1958, 3,619 anglers landed 1,444 salmon from May through November. In 1959, 4,916 anglers landed 85 salmon from March through November.

Trollers at Avila, during the late summer and fall, fished primarily for Pacific bonito, California barracuda, and California yellowtail; these three species formed 37.8 percent of the troll catch during 1959. Although both kelp bass and señorita were observed in the catches of skiff fishermen at Monterey, which is farther from the geographical center of abundance for these species than Cayucos, Morro Bay, or Avila, neither species was recorded at these latter three ports.

8.6.3. *Catch-Per-Unit-of-Effort*

Bottom fishermen and trollers at Cayucos recorded the highest monthly catch-per-hour in the bottom fishery (August), and in the troll fishery (July) of the three adjacent skiff-fishing areas. The best months for tolling were July and August, and for bottom fishing, August, and November. Although the lowest average catch-per-hour values for any skiff bottom fishery were recorded in this area, the troll fishery average was the highest we recorded over the entire survey area.

9. GENERAL RESULTS[3]

Only the more salient results, those which present a general overall picture of the sport fisheries, their interrelationships, and relationship to the commercial fishery will be given.

9.1. Species Composition

Approximately 3,218,000 fish weighing 4,370,000 pounds were landed annually by hook-and-line and spear fishermen from 1958-1960 (Table 12) ; 125 species were recorded in this catch. In addition, about 400,000 pounds of surf smelt were taken annually in 42,400 net-days of fishing. Night smelt fishing was not surveyed, and reports indicate this fishery may be nearly as large as the surf smelt fishery. Not elaborated on in this report were catches of eulachon around the mouths of the Smith and Klamath Rivers, Pacific lamprey gaffing at the Klamath River, and Pacific herring fishing inside Noyo Harbor and several estuaries between Humboldt Bay and San Pablo Bay. This report does not cover the sport fishery for clams, crabs, scallops, and abalone except for the total skindiver take of abalones.

Several species, observed when not sampling or reliably reported by sportsmen, but not included were a tiger rockfish seen at Santa Cruz, and a sargo reported from Morro Bay. Several groups of fishes not often separated into species by the samplers, were smooth-hounds, some skates and rays, copper rockfish and whitebelly rockfish, and pink rockfish and greenspotted rockfish. The market crab is usually not a hook-and-line species, but some have been caught by this method. Crab traps are used by skiff fishermen and sometimes by partyboat fishermen. We have included market crab and octopus data as part of the hook-and-line fishery inasmuch as these catches were reported on partyboat logs and the actual method of take is not known.

of the 125 species of fish, the 20 most abundant made up about 80 percent of the total number caught, and the 20 contributing the most weight made up 85 percent of the total poundage.

The 305,335 blue rockfish totaled were followed by 288,810 white croaker and 273,505 barred surfperch, in that order. By weight, lingcod contributed over 410,000 pounds, followed by blue rockfish and striped bass with about 400,000 and 389,000 pounds, respectively (Table 12, Figure 12).

The species of major importance to the entire sport fishery were those which contributed materially to both numbers and weight; these included: blue rockfish, lingcod, striped bass, king salmon, silver salmon, white croaker, jacksmelt, barred surfperch, redtail surfperch, yellowtail rockfish, black rockfish, shiner perch, vermilion rockfish, and walleye surfperch. The aggregate of all others is important, but any one of the remaining species could be eliminated without seriously affecting the fishery, even though a segment of the fishery might be adversely affected. The serious decline of any of the major

[3] A summary of the general results of this survey were published in the 15th Annual Report of the Pacific Marine Fisheries Commission (Miller, 1963). Since that manuscript was prepared, additional data were included in the total sportfish figures which altered slightly the actual percentages, especially on Figure 13 of this report which appeared in Figure 16 of the P.M.F.C. report. The overall relationships and conclusions of the two manuscripts remain unchanged.

TABLE 12

Average Annual Catch (by Numbers) of Pier, Skindiving, Shore, Partyboat, and Skiff Fishermen, and Total Catch (by Numbers and Weight) Oregon-Point Arguello, 1958–1961

Species	Pier	Skindiving	Shore	Partyboat	Skiff	Total	Percent comp. by numbers	Average weight in pounds	Total catch in pounds	Percent comp. by weight
ROCKFISH	**11,899**	**9,790**	**35,317**	**682,484**	**179,779**	**919,269**	**28.57**	**1.83**	**1,685,680**	**38.57**
Blue	605	3,076	14,239	215,197	72,218	305,335	9.49	1.31	400,000	9.15
Black	2,082	2,376	10,887	19,132	29,690	64,167	1.99	2.89	185,440	4.24
Olive	562	435	55	42,087	4,542	48,281	1.50	1.92	92,700	2.12
Yellowtail	0	8	0	145,446	4,596	150,050	4.66	1.73	259,580	5.94
Copper	47	223	332	25,374	19,304	45,300	1.41	2.53	114,610	2.62
Vermilion	37	121	0	30,180	4,630	34,968	1.09	3.90	136,370	3.12
Brown	1,731	1	53	8,820	7,061	17,676	0.55	2.50	44,190	1.01
Gopher	0	187	70	18,645	9,710	28,612	0.89	1.17	33,470	0.77
Bocaccio	3,954	134	46	38,251	1,423	43,808	1.36	3.40	148,950	3.41
China	0	388	24	2,321	1,336	4,069	0.13	1.86	7,570	0.17
Black-and-yellow	8	612	1,048	498	3,770	5,936	0.18	0.95	5,640	0.13
Grass	638	579	7,665	1	3,746	12,629	0.39	1.90	24,000	0.55
Kelp	513	1,650	328	122	593	3,206	0.10	1.25	4,000	0.09
Rosy	0	0	0	22,785	3,965	26,750	0.83	0.46	12,310	0.28
Widow	0	0	0	21,094	49	21,143	0.66	1.70	35,940	0.82
Speckled	0	0	0	2,926	0	2,926	0.09	1.50	4,390	0.10
Greenspotted	0	0	0	14,183	33	14,216	0.44	1.36	19,330	0.44
Greenstriped	0	0	0	2,425	0	2,425	0.07	0.70	1,700	0.04
Canary	0	0	96	34,067	10,294	44,457	1.38	1.65	73,350	1.68
Starry	0	0	0	16,996	626	17,622	0.55	1.40	24,670	0.57
Flag	0	0	0	1,863	40	1,903	0.06	1.70	3,230	0.07
Turkey-red	0	0	0	1,059	1,288	2,347	0.07	5.30	12,440	0.29
Cow	0	0	0	1,633	34	1,667	0.05	4.00	6,670	0.15
Quillback	0	0	0	187	601	788	0.02	1.75	1,370	0.03
Chilipepper	0	0	0	2,165	7	2,172	0.07	2.62	5,690	0.12
Squarespot	0	0	0	1,377	123	1,500	0.05	0.36	540	0.01
Stripetail	0	0	0	85	0	85	T	0.60	50	T
Treefish	0	0	0	127	89	216	0.01	2.30	500	0.01
Calico	0	0	0	94	0	94	T	1.28	120	T
*Rockfishes	1,722	0	454	12,734	11	14,921	0.46	1.80	26,860	0.61

TABLE 12
Average Annual Catch (by Numbers) of Pier, Skindiving, Shore, Partyboat, and Skiff Fishermen, and Total Catch (by Numbers and Weight) Oregon-Point Arguello, 1958–1961

FLATFISH	**22,735**	**32**	**14,456**	**4,647**	**29,968**	**71,838**	**2.23**	**0.77**	**55,250**	**1.27**
Starry flounder	7,271	16	4,333	87	2,686	14,393	0.45	1.26	18,220	0.42
Rock sole	0	8	19	889	2,069	2,985	0.09	1.38	4,120	0.09
Sand sole	2,570	0	8,536	29	1,636	12,771	0.40	0.57	7,230	0.17
Pacific sanddab	4,986	0	1,135	1,946	21,008	29,075	0.90	0.24	6,980	0.16
Petrale sole	0	0	0	1,325	1,647	2,972	0.09	1.83	5,440	0.12
California halibut	0	0	19	144	692	855	0.03	7.40	6,320	0.14
English sole	330	0	0	1	52	383	0.01	1.00	380	0.01
Dover sole	0	0	0	0	46	46	T	0.43	20	T
Scaly-fin sole	0	0	23	14	100	137	T	2.26	310	0.01
Pacific halibut	0	0	287	1	23	311	0.01	5.00	160	T
Rex sole	0	0	17	40	0	57	T	0.50	30	T
Diamond turbot	0	8	0	0	0	8	T	1.25	10	T
Curlfin turbot	0	0	0	0	9	9	T	1.11	10	T
C-O turbot	0	0	58	0	0	58	T	0.51	30	T
*Flatfishes	7,578	0	29	171	0	7,778	0.24	0.76	5,990	0.14
SURFPERCH	**497,584**	**4,923**	**742,668**	**25**	**8,553**	**1,253,753**	**38.96**	**0.73**	**924,406**	**21.15**
Redtail	1,790	0	163,311	4	159	165,264	5.14	1.80	297,470	6.81
Calico	12,930	0	39,656	0	65	52,651	1.64	0.80	42,120	0.96
Barred	51,446	0	222,036	0	23	273,505	8.50	1.00	273,500	6.26
Walleye	89,075	0	68,992	0	3,204	161,271	5.01	0.30	48,380	1.11
Shiner	173,270	0	18,309	0	130	191,709	5.96	0.06	11,500	0.26
Silver	31,898	0	110,561	0	137	142,596	4.43	0.10	14,260	0.33
Striped	2,363	2,597	66,340	11	1,535	72,846	2.26	1.20	87,630	2.00
White	12,349	48	15,046	0	1,672	29,115	0.90	0.60	17,470	0.40
Black	4,094	441	5,272	0	813	10,620	0.33	0.80	8,500	0.19
Rubberlip	3,425	382	761	0	214	4,782	0.15	2.00	9,560	0.22
Rainbow	1,042	233	6,239	0	5	7,519	0.23	0.60	4,510	0.10
Pile	13,866	1,219	6,643	0	586	22,314	0.69	1.20	26,780	0.61
Dwarf	402	0	414	0	0	816	0.02	0.20	160	T
Reef	18	0	246	0	0	264	0.01	0.30	80	T
Spotfin	555	0	184	0	0	739	0.02	0.10	70	T
Sharpnose	5	3	0	0	0	8	T	0.50	4	T
Pink	0	0	0	0	10	10	T	0.20	2	T
*Surfperches	99,056	0	18,658	10	0	117,724	3.66	0.70	82,410	1.89
COTTIDS	**16,971**	**1,282**	**29,661**	**1,718**	**5,761**	**55,393**	**1.72**	**1.46**	**81,010**	**1.85**
Cabezon	2,048	1,270	28,051	1,696	5,248	38,313	1.19	2.00	76,620	1.75
Red Irish lord	0	0	168	8	19	195	0.01	0.50	100	T
Brown Irish lord	30	0	75	0	9	114	T	0.60	70	T
Pacific staghorn sculpin	14,772	0	484	0	154	15,410	0.48	0.20	3,080	0.07
Buffalo sculpin	121	12	198	14	326	671	0.02	1.20	800	0.02
*Cottids	0	0	685	0	5	690	0.02	0.50	340	0.01

TABLE 12—Cont'd.

TABLE 12—Continued

Average Annual Catch (by Numbers) of Pier, Skindiving, Shore, Partyboat, and Skiff Fishermen, and Total Catch (by Numbers and Weight) Oregon-Point Arguello, 1958–1961

Species	Pier	Skindiving	Shore	Party boat	Skiff	Total	Percent comp. by numbers	Average weight in pounds	Total catch in pounds	Percent comp. by weight
SHARKS, SKATES, RAYS	**5,904**	**16**	**1,293**	**41**	**400**	**7,654**	**0.24**	**5.34**	**40,820**	**0.93**
Round stingray	0	8	0	0	66	74	T	2.00	150	T
Pacific electric ray	0	8	0	0	0	8	T	2.50	20	T
Bat ray	56	0	45	0	24	126	T	8.00	1,000	0.02
*Stingrays	0	0	23	0	0	21	T	7.50	170	T
Longnose skate	0	0	0	0	5	5	T	2.00	10	T
California skate	217	0	0	0	0	217	0.01	3.50	760	0.02
Big skate	145	0	23	0	9	177	T	3.50	620	0.01
*Skates and rays	1,661	0	139	3	0	1,803	0.06	3.00	5,400	0.12
Spiny dogfish	199	0	37	10	51	297	0.01	5.00	1,490	0.03
Leopard shark	2,143	0	273	0	81	2,497	0.08	8.00	19,920	0.46
Blue shark	0	0	0	3	33	36	T	30.00	1,080	0.02
Swell shark	73	0	0	0	0	73	T	8.00	580	0.01
*Smoothhounds	724	0	0	0	98	822	0.03	3.00	2,220	0.05
*Sharks	555	0	724	19	0	1,298	0.04	5.00	6,490	0.15
Pacific angel shark	0	0	28	0	7	35	T	4.80	170	T
Shovelnose guitarfish	131	0	0	6	26	163	T	4.00	640	0.01
MISCELLANEOUS	**478,970**	**5,572**	**201,521**	**111,466**	**112,710**	**910,239**	**28.29**	**1.74**	**1,582,768**	**36.22**
Ratfish	0	0	0	0	3	3	T	1.00	3	T
Green sturgeon	0	0	8	0	0	8	T	15.00	120	T
American shad	149	0	0	0	0	149	T	0.40	60	T
Pacific herring	333	0	48	0	0	381	0.01	0.15	60	T
Pacific sardine	0	0	0	56	6	62	T	0.16	10	T
Northern anchovy	10,089	0	0	0	0	10,089	0.31	0.08	800	0.02
King salmon	64	0	16	35,323	9,117	44,520	1.38	8.00	356,160	8.15
Silver salmon	0	0	174	2,482	6,444	9,100	0.28	7.00	63,700	1.46
Pink salmon	0	0	0	0	4	4	T	5.00	20	T
*Salmon	0	0	0	130	0	130	T	7.50	980	0.02
Steelhead rainbow trout	0	0	45	0	17	62	T	4.00	250	0.01
Surf smelt	834	0	0	0	0	834	0.03	0.10	80	T
Night smelt	276	0	0	0	0	276	0.01	0.07	20	T
*True smelts	857	0	0	0	0	857	0.03	0.10	80	T
Pacific hake	0	0	0	19	60	79	T	1.00	80	T

TABLE 12
Average Annual Catch (by Numbers) of Pier, Skindiving, Shore, Partyboat, and Skiff Fishermen, and Total Catch (by Numbers and Weight) Oregon-Point Arguello, 1958–1961

Pacific tomcod	781	0	7,487	3	5	8,276	0.26	0.15	1,240	0.03
Kelp bass	0	44	59	0	24	127	T	1.50	190	T
Sand bass	0	10	0	0	13	23	T	2.00	50	T
Striped bass	5,099	0	38,840	30,767	27	74,733	2.32	5.20	388,610	8.89
Giant sea bass	0	0	0	0	4	4	T	10.00	40	T
Ocean whitefish	0	0	0	1	9	10	T	1.20	120	T
California yellowtail	0	0	0	0	25	25	T	20.00	500	0.01
Jack mackerel	2,522	0	0	9,403	1,854	13,779	0.43	0.60	8,270	0.19
White seabass	0	0	9	11	51	68	T	18.20	1,230	0.03
White croaker	218,206	0	14,899	1,024	54,681	288,810	8.98	0.51	147,290	3.37
Queenfish	4,284	0	0	0	0	4,284	0.13	0.19	810	0.02
Halfmoon	0	4	0	0	0	4	T	1.25	5	T
Opaleye	0	94	0	0	0	94	T	2.00	190	T
Senorita	0	0	1,137	0	14	1,151	0.03	0.09	100	T
California sheephead	0	32	0	0	0	32	T	3.65	120	T
Pacific mackerel	54	0	0	3,942	5,226	9,222	0.29	0.57	5,260	0.12
Pacific bonito	0	0	0	68	476	544	0.02	8.00	4,350	0.10
Albacore	0	0	0	176	0	176	T	15.00	2,640	0.06
Sablefish	0	0	0	117	43	160	T	0.25	40	T
Kelp greenling	1,119	2,093	49,341	521	3,579	56,653	1.76	0.84	47,610	1.09
Rock greenling	88	156	15,897	0	333	16,474	0.51	0.80	13,180	0.30
Painted greenling	0	1	0	0	0	1	T	0.80	1	T
Lingcod	1,312	2,923	3,045	25,595	18,378	51,253	1.59	8.00	410,030	9.38
Giant kelpfish	85	24	159	0	0	268	0.01	1.20	320	0.01
Onespot fringehead	0	0	104	0	0	104	T	0.10	10	T
*Clinids	0	0	819	0	27	846	0.03	0.12	100	T
Wolf-eel	13	126	0	2	56	197	0.01	10.00	1,970	0.05
Monkeyface eel	0	11	710	0	9	730	0.02	3.00	2,190	0.05
Rock eel	0	0	64	0	0	64	T	1.88	120	T
*Eels	0	0	0	3	0	3	T	2.00	6	T
Pacific pompano	27	0	0	0	0	27	T	0.38	10	T
California barracuda	480	0	0	5	135	620	0.02	4.00	2,480	0.06
Topsmelt	42,607	0	57	0	0	42,664	1.33	0.25	10,670	0.24
Jacksmelt	189,570	0	68,606	1,665	12,059	272,000	8.45	0.40	108,800	2.49
*Atherinids (Smelts)	0	0	0	10	0	10	T	0.30	3	T
Mola	21	54	0	0	31	105	T	15.00	1,590	0.04
Market crab	0	0	0	44	0	44	T	2.00	90	T
Octopus	0	0	0	3	0	3	T	3.00	10	T
Unidentified fish	0	0	0	96	0	96	T	1.00	100	T
TOTAL FISH	1,034,053	21,615	1,024,916	803,331	337,171	3,218,146	100.01	1.36	4,389,934	99.99
Total angler days	530,702	39,700	603,097	115,701	121,038	1,410,238				

* May include more than one species.

TABLE 12—Cont'd.

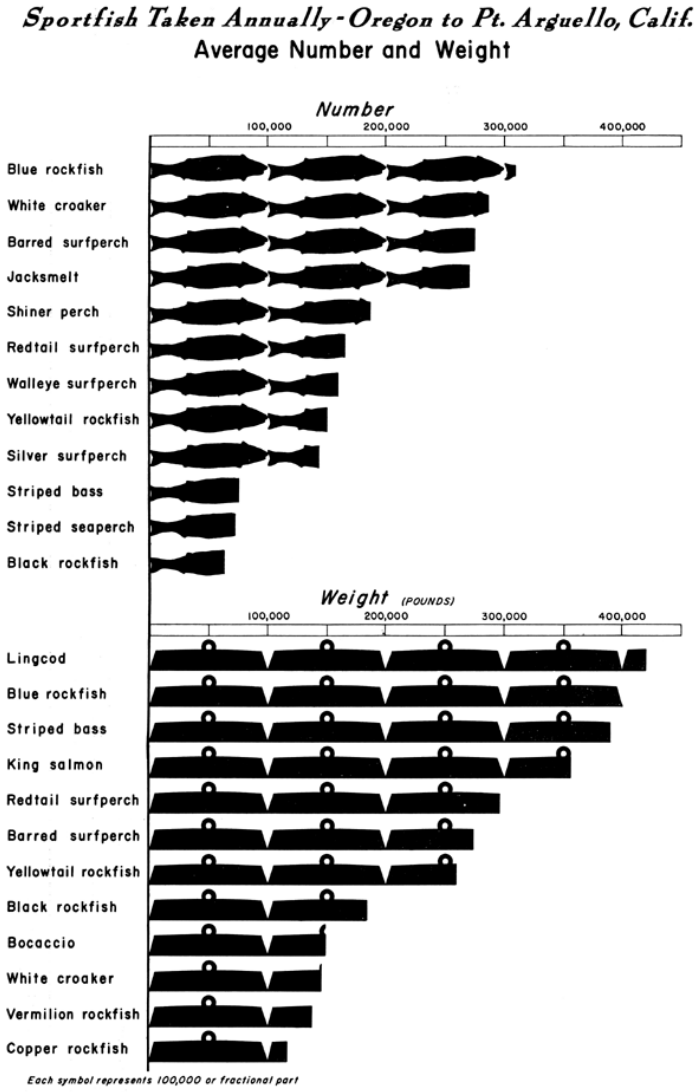


FIGURE 12. Twelve most frequently caught species by numbers and weight, all methods, taken annually—Oregon to Point Arguello, California.

FIGURE 12. Twelve most frequently caught species by numbers and weight, all methods, taken annually—Oregon to Point Arguello, California

species would adversely affect at least one, and most likely several fisheries. Lingcod and blue rockfish were important in all except the pier fishery, and several rockfishes and surfperches appeared in large numbers in at least four of the fisheries (Table 13) .

TABLE 13

Five Most Frequently Landed Species by Numbers and Weight for Each Fishing Method, 1958–1961, Oregon to Point Arguello

Method	Rank	Species by numbers	Species by weight
Party boat	1	Blue rockfish	Blue rockfish
	2	Yellowtail rockfish	King salmon
	3	Olive rockfish	Yellowtail rockfish
	4	Bocaccio	Lingcod
	5	King salmon	Striped bass
Skindiving	1	Blue rockfish	Lingcod
	2	Lingcod	Black rockfish
	3	Striped seaperch	Blue rockfish
	4	Black rockfish	Striped seaperch
	5	Kelp greenling	Kelp rockfish
Skiff	1	Blue rockfish	Lingcod
	2	White croaker	Blue rockfish
	3	Black rockfish	Black rockfish
	4	Pacific sanddab	King salmon
	5	Copper rockfish	Copper rockfish
Shore	1	Barred surfperch	Redtail surfperch
	2	Redtail surfperch	Barred surfperch
	3	Silver surfperch	Striped bass
	4	Walleye surfperch	Cabezon
	5	Jacksmelt	Kelp greenling
Pier	1	White croaker	White croaker
	2	Jacksmelt	Jacksmelt
	3	Shiner perch	Barred surfperch
	4	Walleye surfperch	Walleye surfperch
	5	Barred surfperch	Shiner perch

TABLE 13
Five Most Frequently Landed Species by Numbers and Weight for Each Fishing Method, 1958–1961, Oregon to Point Arguello

Blue rockfish was first numerically in the partyboat, skindiving, and skiff catches. Shore fishing was dominated by barred surfperch from Half Moon Bay southward, and by redtail surfperch from Princeton northward. White croaker, jacksmelt, and shiner perch were important in pier catches, and white croaker and jacksmelt were of prime value to shore casters and skiff fishermen.

By weight, lingcod was first in the skindiving and skiff catches, and fourth in the partyboat catch. Blue rockfish was first by weight in the partyboat catch, and white croaker was first in the pier catch.

These relative rankings by numbers and weight are actually to be considered as "general-importance ratings" rather than exact positions of value. In any one year, rankings could shift considerably with even a slight increase or decrease in the catch of any one of the top eight or nine species, either by weight or by numbers.

During our study, king salmon numbers were below average and blue rockfish catches were declining during 1959 and 1960 at several ports. Lingcod were probably relatively abundant during this time, and striped bass were at a high level after 1957. Thus, in another 3-year period when salmon would be at a peak of abundance as in 1955 and 1956, or blue rockfish at a peak as in 1957 and 1958, the rankings could be altered somewhat with striped bass, lingcod, yellowtail rockfish, and white croaker still yielding large catches, but ranking much lower

in relation to greater abundance of salmon and blue rockfish. Should blue rockfish and possibly lingcod become less available or abundant in future years, species such as yellowtail rockfish, olive rockfish, bocaccio, vermilion rockfish, and black rockfish would become even more valuable to bottom fishermen. Bottomfish catches increased along the north coast area, especially at Bodega Bay, Point Arena, and Fort Bragg when salmon became scarce in 1958 and 1959. Likewise, skiff fishermen in Monterey Bay turned more to bottomfishing during the poor salmon years.

Partyboat log data from 1960 through 1961 demonstrated clearly how the take of species can vary considerably from year to year (Table 14) . When the salmon catch dropped from a high level in 1956 to a

TABLE 14

Partyboat Catch by Numbers for Major Groupings of Fish, Number of Angler-Days, and Number of Boats Reporting at All Ports From Crescent City to Avila, 1956–1961 *

	1956	1957	1958	1959	1960	1961
Rockfish	653,331	637,331	1,046,113	874,623	677,246	511,985
Salmon	114,412	44,695	52,666	55,944	37,930	42,960
Lingcod	22,836	31,383	35,184	27,836	25,534	21,341
Striped bass	--	--	--	--	30,856	42,357
Cabezon	8,434	7,544	5,197	4,136	1,939	1,900
Flatfish	9,636	9,487	3,977	3,120	2,663	5,429
All others	34,462	10,760	23,116	14,206	12,591	7,717
TOTAL	**843,111**	**741,200**	**1,166,253**	**979,865**	**788,759**	**633,689**
Number angler days	152,919	106,374	107,795	120,740	115,111	114,925
Number boats reporting	263	226	178	205	186	189

* Data from partyboat logs compiled at Terminal Island. No striped bass catches were included for the Bay Area during 1956–1959.

TABLE 14
*Partyboat Catch by Numbers for Major Groupings of Fish, Number of Angler-Days, and Number of Boats Reporting at All Ports From Crescent City to Avila, 1956–1961**

a low in 1957, there was a concurrent decrease in the 1957 catch of most other groups of fish except lingcod. In 1958 and 1959, rockfish catches increased sharply, partly because of increased bottom fishing effort in lieu of salmon fishing, and partly because large numbers of good-sized blue rockfish were present at all ports from Bodega Bay to Avila. Over 50 percent of the partyboat catch by numbers at Morro Bay and Avila was of blue rockfish in 1957 and 1958, and nearly 40 percent in 1959. In 1960 and 1961, blue rockfish catches started to decline and concurrently so did the total rockfish catch for central and northern California. The 50 percent decline in the rockfish catch from 1958 to 1961 cannot be explained by a return of effort to salmon trolling as catches of salmon were actually higher in 1958 than in 1961. All data have not been analyzed for 1961, but the relative scarcity of blue rockfish at several ports during 1961 seems to be a primary factor in this decline. Or perhaps the increased catch of the larger yellowtail rockfish, bocaccio, and vermilion rockfish may have resulted in a decrease of numbers of rockfish in relationship to the blue rockfish, but may have actually increased the weight of total rockfish in the partyboat fishery.

Throughout 1957–61, partyboat salmon catches remained low, ranging from 37,930 fish in 1960 to 52,666 in 1958. Lingcod were at a high level in 1957 and 1958, but declined slightly each year thereafter.

The cabezon catch illustrated the steadiest decline by numbers from 1956 to 1961. Flatfish also showed a slight, steady decline by numbers from 1956 to 1961, but throughout the period were of minor significance in the partyboat catch.

In 1954 and 1956, large numbers of young bocaccio (mistakenly called "tomcod" or "red snapper" by most people) concentrated inshore around piers from Santa Barbara to Eureka. Hundreds of thousands of these small fish were taken throughout the summer, and should a heavy inshore run reappear, the ranking sequence in numbers would be considerably altered. The relative position by weight would not be too affected, as these juvenile fish averaged around 6 to 10 per pound.

Regardless of how the exact ranking would be, the most important species listed in this report can be expected to continue to be the valuable ones. Barred surfperch and redtail surfperch can be expected to continue to yield large numbers because good populations apparently are present, and most surf areas are only lightly utilized. In spite of its being a "low status" and sometimes strong-flavored fish, the white croaker is important in the pier and skiff catches.

By major groupings, rockfishes and surfperches greatly dominated the catch in all hook-and-line methods. Surfperch made up 39.0 percent of the total catch by numbers and 21.2 percent by weight (Table 12 and Figure 13). Rockfish made up 28.6 and 38.6 percent of the total catch by numbers and weight, respectively.

Croakers, mainly white croaker, ranked third numerically, followed by greenlings, basses, flatfish, and salmons. By weight, salmons, lingcod, and basses followed the surfperches and rockfishes.

Most fishermen consider some fish of higher sport value than others, mainly because of size or fighting ability. The fishes having the highest statuses in this area of the coast were king salmon, silver salmon, striped bass, lingcod, California halibut, Pacific albacore, and white seabass, so, a relatively large amount of effort was expended in pursuit of them. In spite of this effort, the poor catch-per-hour values recorded for these species tended to lower considerably the overall average catch-per-hour of ocean sport fishermen. When fishing for the more numerous schooling species such as blue rockfish, yellowtail rockfish, and surfperches, the catches were considerably higher. The value of these species lies more in their aggregate weight, than in the catch of an individual fish (except for children on piers who can be thrilled to ecstasy upon catching a 3-inch perch). Catch-per-day values for salmon trollers on party boats averaged around 1.3 fish, as compared to the 11 to 15 fish averages recorded at the various bottomfishing ports. Likewise, surfperch catch-per-hour values were around 0.5 fish as compared to 0.05 striped bass at the same beaches.

Thus, catch-per-unit-of-effort values referred to in this report are useful only in a general way. Included in each computation are multispecies catches, and, at times, preferred, "high-status" species as well as the "aggregate-valued" species. Catch-per-day figures for Año Nuevo fishermen include "preferred" lingcod along with rockfishes taken either incidentally while fishing for lingcod or purposefully on days when lingcod were not plentiful. In many cases, smaller species

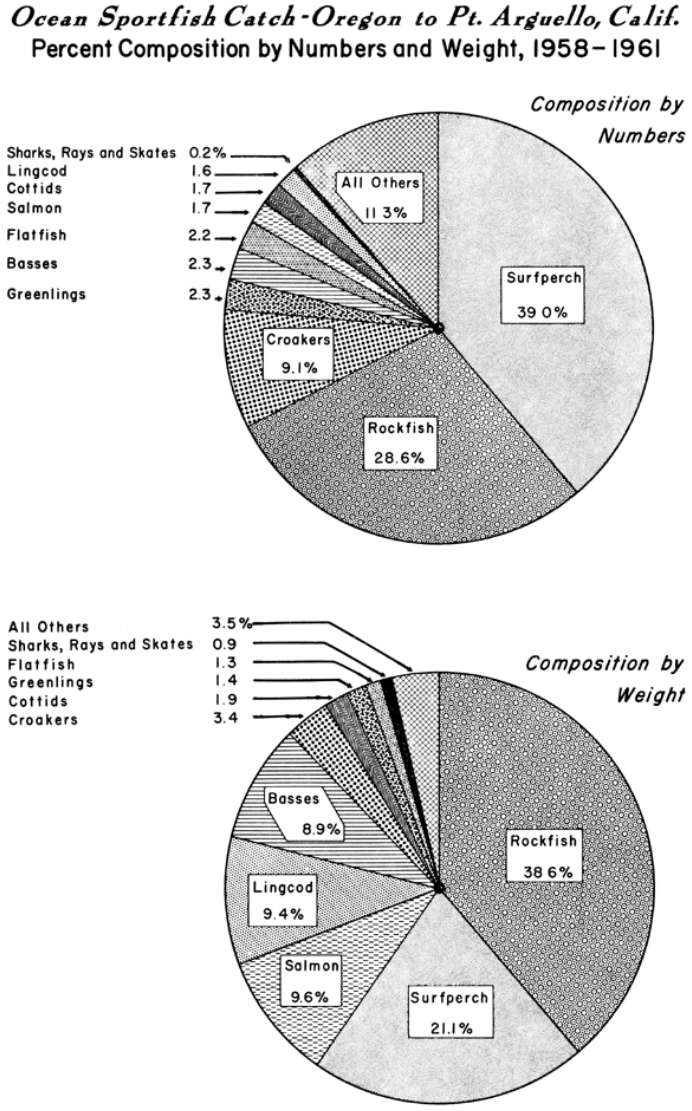


FIGURE 13. Average annual percent composition by numbers and weight by major groupings of sport fish, all methods, Oregon to Point Arguello, California.

FIGURE 13. Average annual percent composition by numbers and weight by major groupings of sport fish, all methods, Oregon to Point Arguello, California

such as blue rockfish are valuable as "fillers" much as are kelp bass in southern California. Both blue rockfish and kelp bass are small, but good-eating species providing good sport and food. These species are of major importance to the livelihood of many fishing concessionaires.

Most of these "aggregate valued" species are good-eating, and sometimes are preferred by fishermen who consider trolling for salmon or fishing for large lingcod too slow and want more action than the less-than-one-fish-per-day average for combined partyboat and skiff trollers. The good-eating rockfishes, surfperches, and flatfishes are pursued by a large group of fishermen who account for the major portion of ocean sportfishing effort. In each fishery, however, there are individuals who seek only the big "status" fishes as well as those after the aggregate species.

Included in our description of the sub-areas is a listing within each sub-area of the top six ranking species taken by numbers for each fishing method (Table 15) . In each sub-area there are 30 first to sixth place rankings, thus in the five sub-areas there are a total of 150 individual rankings. A tally of the number of occurrences (regardless of rank) was made of each species appearing in Table 15, and an interesting frequency array resulted. In all, 35 species were involved. All of the 20 top ranking species by numbers and weight (Table 12) appeared in this frequency. Thus, this appearance of species in this frequency ranking may be another indication of the value of a species in the total sport fishery.

Blue rockfish, the first by numbers and second by weight of all species in the total catch, was tied for first in this frequency rating with black rockfish, which ranked only 12th by number and 8th by weight in the total catch. Black rockfish is possibly more "important" than indicated by the total catch values in that it is of importance in four subareas in both the skindiving and skiff catches and in three subareas in the partyboat catch. These frequency ratings may also be an indication of the potential value of a species should the abundance of the species change abruptly. If a species such as the black rockfish is available to several fishing methods over a wide area of the coast the potential increased take with increased abundance can be assessed. If this species was at a peak of abundance during this study period, then no more importance or much increased take of this species could be expected in the future, inasmuch as it was evidently available to several fishing methods over a wide range of the coast. If blue rockfish became scarce throughout the study area, it is obvious that several fisheries in several areas would be adversely affected.

Cabezon ranked 7th in this frequency rating but was only 16th by total weight and was not within the top 20 by numbers. However, five of the eight occurrences were in the skindiving category which is of relatively minor significance in numbers and weight of fish taken. Thus, the importance of cabezon appears to be distorted in these frequency ratings. Kelp greenling on the other hand was 4th in these frequency ratings but only 13th by numbers and 20th by weight in the total catch. In this case, kelp greenling is probably more important than indicated by the total catch figures in that it appeared in the frequency data in four methods and in four sub-areas in the shore and skindiving catches.

TABLE 15

Six Most Frequently Landed Species in Five Sub-Areas of the Study Area by Method

	Shore	Skindiving	Skiff	Party boat	Pier
Oregon-Fort Bragg					
1	Redtail surfperch	Black rockfish	Black rockfish	Silver salmon	Walleye surfperch
2	Silver surfperch	Lingcod	King salmon	King salmon	Jacksmelt
3	Kelp greenling	Kelp greenling	Silver salmon	Black rockfish	Shiner perch
4	Jacksmelt	Cabezon	Lingcod	Lingcod	Northern anchovy
5	Striped seaperch	Copper rockfish	Copper rockfish	Copper rockfish	Kelp greenling
6	Walleye surfperch	Striped seaperch	Kelp greenling	Vermilion rockfish	Redtail surfperch
Noyo Harbor-Golden Gate					
1	Kelp greenling	Lingcod	Copper rockfish	Blue rockfish	Shiner perch
2	Striped seaperch	Blue rockfish	Lingcod	Black rockfish	Pacific staghorn sculpin
3	Cabezon	Black rockfish	Blue rockfish	Copper rockfish	Walleye surfperch
4	Silver surfperch	Striped seaperch	Canary rockfish	Brown rockfish	White surfperch
5	Walleye surfperch	Kelp greenling	Black rockfish	Canary rockfish	Jacksmelt
6	Redtail surfperch	Cabezon	Brown rockfish	Lingcod	Pile perch
San Francisco-Davenport					
1	Redtail surfperch	Lingcod	White croaker	Blue rockfish	Shiner perch
2	Striped bass	Cabezon	Blue rockfish	Striped bass	Jacksmelt
3	Walleye surfperch	Black rockfish	Black rockfish	King salmon	Walleye surfperch
4	Silver surfperch	Kelp greenling	Canary rockfish	Yellowtail rockfish	White croaker
5	Jacksmelt	Black-and-yellow rockfish	Lingcod	Black rockfish	Pile perch
6	Kelp greenling	Striped seaperch	Brown rockfish	Copper rockfish	Silver surfperch
Davenport-Yankee Point					
1	Barred surfperch	Kelp rockfish	Blue rockfish	Blue rockfish	White croaker
2	Striped seaperch	Striped seaperch	White croaker	Yellowtail rockfish	Jacksmelt
3	Jacksmelt	Blue rockfish	Pacific sanddab	Widow rockfish	Walleye surfperch
4	Walleye surfperch	Lingcod	Jacksmelt	Canary rockfish	Shiner perch
5	Calico surfperch	Cabezon	Black rockfish	Rosy rockfish	Topsmelt
6	White croaker	Pile perch	Lingcod	Olive rockfish	Barred surfperch
Yankee Point-Point Arguello					
1	Barred surfperch	Black perch	Blue rockfish	Blue rockfish	White croaker
2	Jacksmelt	Pile perch	Gopher rockfish	Yellowtail rockfish	Jacksmelt
3	Silver surfperch	Blue rockfish	Copper rockfish	Olive rockfish	Barred surfperch
4	Calico surfperch	Black rockfish	Cabezon	Bocaccio	Walleye surfperch
5	Cabezon	Kelp greenling	Vermilion rockfish	Vermilion rockfish	Silver surfperch
6	Kelp greenling	Cabezon	Black-and-yellow rockfish	Canary rockfish	Shiner perch

TABLE 15
Six Most Frequently Landed Species in Five Sub-Areas of the Study Area by Method

Several other species showed considerably lesser importance in these frequency ratings than was indicated by total catch ratings. These were the redtail surfperch, barred surfperch, yellowtail rockfish, and striped bass. All these are species occurring in large numbers or averaging a large weight, but appear in no more than two methods and along certain sections of the coast.

9.2. Relative Success of Fishing Methods

Catch-per-unit-of-effort values demonstrate the relative success of each fishing method (Figure 8). Partyboat fishermen spend the longest day, averaging around 7 hours. These boats may travel up to 2 ½ hours from port to fishing grounds, and hence must put in a good day's fishing to insure a good catch. Most boats operate on a schedule, usually departing around 6 or 7 AM and returning around 3 or 4 PM. Others may remain fishing until a good catch is made, but very few remain out later than 4 PM.

The average catch-per-day for all partyboat effort was 6.9 fish: 1.7 for trolling, and 11.1 for partyboat bottomfishing.

Skiff fishermen put in the second longest fishing day, averaging 3.8 hours for trolling and bottomfishing combined. The trolling day was 4.2 hours and the bottomfishing day 3.2 hours. Troll catches averaged about 0.5 fish-per-day as compared to 4.0 for skiff bottomfishermen.

Skindivers spent the least time fishing-per-day, less than 1 hour, and caught about 0.5 fish. Pier and shore fishing day-lengths were similar: 3.0 and 3.5 hours, respectively.

Due to the extreme variation in the length of a day's fishing, (7 hours for partyboat bottomfishing and less than 1 hour for skindivers) only catch-per-hour figures can indicate true comparative success between methods.

In this case, partyboat fishermen still recorded the best catches, but only while bottomfishing. The highest catch-per-hour (1.4 fish) was by partyboat bottomfishermen, followed by skiff bottomfishermen (1.0 fish), pier fishermen (0.6 fish), skindivers (0.6 fish), and shore fishermen (0.5 fish).

Trolling catches were poorer than bottom, shore, and pier catches. Partyboat trollers recorded 0.3 and skiff trollers 0.1 fish-per-hour.

9.3. Catch and Effort by Method

The largest effort was expended by shore fishermen, with 42.8 percent of the total effort, followed closely by pier fishermen with 37.6 percent. Thus, over 80 percent of all ocean-fishing effort involved these two methods. Skiff fishermen recorded the third largest effort (8.6 percent), followed by party boat and skindiving with 8.2 and 2.8 percent, respectively.

Pier fishermen made the largest aggregate catch: 1,034,000 fish representing 32.1 percent of total. Shore fishermen recorded the second largest aggregate catch (31.9 percent of the total number), followed by party boat, skiff, and skindiving with 24.9, 10.5, and 0.7 percent, respectively.

The partyboat fishery, however, recorded the largest catch by weight because of relatively large fish, such as striped bass, salmon, lingcod,

and vermilion rockfish, along with large numbers of average-sized blue rockfish. Weight data were calculated only for the partyboat catch, and for skiff and skindiving catches at certain localities.

9.4. Sport Fishery by Areas of the Coast

Areas where certain species were concentrated or where physical shoreline features were unique, often caused vast anomalies in fishing, method, effort, and yield. The presence or absence of key species such as striped bass, salmon, lingcod, surf smelt, rockfish, and California halibut was very important, especially in areas close to centers of population. The presence or absence of shore access and piers, and the presence of bays, protected harbors, and freshwater runoff all contributed to the type and intensity of the sport fishery at any given locality.

Fisheries such as bottomfishing for rockfish and lingcod, and shorefishing, were much the same throughout the study area, but other types of fishing were more specific to fish populations of certain areas.

A description of the study area giving a summary of all sport fishing in five geographical sub-areas will best describe the general sport fisheries as well as the more specific unique types (Figure 14). These sub-areas are: Oregon to Fort Bragg, Noyo Harbor to the Golden Gate, San Francisco to Davenport, Davenport to Yankee Point, and Yankee Point to Point Arguello.

About 80 percent of all sportfishing effort was expended from San Francisco south, mainly because the northern coastline is less accessible to the large centers of population in the San Francisco Bay area and interior valleys. The area north of San Francisco encompasses about 410 miles of shoreline, while the area south of there covers about 340 miles of shoreline.

9.4.1. Oregon to Fort Bragg

Even though the hook-and-line effort in this area represented only about 8 percent of the total effort of all methods, about 30 percent of the total skiff effort was recorded here. The salmon skifftrolling fisheries at Crescent City, Trinidad, and Humboldt Bay are among the most concentrated ocean skiff fisheries along the coast. This salmon fishery occurs each summer and fall. However, shore fishing, primarily for redtail surfperch, is the dominant sport fishery in this area, accounting for more than half the effort of all ocean hook-and-line fishing (Figure 14). Not only is it a popular fishery for those who favor this species, but salmon fishermen often try for redtail surfperch when salmon are scarce, and surf netters, awaiting runs of surf smelt, will fish for surfperch. Surf smelt and night smelt runs occur during late winter and spring, about the time when redtail surfperch are most available in the surf.

Bottomfishing from skiffs and party boats is not undertaken on a large scale because of the greater interest in salmon. When bottomfishing is conducted, the catches are usually of larger-than-average lingcod, black rockfish, copper rockfish, and vermilion rockfish. Bottomfishing for salmon or "mooching" is undertaken at Humboldt Bay. Actually, at Humboldt Bay, more king salmon were taken per hour's fishing this way than by trolling. There is little rocky bottom

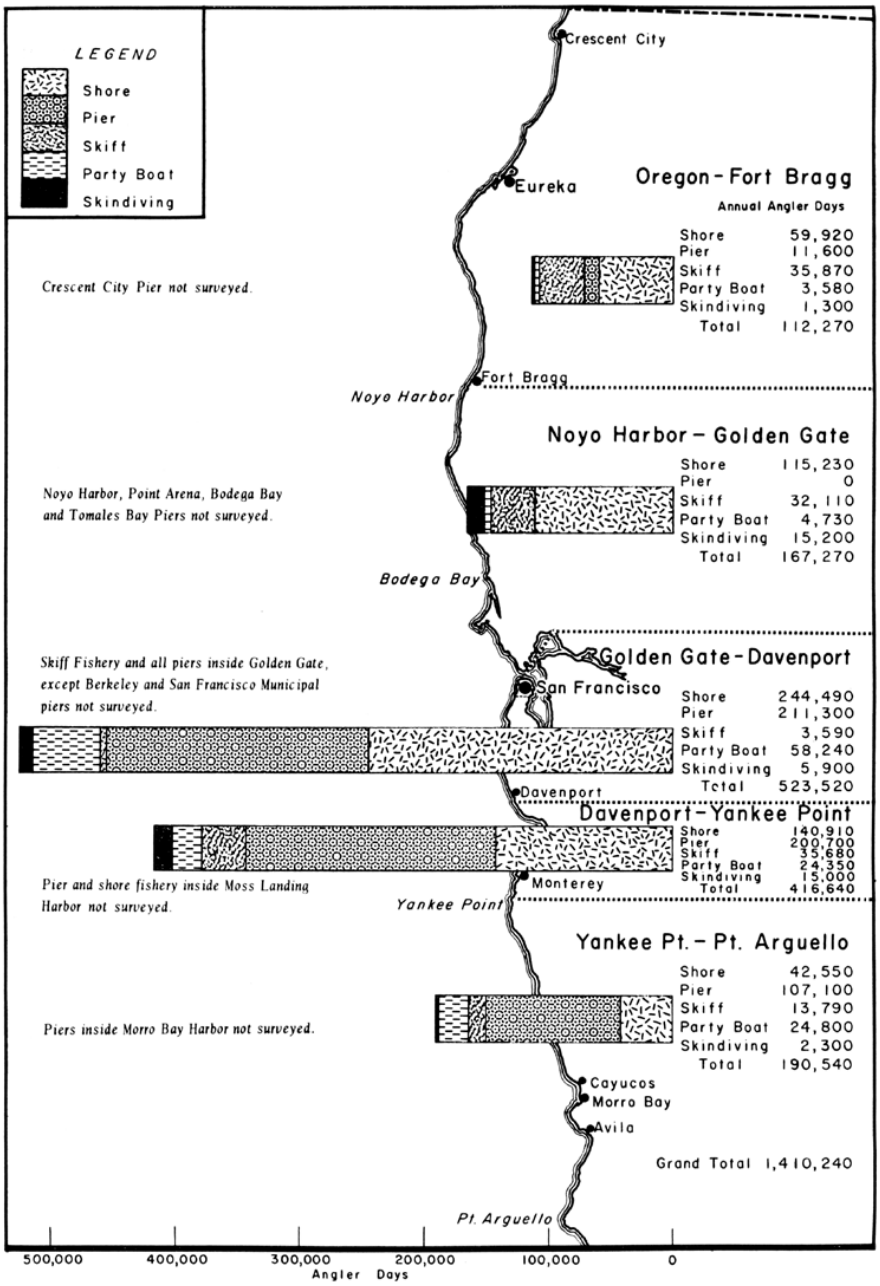


FIGURE 14. Average annual angler days in the shore, pier, skiff, partyboat, and skindiving fisheries in five sub-areas, 1958–1961.

FIGURE 14. Average annual angler days in the shore, pier, skiff, partyboat, and skindiving fisheries in five sub-areas, 1958–1961

near Humboldt Bay, hence the boat catch is nearly all of pelagic or sand-bottom species. There are good rocky reefs at Crescent City and Trinidad, and increased bottomfishing will occur in these areas as fishing pressure increases.

Skindiving is limited because of the great distance from urban centers and poor visibility during periods of freshwater runoff. Excellent abalone picking and spearfishing can be had when conditions are ideal.

of all the ocean coastline of California, this section from Oregon to Fort Bragg is the least exploited and is relatively rich in fish resources. Although the 220 miles of coastline comprise 30 percent of the total distance from Oregon to Point Arguello, only 7.9 percent of the total effort was expended here. None of the piers was built expressly for fishermen, as is the case farther south. Several small, private piers were fully utilized during summer, and better-than-average catches were recorded from them, especially inside Humboldt Bay. One of the most striking differences in the sport fisheries of our survey area, was the weak pier-fishing effort north of San Francisco (Figure 14).

Good steelhead, silver salmon, king salmon, and cutthroat trout runs in most rivers and larger streams attracted much more effort than is indicated by our ocean salmon fishing data. Ocean fishing combined with fresh water fishing draws a considerable number of non-resident sportsmen into the area, and is a prime source of income to coastal communities from Fort Bragg north.

Although incompletely covered in this report, several other fisheries were important to fishermen. These included night smelt runs at most of the sandy beaches, especially near mouths of streams and rivers, eulachon runs at Klamath River, lamprey gaffing at the mouth of the Klamath River, and Pacific herring and skiff surfperch fishing inside Humboldt Bay and the estuaries of the larger rivers. Clamming is also of major importance, and the best razor clam beaches of the state lie between Crescent City and Eureka. Digging Washington and gaper clams in Humboldt Bay is highly popular with local residents, and there is a limited market crab sport fishery in the Eel River estuary, in Humboldt Bay, and at Crescent City.

This northcoast sub-area probably has the highest potential of all for increased recreational ocean fishing. However, the shortage of shore access, poor roads, especially during winter, and distance from large population centers preclude any rapid increase in effort for some time.

9.4.2. *Noyo Harbor to the Golden Gate*

As in the area from Oregon to Fort Bragg, salmon, lingcod, and redtail surfperch are the esteemed species, but nearer to San Francisco lingcod, rockfish, striped bass, and California halibut become more important. A total of 167,270 angler days (11.9 percent of the total effort) was expended in this area's 190 miles of coastline (25 percent of our study area). Here too, pier fishing effort was practically non-existent, compared to that inside the Golden Gate and south of San Francisco. There were only a few small piers in Noyo Harbor, Bodega Bay, and Tomales Bay, and one small, private ocean pier at Point Arena.

Shorefishing made up nearly 70 percent of the total effort in this sub-area. There was good rock-fishing as well as surf-casting, and better-than-average shore catches were recorded. Surf smelt and night smelt were also heavily fished, especially from Alder Creek to the

Garcia River, and at the Sonoma Coast County State Park beaches.

This area is popular for skindiving and abalone picking. Water visibility is usually above average, and the red abalone take remains good in spite of continued harvest by both shore pickers and skindivers.

There are summertime salmon fisheries at Noyo Harbor, Albion, Bodega Bay, and Tomales Bay. Bottomfishing plays an important part of the boat fisheries, especially at Point Arena, and at Albion, Bodega Bay, and Tomales Bay. The Tomales Bay skiff fishery involves several types of activity: trolling for salmon; bottomfishing off Tomales Point; trolling for California halibut inside the bay; and bottomfishing for rockfish, surfperch, and jacksmelt inside the bay.

A comparison of the shore, skiff, partyboat, and skindiving catches was made to point out the inter-relationship of the different fisheries (Table 15). Lingcod, blue rockfish, kelp greenling, and copper rockfish were taken by all fishing methods, and each of these species ranked high in at least two fisheries (three in the case of lingcod and blue rockfish). This was the only area in which the kelp greenling ranked first numerically in the shore catch. The rockiness of the shore area is also indicated by the high take of striped seaperch and cabezon which are rock-frequenting species.

Length-frequency data on four important species revealed that shore fishermen take smaller fish on the average than offshore fishermen. The shallow inter-tidal and kelp-bed zones are evidently nursery areas for juveniles and young of several species, especially blue rockfish and kelp greenling.

Larger lingcod were taken by partyboat fishermen than skiff fishermen. Skindivers obviously selected larger fish. Copper rockfish lengths also indicated that skiffs and party boats were not operated at the same areas, or possibly have a gear selection bias, because much larger fish generally were taken on party boats. In this section, as well as in other sections of the coast, shore and pier fishermen sometimes catch small copper rockfish (120–200 mm total length). This species probably schools by size at certain depths, with the larger fish frequenting the deeper banks.

Nearly all fish taken by skindivers in this area, as well as throughout the study area, exceeded 250 mm total length, about 10 inches. Fish as small as 120 mm total length were taken by skindivers, but the numbers below 250 mm were very small. This is probably a skindiver's personal selection rather than a gear selection. The skindiver is the only fisherman who can choose the size of fish he wants. Hook-and-line fishermen can also make a general choice by selecting hook and bait size or area of fishing, but not all small fish will stay away from large hooks, and vice versa.

In this area, we did not cover the poke-pole fishery from Bodega Bay to the Golden Gate, nor the Tomales Bay skiff and shore fishery for steelhead, silver salmon, and striped bass.

Poke-poling is a favorite sport around Bodega Bay and Dillon Beach where monkeyface eels are found in the extensive tide pool areas at low tide. This area was not surveyed from the shore, so this species does not appear in our catch data for this area. Considering the relatively low effort and catch in this fishery, the omission of these fish does not affect our overall sportfishing statistics.

The skiff fishery inside Tomales Bay during fall and winter was of considerable magnitude, but the area fished was at the southern end of the bay, so we considered it an estuarian fishery. Most of the skiffs operating in this fishery originated from Inverness or the Tomales Bay Boat Harbor, south of Marshall. No skiff effort from these areas has been included in this report.

There are important mud clamming areas in Bodega, Tomales, Drakes, and Bolinas bays, and littleneck clams are dug near Bolinas Bay and Duxbury Point. Abalone picking is popular not only from Fort Bragg to the Russian River, but also on Tomales Point. Crabbing for market crabs is popular at Bodega Bay.

9.4.3. *San Francisco to Davenport*

A total of 523,520 angler days was expended in this sub-area which encompasses about 70 miles of shoreline: 50 miles of sandy beach, and 20 miles of rocky shoreline. Thus, about 37 percent of the total fishing effort was expended along about 9 percent of the total shoreline.

This sub-area was the most complex to survey, not only because of the large concentration of anglers, but because of the complex fisheries and fishing facilities inside the Golden Gate. Originally all of San Francisco Bay and San Pablo Bay north to the San Rafael-Richmond Bridge was included in the survey. It soon became apparent that it was impossible to cover completely the area inside the Golden Gate, and survey the outer coast area from Oregon to Point Arguello at the same time.

Some fishing data were necessary from inside the bays. Party boats fished both inside and outside the Golden Gate, and it was not possible to separate these catches inasmuch as some boats would work both areas on the same trip. Consequently, all partyboat effort and catch of boats operating out of all ports from Rodeo oceanward have been included. No trolling boats were sampled, hence catches of bottomfish taken incidentally while trolling were not examined by project personnel. Fortunately, personnel on the Department's salmon investigation obtained samples we could use to determine composition of the troll catch.

The effort and catch of Berkeley and San Francisco Municipal piers was also included in the survey. Spot checks were made at many small piers throughout the bay area, but these data were not included. No skiff sampling was conducted inside the Golden Gate. This effort was dominantly for striped bass inside the Golden Gate, and entailed a large effort from many skiff-launching sites, mainly at Berkeley, Alameda, Sausalito, San Francisco, and South San Francisco.

The total shoreline mileage for this sub-area (70 miles) is from the Golden Gate to Davenport, the area covered in our shorefishing, skiff, and skindiving surveys. Thus, much effort (two large piers and the entire partyboat effort from Rodeo seaward) is actually outside the sub-area boundaries. The shoreline inside the Golden Gate stretches for about 100 miles, but since none of the shorefishing, skiff fishing, and pier fishing at dozens of small piers was sampled, the shoreline area inside Golden Gate has not been included.

The largest effort at any pier in the study area was recorded at Berkeley Municipal pier. An estimated 104,720 angler-days were expended here in 1958. San Francisco Municipal pier yielded 76,350 angler-days, and the piers at Princeton another 30,240 angler-days (Table 4).

This pier effort nearly equals the shorefishing effort expended from the Golden Gate to Davenport. If shore and pier fishing inside the Golden Gate had been surveyed, these figures would have been considerably higher, possibly by 50,000 to 100,000 angler-days-per-year for each method. The catches at these piers were predominantly of surfperch and jacksmelt, but at Berkeley and San Francisco a large amount of effort was for striped bass. At Princeton, surfperch, jacksmelt, white croaker, and starry flounder were sought.

Several hundred party boats, operated from bay ports and Princeton, contributed the largest concentration of partyboat effort in the study area. Most of the party boats were small (30–40 feet) salmon-trolling vessels; only a few larger boats were used, mostly for both salmon trolling and bottomfishing. Regular summer and fall salmon runs off the Golden Gate, and striped bass concentrations inside the bay insures troll fishing throughout most of the year.

Skiff fishing at Pedro Point and Princeton was primarily for bottomfish, as was the partyboat fishery at Princeton. Runs of salmon appeared close to Pedro Point, and occasionally Princeton, each year, but they were usually of short duration. White croaker, black rockfish, blue rockfish, and canary rockfish were the primary skiff-caught species.

Party boats from Princeton ranged north to the Farallon Islands and south to Pigeon Point in quest of lingcod and rockfish. Blue rockfish, yellowtail rockfish, lingcod and copper rockfish were the popular partyboat bottomfishes.

Skindiving close to the "Bay Area" was inhibited by poor visibility. Diving was observed from Pedro Point south, with the most popular areas at Moss Beach, Pillar Point, Pigeon Point, Ano Nuevo State Park, and Greyhound Rock. Lingcod and black rockfish were the two most commonly speared fish, and red abalones were popular at most areas, although abalone catches were poorer than in the sub-areas to the north and south.

Shorefishing for striped bass and surfperch from sandy beaches, and rockfishing, constituted the largest sportfishery. The 244,490 angler days expended by shore fishermen in this 70 miles of coastline, represented about 40 percent of the total shorefishing effort from Oregon to Point Arguello, and 47 percent of all fishing effort in this subarea. Striped bass runs occur each year along San Francisco beaches and south at least to San Gregorio Beach, and often, as in 1958 runs occur south to Monterey and north to Bodega Bay.

Redtail, walleye, silver, calico, and barred surfperches were present, often in large numbers, at most sandy beaches. Kelp greenling, cabezon, and striped seaperch were commonly taken in rocky areas. The two large rock jetties at Princeton were popular with shorefishermen. The West jetty was built partly over a natural rock reef, and the species there were mostly rock-frequenting forms. At the East jetty,

which is built over sand, the species were dominantly white croaker and sand-frequenting surfperch and flatfishes.

No striped bass were measured, nor were the fishes caught from the piers and sandy beaches. Rockfishing, skindiving, skiff, and partyboat catches were measured. Length comparisons of the blue rockfish, black rockfish, lingcod, and kelp greenling demonstrated trends similar to those we noted in the Noyo Harbor-Golden Gate sub-area catches. Again, kelp greenlings were taken in all fisheries with juveniles predominantly in the shore catch. Most of the small kelp greenlings were recorded at the West Princeton jetty. There was a striking difference in the sizes of blue rockfish taken by skiff and partyboat fishermen. Not only was the modal size of the partyboat-caught fish about 40 mm larger than that of the skiff catch, but the maximum size was about 30 mm larger in the partyboat catch. Black rockfish, on the other hand, appear to be more homogenous in size distribution throughout the area, with the result that the length frequencies of skiff and partyboat catches were quite similar with a slightly larger modal size in the partyboat catch. Lingcod sizes, likewise, were quite similar in both the skiff and partyboat catches, but a few more of the largest-sized individuals were taken in the partyboat catch.

Less important fisheries included poke-poling for blennys in the Pescadero—Ano Nuevo State Park area, digging for littleneck clams at Ano Nuevo, and surf netting for smelt at Half Moon Bay, Martin's Beach, Greyhound Rock, and near Scott Creek. The southernmost known spawning area for surf smelt is in the Davenport area.

9.4.4. *Davenport to Yankee Point*

A total of 416,640 angler-days was expended per year in this sub-area which included about 70 miles of coastline, 52 of sandy beach and 18 of rocky shoreline. This fishing effort was comparable to that in the San Francisco—Davenport sub-area, except for a greater proportion of pier-fishing effort in the Monterey Bay area. About 30 percent of all sportfishing effort from Oregon to Point Arguello was expended in this sub-area, comprising about 9 percent of the total coastline. Thus, in the 140 miles between San Francisco and Yankee Point (about 18 percent of the total coastline surveyed), over two-thirds of all sport fishing effort was expended.

Over 200,000 angler-days per year were expended on the six large piers in this sub-area. Skiff fishing was also popular here, contributing over 35,000 angler-days per year. There were 10 private and public launching sites in Monterey Bay, and during runs of salmon and California halibut, these sites were heavily used. There was year-round bottomfishing at all sites. Most bottomfishing at Moss Landing was inside the harbor as there are no extensive rocky areas outside.

Skindiving was very popular here, with a large effort expended each year at Santa Cruz Point and on the Monterey Peninsula. The best average water clarity was reported from the Monterey Peninsula, especially in Carmel Bay where on many days, 20 feet of visibility were reported. The calm beaches at Pacific Grove and along Cannery Row were favorite areas for practice diving, and the clear waters of Carmel Bay were popular with underwater photographers, shell collectors, and deep-diving SCUBA enthusiasts.

Shore fishing for barred surfperch, walleye surfperch, and silver surfperch was available throughout the extensive sandy beaches from Capitola to Monterey. An occasional run of striped bass, especially off Marina and Seaside, provided added surf-fishing sport in 1958 and 1960. Rockfishing for striped seaperch, kelp greenling, cabezon, grass rockfish, and other rock-frequenting surfperches was popular from Natural Bridges Beach State Park to Santa Cruz Point and on the Monterey Peninsula. Some of the best rockfishing catches were recorded at Point Lobos Reserve State Park.

Salmon trolling was popular during spring and summer, but the mainstay of the boat catches were bottom fish. Salmon catches, mostly of king salmon, have been more erratic in this area than to the north. In some years, as in 1956, salmon catches were good throughout the season, but in years such as 1958 the runs were of short duration and primarily during the early part of the season. Over the past 10 years, the best salmon catches have been recorded during April-June.

Blue rockfish, yellowtail rockfish, and lingcod were the most sought-after fishes by boat anglers. Effort for California halibut has increased at Santa Cruz, Capitola, and Moss Landing in recent years, and some striped bass effort was expended each year inside Moss Landing Harbor. White croaker and Pacific sanddabs were the principal sand-bottom species taken from boats, with an occasional petrale sole and sablefish also caught. White croaker was the principal pier-caught species.

The rocky reefs in this sub-area are intensively fished throughout the year. Sport partyboat and skiff fishermen, as well as commercial skiff fishermen and long-line boats, operate on these reefs year after year. With this pressure, there is some concern over the ability of these reefs to continue yielding good catches, particularly on the Santa Cruz side of the bay. A more intensive study of this area is planned for the future.

Yellowtail rockfish were important in both the partyboat and skiff catches. Length frequency data demonstrate that yellowtail rockfish migrate out of the range of skiff fishermen when they are about 300 to 320 mm total length. The partyboat catches, generally made in deeper water, were of considerably larger fish, with most fish around 400 mm total length. The partyboat catches, generally made in deeper water, were of considerably larger fish, with most fish around 400 mm total length; yellowtail rockfish in the skiff catches were mostly around 280 mm total length.

As in the other sub-areas, most kelp greenlings caught from shore were juveniles.

Cabezon were important, even though their numbers were relatively small. Length data demonstrate their relative sizes in the different fisheries. Shore fishermen caught more juvenile fish than adults, and none exceeded 450 mm total length. Skiff fishermen landed the most cabezon, and also the largest. Partyboat catches were of large fish, but in small numbers. Skindivers favored this species. A size group (around 380 mm total length) appeared in the skin-diving length-frequency data that was not distinct in the catches by other methods.

Lingcod catches were similar in magnitude for skindivers, skiff fishermen, and partyboat fishermen. Partyboat fishermen, as in other

areas, recorded the largest lingcod although the size distribution in this sub-area of both skiff and partyboat catches was quite similar.

The blue rockfish is of prime importance in this sub-area, but since 1959, the catch has been decreasing in both numbers and size. The shore catch was predominantly of small fish around 200 mm total length. Most shore-caught blue rockfish were recorded at Point Piños and Point Lobos Reserve State Park. On the Santa Cruz side of Monterey Bay, partyboat fishermen caught fish that were larger, on the average, than skiff-caught fish. However, larger blue rockfish were recorded on the Monterey side of the bay than at Santa Cruz in both the skiff and partyboat catches. This smaller average size of blue rockfish on the Santa Cruz side was accentuated by a marked decrease in numbers.

We did not survey the night smelt fishery at Moss Landing, which is the southernmost area this species is known to spawn. There is Pismo clam digging at several beaches from the Cement Ship to Salinas River, littleneck clams are dug at Capitola and near Santa Cruz, and mud clamming is popular inside Moss Landing Harbor, but we did not survey these fisheries.

9.4.5. Yankee Point to Point Arguello

A total of 190,540 angler-days was expended per year in this 196 miles of coastline, consisting of 99 miles of rocky shoreleine and 97 miles of sandy beach. Thus, about 14 percent of the total sportfishing effort from Oregon to Point Arguello was expended here in about 26 percent of the total coastline.

This area is somewhat comparable to the northernmost section of the state, in that large areas of inaccessible shoreline are interspersed with several centers of heavy fishing activity. The area from Yankee Point to Point Piedras Blancas is more or less inaccessible, except for a few skindiving and shore fishing areas at some newly-opened Federal access areas. Other inaccessible areas lie between Cambria and Estero Point and from Hazard Canyon to Avila.

Party boats and skiffs operate year round at Morro Bay and Avila. There were summertime partyboat and skiff concessions at Cayucos, and a summer-vacation partyboat concession at San Simeon.

Two of the several good-sized piers in this area (Pismo Beach and Cayucos) were used primarily for fishing. The most angler-days were spent each year pier fishing, followed by shore fishing and partyboat fishing (Figure 14).

Shorefishing was primarily for barred surfperch and jacksmelt in sandy areas and for cabezon, kelp greenling, and calico surfperch in rocky areas. The extensive sandy beaches around Morro Bay and from Pismo Beach to Surf were some of the best barred surfperch areas in central California. In this area, the barred surfperch contribution to the shore catch enabled this species to rank high among all species.

Pier catches were dominantly of white croaker, jacksmelt, and barred surfperch (Table 15). Barred surfperch were most often caught in the breaker zone, whereas white croakers were taken in the deeper waters off the piers. Jig fishing was popular for jacksmelt, and for California

barracuda which appeared each year during September at Pismo Beach pier.

Blue rockfish was dominant in both the partyboat and skiff catches. Yellowtail rockfish, olive rockfish, bocaccio, and vermilion rockfish were also important numerically in the partyboat catches. Lingcod were important by weight, and were mostly taken with live bait. Morro Bay is the northernmost area where live bait was used in the partyboat operation.

Skiff catches were comprised mostly of shallow-water species including gopher rockfish, small copper rockfish, and cabezon. California halibut were sought inside Morro Bay, and recently a livebait fishery for this species has developed there.

From Point Piedras Blancas to Cayucos was one of the best abalone skindiving areas in our entire study area. Red abalones are found throughout this area, and were the prime target of skindivers. Some spearfishing was conducted, but on a minor scale compared to other areas. Skindiving effort was surprisingly low in this area, probably because of the great distance to large population centers. Also, water visibility was poor in this area during most of the year.

Length frequency data for blue rockfish, lingcod, and yellowtail rockfish for partyboat and skiff catches revealed a somewhat different pattern in this sub-area. Here, on the average, skiff fishermen caught larger lingcod than partyboat fishermen, although the greatest number of the largest fish were landed by partyboat fishermen. The modal peak of skiff-caught lingcod was around 640 mm total length, as compared to the 540 mm mode of partyboat-caught lingcod.

The striking length differences of skiff- and partyboat-caught yellowtail rockfish recorded for the Davenport-Yankee Point sub-area were not repeated in Yankee Point to Point Arguello catches. Large yellowtail rockfish were mostly taken by partyboat fishermen, but the modal peaks of each method occurred at the same 2-cm groupings, 301–320 mm total length.

Blue rockfish lengths were, on the average, larger in the partyboat catch but not strikingly so. Skiff fishermen took about the same overall sizes of blue rockfish, but more in the smaller sizes from 240–280 mm total length.

Sport activity we did not cover in our survey, included the very popular Pismo clam digging around Morro Bay and from Pismo Beach to Oso Flaco Lake Beach, razor clam digging in Morro Strand, and mud clamming inside Morro Bay.

10. COMMERCIAL—SPORTFISH RELATIONSHIPS

Inasmuch as ocean fish stocks are public property and are available to all who wish to utilize them, public agencies have the responsibility of enforcing protective regulations and investigating life histories of important species.

Commercial fisheries are regulated by establishing seasonal closures, size limits, authorized species, closed areas, gear restrictions, and bag limits.

It is not feasible to maintain cumulative totals on sport catches, so it is impossible to impose annual bag limits on the sport catch if such

were desired. Instead, the principal management tools for sportfishing usually include individual daily bag limits, seasonal closures, areal closures, gear-restricted areas, gear restrictions, and size limits.

The California Fish and Game Commission has plenary powers over the sport catch, allowing it to set new, or to change existing regulations without legislative action. The Commission, on the other hand, has very limited powers with respect to commercial fishing. Most controls of commercial fishing are laws enacted by the legislature.

Along with this basic difference in regulatory measures for sport and commercial fisheries, there is another basic difference in the types of gear used. Except for surf and night smelt which are caught with nets, sportfish are taken by hook-and-line. Most of the commercial catch is made with nets, including purse seines, lampara nets, gill nets, trammel nets, trawl nets, beach seines, and A-frame nets. Hook-and-line commercial fishing is conducted in trolling for salmon and albacore, and in long-lining for bottomfish.

10.1. Interfishery Competition

When several entrepreneurs are competing for the same stocks, a certain amount of antagonism often exists between users of different types of gear or between sport and commercial interests. This is especially so when fish stocks become scarce or less available. Kelp cutting operations, seismic operations, and sea lions are often looked upon as being responsible for the scarcity or "depletion." Most such accusations are not founded on any empirical data, and are usually not valid. In fact, there is often immediate antagonism toward a new fishing method, because it is believed to be too efficient, too competitive, or too destructive. Much of the early criticism of skindivers by conventional hook-and-line fishermen was of this nature. These first fears are now allayed in that facts show that skin#ivers do not pose a threat to inshore fish stocks.

These sincere feelings of concern for our resources are appreciated and necessary if proper research and management is to be undertaken. The job of the researcher is to separate fact from fantasy and prejudice, and to make known to all parties concerned how his findings relate to the problem.

Our study has yielded empirical data which have already been used to resolve several problems, and which will be of considerable value for future controversies. At Morro Bay, project data were used to resolve a sport-commercial conflict, in which some partyboat concessionaires claimed trawling operations were responsible for a decrease in partyboat catches. A 1-year study by the Department's trawl investigation personnel and our project's personnel disclosed that interfishery competition could not possibly exist because the species being taken and the areas of fishing were not the same for the two fisheries (Heimann and Miller, 1960). Bocaccio and chilipepper were the principal commercial species, whereas blue rockfish and olive rockfish were the principal sport species.

A similar study conducted in the Monterey Bay area in 1960 revealed a comparable separation of fishing areas and species landed (Heimann, 1963). Here, bocaccio, chilipepper, and splitnose rockfish

were the dominant trawl species, whereas blue rockfish, yellowtail rockfish, and lingcod were the principal partyboat species.

In 1960, Cayucos pier fishermen accused bait haulers using lampara nets of being a threat to pier fishing success. Project pier sampling data gathered in 1958, along with data collected on the bait sampling program of the Department's pelagic fisheries investigation, revealed that interfishery competition was not possible because the species taken by lampara fishermen were not taken by pier fishermen.

Differences in trawler and partyboat catches can be expected to remain fairly constant over the entire study area as the trawl fishery is typically a deep-water net fishery, whereas the partyboat fishery is a shallow-water hook-and-line fishery.

10.2. Commercial Catch—Sport Catch Comparison

This comparison is given by groups of fishes, i.e., flatfish, rockfish, surfperches, etc., because much of the commercial catch is not entered by species on the logs. However, several commercial fishery research programs have collected data on the different species in these major groups and these data have been made available for this report.

The average annual commercial catch (1959 and 1960) from Oregon to Point Arguello was about 20 times greater than the average annual sport catch by weight during the same period (Table 16) . Almost half of the commercial catch was of species which rarely appear in the sport catch, including the Pacific sardine, northern anchovy, albacore, and Pacific herring.

of the comparable groups (Table 16), flatfish were the most important in the commercial catch making up 19.4 percent of the total,

TABLE 16

Comparison of Average Annual Catch of Sport and Commercial Fishermen, Oregon to Point Arguello, 1958 to 1960

Species	Commercial catch (pounds)	Percent comp. of comm. catch	Sport catch (pounds) (1958–60)	Percent comp. of sport catch	Total average annual catch	Percent of each group landed by commercial	Percent of each group landed by sportsmen
Rockfish	12,796,500	15.53	1,685,700	38.57	14,482,200	88.36	11.64
Flatfish	15,972,000	19.38	55,300	1.27	16,027,300	99.66	0.34
Surfperch	188,300	0.23	924,400	21.15	1,112,700	16.92	83.08
Salmon	6,491,500	7.88	420,900	9.63	6,912,400	93.91	6.09
Cottids	6,600	0.01	81,000	1.85	87,600	7.53	92.47
Lingcod	1,292,000	1.57	410,000	9.38	1,702,000	75.91	24.09
Croakers	601,000	0.73	149,300	3.42	750,300	80.10	19.90
All others	45,072,000	54.67	643,300	14.72	45,715,300	98.59	1.41
TOTALS	**82,419,900**	**100.00**	**4,369,900**	**99.99**	**86,789,800**	**94.96**	**5.04**

TABLE 16

Comparison of Average Annual Catch of Sport and Commercial Fishermen, Oregon to Point Arguello, 1958 to 1960

while rockfish were the greatest contributors in the sport catch, making up 38.6 percent of the poundage. Only 1.3 percent of the sport catch was flatfish, and if commercial and sport flatfish catches are combined, the commercial catch made up 99.7 percent. Commercial flatfish species were primarily English sole, rex sole, Dover sole, and petrale sole; the principal sport species by weight were starry flounder, sand sole, Pacific sanddab, California halibut, and petrale sole.

Rockfish comprised 15.5 percent of the commercial catch. of the total rockfish landed, both methods, the commercial catch made up

88.4 percent. Since most of the commercial rockfish catch was landed by trawlers, deeper-water species such as bocaccio and chilipepper were dominant along with splitnose rockfish and widow rockfish. Thus, even though rockfish were important in both fisheries, the only overlap for a species was with bocaccio, which made up 3.4 percent of the sport catch.

Most of the surfperch were caught by sport fishermen who landed 83.1 percent of the total. Much of the commercial surfperch catch was made by hook-and-line fishermen from San Francisco north at the good redtail surfperch beaches.

Another group in which the sport catch was greater than the commercial, was the cottids in which cabezon was the principal species by weight. For both fisheries, however, this group was of minor significance making up 0.01 and 1.85 percent of the total commercial and sport catch, respectively.

The largest fish taken by both sport and commercial fishermen were the king salmon, silver salmon, lingcod, white seabass, albacore, and California halibut. In this northcoast area, albacore, and white seabass are not commonly taken by sport fishermen, and white seabass and California halibut contribute only minor amounts in both fisheries. King salmon, silver salmon, and lingcod, however, are important to both groups, and it is with these three that interfishery competition may exist, although there is no evidence that the catch of one group affects the catch of the other.

The commercial salmon catch made up 93.9 percent of the total salmon landings, and the commercial lingcod catch was 75.9 percent of the combined lingcod poundage. Within the sport catch, lingcod was the most important, while king salmon ranked fourth by weight. The areas fished by sport and commercial salmon fishermen are often the same, but commercial fishermen commonly ply deeper water and farther offshore. Lingcod commercial fishermen catch fair numbers in trawl nets in areas not frequented by partyboat fishermen. Some commercial long-line and hook-and-line lingcod fishing takes place in areas frequented by sportfishermen, but these catches are less than either the partyboat catch or the commercial trawl catch of this species.

In summary, the present concern by sport interests that commercial catches are endangering the success of sport anglers is not founded on fact. Only for a few large species is there any overlap of take by both groups, and with these species the fishing grounds are not always the same, even though the same population is being utilized by both groups. of course there may be local situations where one particular species may be highly desired and easily taken by both fisheries. In these situations, interfishery competition may well exist. For example, on small, easily-located, shallow reefs, partyboat, skiff and skindiving sportsmen may be competing with commercial skiff and long-line fishermen for a few larger rockfish and lingcod. Heavy pressure on a small area obviously will decrease the number of large desirable fish present there. Evidence indicates that reefs nearest large fishing ports are often not as productive for large fish as reefs farther away, and less intensively fished.

11. SPORT FISHERY TRENDS AND RECOMMENDATIONS

Expansion of ocean sportfishing is possible for all species and in all areas. However, yearly catches of king salmon, silver salmon, blue rockfish, and some others, have fluctuated in response to changes in abundance or availability, indicating the catch for these species now is at a level where it is affected by these changes. For many species not utilized to this extent, the level of fishing intensity at which the catch will be affected by changes of abundance or availability is not known.

Periodic variations in availability have been noted for practically all species, but over a year's time the catches, for the most part, are in direct proportion to the effort expended, at least for species other than salmon. There are periods when fishermen cannot catch fish at areas or on reefs which are usually productive. The periods of nonproductivity have lasted from several days to several months before catches suddenly return to "normal." Apparently, changes in the physical environment have a considerable effect upon the availability of fish to hook-and-line fishermen. During periods of low catch, fathometer tracings often reveal that schools of fish are present, but only an occasional fish will be caught. Lingcod and rockfish are often difficult to catch during periods of high swells and shoreline turbidity, whereas, white croaker and jacksmelt are seldom affected during these stormy periods.

During years when salmon were at a low level, stocks of other fish received greater utilization. When short-term periods of unavailability occur on rocky reefs during poor salmon fishing, hook-and-line fishermen become even more concerned that commercial fishermen, sea lions, skindivers, seismic operators, etc., are depleting fish stocks or are adversely affecting conditions in the ocean. As pointed out, these concerns are almost always unfounded. The sea-lion controversy of 1957–59, was a result of sportsmen as well as commercial fishermen blaming sea lions for the sudden drop in the salmon catch. Even though sea lions do take hooked salmon, the fishing public must also become aware of the more profound interrelationships of sea lions and the total biological environment in the ocean. Data from our study indicate that fishermen should certainly review their opinions of the effects of sea lions on fishing. There is actually a positive correlation between fishing success and heavy sea-lion concentrations. Special lingcod and bottomfish partyboat excursions are made to Año Nuevo Island and the Farallon Islands—sites of large sea-lion rookeries. Shore fishing and skindiving catches are above average adjacent to near-shore sea-lion rookeries and resting areas at Fort Ross, Año Nuevo Island, Santa Cruz Point, Monterey breakwater, and Point Lobos Reserve State Park. Certainly many factors are operating in these areas other than the presence of sea lions, but at least heavy concentrations of sea lions do not result in decimated fish populations. Underwater observations at Año Nuevo Island and Monterey breakwater revealed considerable quantities of partly digested material in the water—an obvious attraction to fish. From these data and from more recent information on the food habits of sea lions, it would not be recommended that sea lions be greatly reduced in numbers.

One of the most productive management procedures to enhance ocean fishing and recreation is the construction and improvement of fishing piers. Piers allow ready access for many fishermen of all ages as well as cheap, comfortable family fishing excursions. Fish populations build up around piers because of food concentrations, protection, and orientation to vertical objects. Thus, piers are both habitat-improvement and fishing access projects.

Shore access is also important for shore fishermen, skindivers, and abalone pickers. Several of the present readily-accessible shore areas are being heavily utilized, and much more area will be needed in the future.

Shellfish populations are probably being more heavily utilized than are inshore and sub-tidal fish populations due to the limited concentration and immobility of abalones, clams, and scallops. Recreation values, however, involve more than the catch. Fishing space, and a certain degree of isolation and privateness are also recreation values. At many shore access areas these attributes are becoming seriously endangered.

Skiff-launching sites are necessary but are used by a relatively few fishermen affording expensive equipment. Increased use of these ramps by joy riders, skindivers, water skiers, clam diggers, sailing, etc., gives increased justification for public launching-ramp construction, involving the total recreational use rather than fishing use alone. The cruising range of skiffs is such that launching facilities spaced 20 miles apart would enable skiff fishermen to cover practically all rocky reef areas along the coast.

Habitat improvement in the form of artificial reefs may be of value in the extensive sandy-bottom areas off Eureka, Moss Landing, and Morro Bay, but emphasis should first be placed on aiding fishermen to locate natural reef areas. After natural reefs are utilized, there will be more justification for expensive artificial reef construction.

As fishing pressures increase, it may become necessary to control the take of certain species. The daily take of many species is now limited and, in some cases, minimum size limits have been imposed. However, many of the present day limits are based upon "wasteage" considerations rather than biological requirements. The daily bag limits of rockfish, surfperch, lingcod, and cabezon were set to minimize fish wastage which occurred when fishermen caught more than was readily used. However, these regulations were enacted prior to the popularization of home freezers and freezer compartments in refrigerators. Possibly for some species bag limits can be expanded if fish are not wasted. Large catches of several hundred white croakers, Pacific sanddabs, and mackerels have been observed and, upon interviewing the fishermen, there was no indication that any of the fish would go to waste. Research data on the life history and potential yield of fish stocks is needed to determine usefulness of specific regulations. In terms of management, it seems proper to encourage the take of species which are under-utilized to ease the pressure on moredesired and heavily-fished species.

Research has been conducted on salmon and striped bass for several decades, yet there are other species of almost equal value about which relatively little is known. Funds and personnel should be made

available to study many of these. Also, needed are ecological surveys of natural reef areas, especially those which are heavily fished and those which are possible nursery areas for young fish of important species. Movements of species from one rocky reef to another, and the potential yield of the multi-species reef populations should be studied. These vast expanses of sand and mud bottom where populations of flatfish, white croaker, and sometimes sablefish are available, need to be delineated. One of the greatest potentials for increasing the yield of our ocean sport fisheries is to delineate areas of fish concentrations, and to develop methods for catching these fish.

12. SPECIES SUMMATION

Data on latitudinal distribution, size distribution by depth, and general importance and frequency of appearance of each species have been mentioned in an unconnected way throughout the text. A concise summation of these data is in order.

12.1. Latitudinal Distribution

The geographical ranges of 77 species encountered during our survey, extend below and above the latitudes encompassed within our study area. On the other hand, the northern range limit of 38 southern species fell within the study area, as did the southern range limit of 8 northern species. Most of the 38 species whose northern range limit was in the study area were not common north of San Francisco. Even though they did not range throughout the study area, barred surfperch, California halibut, gopher rockfish, olive rockfish, calico surfperch, and rubberlip perch were of considerable value to sport fishermen from San Francisco south.

The fishery north of Bodega Bay may be classed as a "Pacific Northwest type," with salmon, true smelt, rockfishes, redtail surfperch, lingcod, and greenlings being the primary groups. From Bodega Bay to Monterey, there is considerable overlapping of "northern" and "southern" forms, including the unique striped bass. From Monterey southward, southern forms become more important, but still the fauna does not attain the sub-tropical influence it does near the Mexican border in southern California. Such sub-tropical forms as groupers, California yellowtail, California barracuda, bluefin tuna, and striped marlin, rarely, if ever, enter the central and northern California sport catch.

The northern ranges of 10 species and the southern ranges of 2 were extended during the period of our survey. Most of these range extensions were first noted by project personnel, but several were reported by other research project personnel (Table 17) The spotted sand bass saved by a Monterey partyboat operator for the Department represented the longest range extension, in miles.

12.2. Distribution by Depth

Juveniles of several species are found in shallow water, but migrate to deeper water as they attain a certain size. Some species apparently remain in shallow areas throughout their lives. Others may enter shallow

TABLE 17

Range Extensions of Twelve Species in Central and Northern California, 1957 to 1963

Species	Location of capture	Method of capture	Date	Authority
Kelp bass (N)	Princeton W. Jetty	Hook-and-line, Shore fisherman	Sept. 25, 1960	Dan Miller
Spotted bass (N)	Monterey	Hook-and-line, Party Boat	Feb. 24, 1963	Dan Miller
Sand bass (N)	Santa Cruz	Spearfishing; Hook-and-line, Skiff	May 17, 1959	Dan Miller Dan Gotshall
Olive rockfish (N)	Shelter Cove, Humboldt Co.	Hook-and-line, Skiff	July 11, 1959	Dan Gotshall
Kelp rockfish (N)	Bodega Bay	Hook-and-line, Skiff	Aug. 11, 1960	Gary Smith
Quillback rockfish (S)	Point Sur	Hook-and-line, Research Vessel	May 7, 1963	Dan Gotshall
Calico rockfish (N)	Morro Bay	Hook-and-line, Party Boat	Sept. 2, 1960	Don Johnson
Squarespot rockfish (N)	Farallon Islands	Hook-and-line, Party Boat	Aug. 18, 1962	Dan Gotshall
Onespot fringehead (N)	Bodega Bay	Hook-and-line, Pier	July 10, 1960	Gary Smith
Sarcastic fringehead (N)	Princeton W. Jetty	Hook-and-line, Shore fisherman	April 10, 1960	Dan Miller
Rubberlip perch (N)	Van Damme Beach State Park	Spearfishing	July 19, 1958	Dan Gotshall
Rosylip sculpin (S)	Bodega Bay	Hook-and-line, Shore fisherman	Nov. 17, 1957	Dan Gotshall

TABLE 17

Range Extensions of Twelve Species in Central and Northern California, 1957 to 1963

areas only to spawn, and still others apparently do not enter shallow areas at any stage of their life history.

It is difficult to portray adequately the behavior of each species, because so much information is incomplete or fragmental, even on extremely important species. Throughout our study certain relationships between species have appeared, and in general the depth preference of many species was indicated by the catch records. Using these catch records, depth preferences have been presented graphically for the more important species (Figures 15 and 16).

It must be remembered, however, that although lingcod are mentioned as principally a shallow rocky-reef species, they are also taken intertidally as adults and to depths exceeding 300 feet; as juveniles they are found in pelagic situations far out to sea as well as in eel grass in the shallow waters of harbors. Other species may inhabit similar complex habitats during stages of development from egg to adult.

Only a few species are frequently found in both rocky-bottom and sandy-bottom habitats. Pelagic or wandering, inshore forms such as jacksmelt, shiner perch, and walleye perch are the most common of these. There is, as a general rule, a fairly natural separation of sandy-bottom and rock-bottom types, as well as a separate group of pelagic and mid-depth species.

12.3. ROCKY BOTTOM AND KELP BED SPECIES

12.3.1. Tide Pool Areas

No species was taken solely in isolated tide pools. Those species found in tide pools were also frequently taken in shallow wash areas between rocks. Those most frequently taken in tide pools were monkey-face eel, rock ell, dwarf perch, juvenile kelp greenling, juvenile rock greenling, reef perch, and juvenile cabezon. Several species of tide-pool cottids and blennys did not appear in the catch.

12.3.2. Shallow Water Reef and Kelp Bed

Numerous species occur in from 0 to 150 feet of water, and several vary considerably in color. Not only is this zone inhabited by many

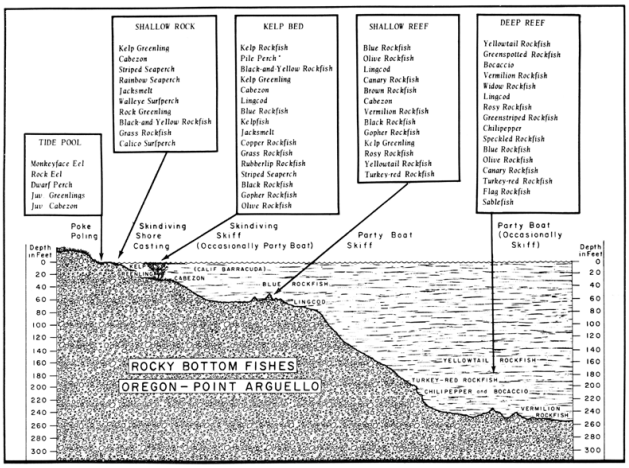


FIGURE 15. Most commonly-taken species in rocky bottom habitats, Oregon—Point Arguello.

FIGURE 15. Most commonly-taken species in rocky bottom habitats, Oregon—Point Arguello

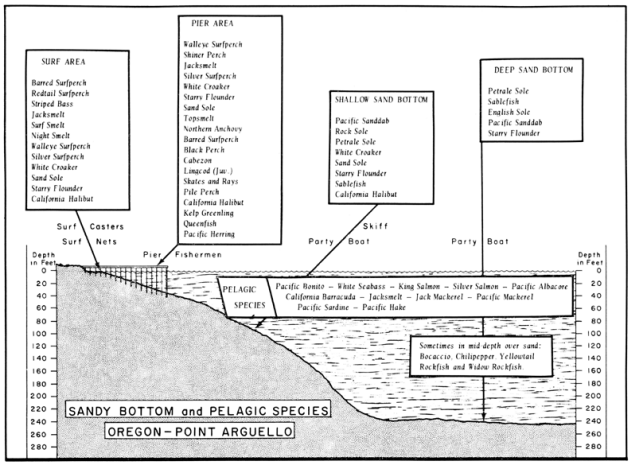


FIGURE 16. Most commonly-taken species in sandy bottom and pelagic habitats, Oregon–Point Arguello.

FIGURE 16. Most commonly-taken species in sandy bottom and pelagic habitats, Oregon—Point Arguello

endemic species, but juveniles of species common to deep waters or sandy bottoms are often found here. For instance, juvenile sand sole are taken from rocky shore areas, but the adults are found in sandy surf or in harbors and bays. Juvenile copper rockfish and canary rockfish are often found in shallow rocky areas, whereas the adults are most often taken in depths from 20 to 200 feet.

Some species taken only in the shallow rocky and kelp areas were kelp rockfish, giant kelpfish, señorita, rainbow seaperch, grass rockfish, rubberlip perch, gopher rockfish, black-and-yellow rockfish, kelp bass, opaleye, California sheephead, and fringeheads. Some of the largest catches in this habitat were of striped seaperch, lingcod, black-and-yellow rockfish, blue rockfish, kelp greenling, cabezon, gopher rockfish, kelp rockfish, jacksmelt, and walleye surfperch. Black rockfish, rock greenling, and an occasional olive rockfish were also important. Most skindiving and skiff effort and all rock shorefishing, except for some poke-poling, is conducted in this area.

12.3.3. Deep Reef Area

Rocky banks 150–350 feet deep are inhabited mostly by rockfishes, but an occasional lingcod, sablefish, petrale sole, or cabezon is caught there too. Usually only party boats operate in these areas, but recently more skiffs have been operating in these deeper waters. Commercial long-line boats have been operated for years at some of the more productive reefs.

Yellowtail rockfish were the dominant species taken on and over these banks, but bocaccio, chilipepper, widow rockfish, greenspotted rockfish, starry rockfish, rosy rockfish, canary rockfish, turkey-red rockfish, and vermilion rockfish were also abundant.

Species taken only in deep reef areas were chilipepper, large bocaccio, squarespot rockfish, stripetail rockfish, speckled rockfish, widow rockfish, greenstriped rockfish, and greenspotted rockfish.

12.3.4. Sandy Bottom Habitat

Most of the fishes on sandy bottom were surfperches or flatfishes, but many fish, such as the white croaker and sablefish, spend part of the time on the bottom and part at mid-depth. The shallower surf areas were frequented by striped bass, silver surfperch, redtail surfperch, barred surfperch, walleye surfperch, starry flounder, sand sole, smoothhounds, and white croaker. This listing doesn't apply to all sections of the coast, but the enumerated species were most frequently encountered. Jacksmelt were also taken in large numbers in the surf area, but were also taken around piers, kelp beds, on the surface in deeper water, and in harbors and bays, so are not classed as a dominantly surf species. Although the white croaker is often at mid-depth, it usually is over sandy bottom. The California halibut is a surf species, but is more common outside the breaker line and inside bays during spring and summer.

In deeper sandy bottom areas, rock sole, Pacific sanddabs, petrale sole, and sablefish are common. The rock sole was taken at varying depths, often over gravelly beds in 30 to 50 feet of water. Pacific sanddabs were taken in these areas as well as in deeper areas over fine sand.

Mid-depth species which often were found over sandy bottom included bocaccio, chilipepper, widow rockfish, and Pacific hake. Commercial trawlers catch large numbers of these four species, but they are of minor importance in the sport fishery.

The starry flounder is one of the few species which was caught in shallow bays, in surf areas, and in shallow and deep sandy areas. Most of the starry flounder catch was made from piers.

12.3.5. Pelagic or Wandering Species

Many of the large, predatory species are pelagic, migratory or wandering species. They usually exhibit seasonal movements, some appearing each year, and others becoming available only in certain years. These species include king salmon, silver salmon, albacore, Pacific bonito, California barracuda, white seabass, jack mackerel, Pacific mackerel, and California yellowtail.

Other more-or-less pelagic fishes such as Pacific sardines, northern anchovies, Pacific herring, jacksmelt, and topsmelt, usually are taken inshore around piers and inside bays.

12.4. Species Summary

For each species we recorded in the ocean sport catch, we have attempted to bring together the most improtant aspects of its distribution, life history, fishery, etc. The listing follows our alphabetical list of common and scientific names. Range descriptions will include three symbols: (T) indicating that the range extends in latitude below and above that of the study area; (N), the northern limit of the range is within the study area; and (S) the southern limit of the range is in the study area. Included with the (N) and (S) symbols will be the exact location, if known, of the range limit.

During the project sampling, lengths were taken of all species in the skiff, partyboat, and skindiving catches as well as in the rocky-shore catches and some of the surf-fishing and pier catches. Extensions of known sizes were recorded for 17 species: cabezon, white croaker, kelp rockfish, grass rockfish, brown rockfish, copper rockfish, calico rockfish, rosy rockfish, china rockfish, black rockfish, gopher rockfish, squarespot rockfish, calico surfperch, reef perch, dwarf perch, pile perch, and silver surfperch. Average size based on our sport catch sampling data, and maximum known size are given for each species.

Albacore (T). Average weight: 15 pounds. Maximum size: 93 pounds off Hawaii, 76 pounds on our coast.

This large fish is usually found at the surface well offshore in waters from 58° to 70° F. They are usually taken each year off Morro Bay by partyboat fishermen using live bait. This species rarely comes close enough to shore to be fished by skiff fishermen, although in some years they have been taken off Monterey and Humboldt Bay. During our survey, albacore were recorded only in the partyboat catch and in very small numbers.

Northern anchovy (T). Average weight: 0.08 pounds. Maximum size: 7 inches.

Small, 3- to 5-inch fish appear erratically in the inshore area and around piers in some years. Anchovies were of minor importance in the pier catches in Monterey Bay and Humboldt Bay.

California barracuda (T). Average weight: 4 pounds. Maximum size: 18 pounds 3 ounces.

A typical warm-water species that was taken each year in the Avila area by both skiff and pier fishermen. It is rare north of Cayucos.

Giant sea bass (N—San Francisco). Average weight: 10 pounds. Maximum size: 539 pounds.

Skiff fishermen landed several young fish in the Morro Bay-Avila area. This southern species is occasionally taken in the study area, but no large adults were seen. Juveniles inhabit shallow areas, adults usually are found around rocks in water 50 to 200 feet deep.

Kelp bass (N—Princeton west jetty). Average weight: 1.5 pounds. Maximum size: 27 ½ inches total length.

This species was not seen in the northcoast sport catch for several years prior to 1957. After the warm-water period, small individuals began to appear in the skiff catch throughout Monterey Bay. Larger kelp bass are now being landed from Santa Cruz to Monterey by skiff fishermen, and occasionally by shore fishermen, but in small numbers.

Sand bass (N—Santa Cruz). Average weight: 2 pounds. Maximum size: 25.6 inches.

Only one specimen was observed in 1958 north of Cayucos; it was taken by a skindiver at Santa Cruz. Skiff fishermen occasionally catch one of these in the Morro Bay-Avila area. A shallow water species.

Striped bass (T). Average weight: 5.2 pounds. Maximum size: 78 pounds.

Even though this species ranges from Ensenada, Mexico, to the Columbia River, nearly all the ocean sport catch is made between Monterey and San Francisco Bay. A summer surf run occurs each year as far south as San Gregorio Beach, and in some years such as 1958, south to Monterey and north to Bodega Bay. A few fish are taken each year at Moss Landing, inside Morro Bay, and at Tomales Bay. These may represent small, local populations.

The main fishery is inside the Golden Gate, ranging into the Delta area. Partyboat and skiff fishermen troll intensively in the area from the Golden Gate to Angel Island and Treasure Island and Berkeley. Striped bass cannot be legally taken by commercial fishermen. It ranked 10th by numbers and 3rd by weight in the total sport catch, and was the largest of all shore-caught species. They remain at all times in shallow water near shore and in bays.

Pacific bonito (T). Average weight: 8 pounds. Maximum size: 37 pounds.

This pelagic species was taken each year in small numbers in the Morro Bay-Avila area. They appeared in the skiff and partyboat catch, but in small numbers. These fast, fighting fish were taken mostly by

trolling, but can also be taken drift fishing using live bait chum. In some years, bonito are reported in the Monterey Bay area.

Cabezon (T). Average weight: 2 pounds. Maximum size: 39 inches recorded May 16, 1962 by James Beck at Point Lobos State Reserve.

The cabezon was caught by all methods, but principally by shore fishermen. Juvenile fish were abundant in the shore fisherman's catch, as this species tends to inhabit deeper waters as it attains larger size. It is mainly a shallow-water, rock-dwelling species; the largest individuals usually are taken by skiff and partyboat fishermen. Even though relatively few were taken, it was important throughout the coastal area, and was taken in all fishing methods.

White croaker (T). Average weight: ½ pound. Maximum size: 15 ½ inches recorded July 7, 1959 at Princeton.

This was another important species, especially for pier and skiff fishermen from San Francisco southward. They averaged around ½ pound, yet most of the skiff catch was around 1 to 2 pounds. Juveniles frequent inshore areas around piers, and because of the large numbers taken off piers the average weight was quite low. Adults form looseknit schools over sandy bottoms, and can be easily taken on small, baited hooks. The white croaker ranked 2nd by numbers and 10th by weight, and was recorded in all fishing methods except skindiving. About three-fourths of the entire catch by numbers was made from piers.

Spiny dogfish (T). Average weight: 5 pounds. Maximum size: About 5 feet.

A rarely-taken species, found from the surf to several hundred feet over sandy bottom. Appeared in small numbers in all fishing methods except skindiving. Most were taken by pier fishermen.

Monkeyface eel (N—did not appear north of Bodega Bay during our survey). Average weight: 3 pounds. Maximum size: 30 inches.

Strictly a tide-pool, or shallow, rocky-area species recorded in the shore, skiff, and skindiving catches. Poke-poling is a specialized shore-fishing method primarily to catch this species. The principal pokepoling areas were at Dillon Beach, Pescadero Beach, Año Nuevo Point, and on the Monterey peninsula.

Rock eel (T). Average weight: 1.88 pounds. Maximum size: 20 inches.

of minor significance in the shore catch. Those taken were about as large as this species attains. A tide-pool, wash-rock species.

Wolf-eel (T). Average weight: 10 pounds. Maximum size: 8 feet reported but is a doubtful figure. Most likely a 6' 8" specimen is a record.

A shallow-water, rock-frequenting species taken primarily by skindivers and occasionally by skiff and partyboat fishermen. It is rarely brought to shore, because it is erroneously thought to be poor-eating. It also can administer a serious bite, so most skindivers leave it alone. Only about 200 per year were brought in by sport fishermen.

Starry flounder (T). Average weight: 1.26 pounds. Maximum size: 3 feet, 20 pounds.

This was one of the most commonly-taken flatfish; it appeared in all fishing methods, but primarily in the pier catch. It is a sand, mud, and gravelly-bottom species ranging in all depths from the surf and shallow waters of bays to several hundred feet.

Boat catches were of large adults ranging from 3 to 15 pounds, but the large number of juvenile fish taken from piers brought the average down to a little over 1 pound.

Onespot fringehead (N—Bodega Bay). Average weight: 0.10 pound. Maximum size: 8 inches.

A rarely-caught species in rocky, shallow water on the open coast; it was recorded only in the shore catch.

Kelp greenling (T). Average weight: 0.84 pounds. Maximum size: 21 inches.

One of the more important species, especially in the rocky-shore and skindiving catches. It appeared in catches of all fishing methods, smaller individuals being taken in shallower areas. Most skiff-, skindiving-, and partyboat-caught fish were large adults averaging well over 1 pound each, but the large numbers of young fish taken by shore-fishermen lowered their average weight. Although they appeared in all areas of the rocky coastline throughout the year, they ranked only 13th by number and 20th by weight.

Painted greenling (T). Average weight: 0.08 pounds. Maximum size: 10 inches.

A small, tide-pool, shallow-rocky-area fish rarely taken by sportsmen. One specimen was brought to shore by a skindiver.

Rock greenling (T). Average weight: 0.80 pounds. Maximum size: 24 inches.

This species is restricted to shallow water, and was recorded in all fisheries except the partyboat. Most, over 90 percent, were taken by shore fishermen. It is of relatively minor importance.

Shovelnose guitarfish (N—Monterey Bay, but northernmost occurrence during our survey was at Morro Bay.) Average weight: 4 pounds. Maximum size: 40 ½ pounds.

An uncommon, usually bay-frequenting species occasionally taken by pier, skiff, and partyboat fishermen. Most were recorded at Pismo Beach pier.

Pacific hake (T). Average weight: 1 pound. Maximum size: about 3 feet.

Taken incidentally by salmon trollers and bottomfishing, partyboat and skiff fishermen over deeper areas. Is not considered good to eat, and is usually discarded.

Halfmoon (N—Redding Rock, Klamath River). Average weight: 1.25 pounds. Maximum size: 19 inches.

Taken only by skindivers at Monterey, but fairly common in southern California where it is a shallow-water, rock-frequenting species. The young are pelagic.

California halibut (N—Redding Rock, Klamath River). Average weight: 7.4 pounds. Maximum size: 61 ½ pounds.

This large flatfish was recorded in the skiff, partyboat, and shore catch, but was also taken by skindivers at Tomales Bay and off Seaside. This species has shown a "comeback" since 1958, and in 1962 was one of the more sought-for fish in Moss Landing Harbor, Tomales Bay, and inside Morro Bay, as well as outside the breaker line off Aptos and Seaside.

Small fish are taken inside the bays, and the large individuals off the beaches. Large fish appear seasonally near the surf where they spawn and feed.

Pacific halibut (T). Average weight: 5 pounds. Maximum size: 8 feet.

This species was rarely taken by shore and skiff fishermen from Fort Bragg northward. In 1958, several juveniles were caught at the mouth of Noyo Harbor by jetty fishermen. Large adults are usually taken in deep reef areas.

Pacific herring (T). Average weight: 0.15 pounds. Maximum size: 13 inches.

Adult Pacific herring are taken from shore inside bays and river estuaries during the spawning period from December through March. This fishery was not covered on our survey, and the catch of the spawning runs is not included. Most of this catch is made in San Pablo Bay. During the spring and summer, young fish, mostly 1- and 2-year-olds, concentrate inside harbors and the large river estuaries from Bodega Bay northward. These fish are taken at night with small hooks and snag lines. A few Pacific herring were taken by surf netters at Mad River beach during daytime.

Brown Irish lord (T). Average weight: 0.6 pounds. Maximum size: 10 inches.

This small, shallow-water fish was occasionally caught by pier, shore, and skiff fishermen, but was usually brought in as an oddity, rather than to be eaten. It is rather uncommon, and taken usually around rocks.

Red Irish lord (S—Monterey Bay). Average weight: 0.5 pounds. Maximum size: 20 inches.

Those recorded in the shore, skiff, and partyboat catches were small fish, and were quite uncommon. Not enough were taken to disclose a preferred habitat, although most were taken by rock-shore fishermen.

Jacksmelt (T). Average weight: 0.4 pounds. Maximum size: 22 inches.

This was one of the most numerous species taken, ranking 4th by numbers and 13th by weight. It was taken in all fishing methods except skindiving, and throughout the study area in shallow bays, around piers and kelp beds, as a pelagic schooling-species over deep water, and in the surf and rocky shoreline areas. The largest catches were by pier fishermen, followed by shore and skiff fishermen. Jacksmelt spawn during winter in the shallower areas of bays, where their mass of eggs on "strings" are attached to marine vegetation and bottom debris. This fish appears erratically wherever it is found, sometimes in small numbers and sometimes in fairly dense schools.

Giant kelpfish (T). Average weight: 1.2 pounds. Maximum size: 24 inches.

A brightly-colored fish of minor importance, occasionally taken by shore and pier fishermen and skindivers. It is a shallow-water, kelp-bed form, that rarely strays from a rocky or kelp-bed situation.

Pacific lamprey (T).

The lamprey fishery at the mouth of the Klamath river was not surveyed hence this species did not appear in our sample.

Lingcod (T). Average weight: 8 pounds. Maximum size: about 70 pounds.

The most important fish by weight in our survey, and ranked 15th by numbers. Smaller fish are landed by shore fishermen, but they did not catch many. Over one-half were taken by partyboat fishermen with the skiff catch amounting to about one-third of the total. Lingcod were taken in all areas, by all fishing methods throughout the year, and from shallow depths to depths in excess of 300 feet. There were special lingcod excursions to the Año Nuevo Island area, and it was one of the choice species sought by skindivers. They spawn in the fall and early choice species sought by skindivers. They spawn in the fall and early winter, and the male guards the nest of eggs deposited in a rocky crevice or niche. Females attain much larger sizes than males, and are sought principally during the fall when they are most available. The juveniles are pelagic, but young adults are found in harbors and bays, moving to shallow rocky reefs and kelp beds as they grow larger.

Jack mackerel (T). Average weight: 0.60 pounds. Maximum size: 32 inches.

This pelagic, schooling species is found occasionally around piers where it is sometimes taken in large numbers. In size, they range from a few inches to more than 2 feet, often taken incidentally on salmon trolling gear. It was recorded in the pier, skiff, and partyboat catches. of minor importance in central and northern California, most of the catch was taken by pier fishermen in the Monterey Bay area, and by salmon trollers in Monterey Bay and north to Bodega Bay. Sometimes taken by partyboat bottomfishing in Monterey Bay.

Pacific mackerel (T). Average weight: 0.57 pounds. Maximum size: 25 inches.

The Pacific mackerel is also a pelagic species, but does not attain as large a size as jack mackerel. In fact, this species is of quite uniform size in the catch, often schooling with similar-sized jack mackerel and large Pacific sardines. It was recorded in the skiff, partyboat, and pier catches, with greatest numbers landed by skiff fishermen.

Mola (T). Average weight: 15 pounds. Maximum size: 2 tons.

This pelagic, plankton and jellyfish eater, is found near shore each summer. It is often picked up as an oddity, and more rarely brought in as a food item by skiff and pier fishermen and skindivers.

Opaleye (N—San Francisco). Average weight: 2 pounds. Maximum size: 13.46 pounds.

A small, shallow-water species sometimes taken by skindivers off Monterey and Pacific Grove. It is usually a herbivore, but in southern California, where it is fairly common, it has been taken on small, baited hooks.

Pacific pompano (T). Average weight: 0.38 pounds. Maximum size: 10 inches.

Pompano were taken only by pier fishermen at Cayucos during our survey. Commercial fishermen have taken these in Monterey Bay in past years. They usually are found in small schools over shallow, sandy bottom.

Queenfish (T—Yaquina Bay, Oregon). Average Weight: 0.2 pounds. Maximum size: 12 inches.

Taken only from Cayucos pier south during our survey. (Several taken in 1963 at Capitola pier.) A small, inshore species, concentrating over sandy bottom around piers and inside harbors.

Ratfish (T). Average weight: 1 pound. Maximum size: about 30 inches.

This deep-water species is rarely brought in by skiff fishermen as an oddity; it is not considered edible and has a venomous dorsal spine.

Bat ray (T). Average weight: 8 pounds. Maximum size: 210 pounds.

Bat rays are interesting to most people, so they will bring them to shore even if they don't intend to eat them. They were recorded in the shore, pier, and skiff catches. Most of the shore catch was made inside harbors or from jetties at the mouths of harbors. Bat rays usually inhabit shallow areas, and are pests on commercial oyster beds. There is a shark derby each year at Moss Landing in which this species is the predominant catch. Derby records were not included in our survey.

Pacific electric ray (T). Average weight: 2.5 pounds. Maximum size: 90 pounds.

These are common on sandy bottom in Monterey Bay, but only one specimen was observed in the sport catch; it was brought in by a skindiver.

Black Rockfish (T). Average weight: 2.89 pounds. Maximum size: 23 ¼ inches recorded on April 20, 1959 by Dan Gotshall at Humboldt Bay.

This was one of the more-important species; it appeared in all fishereries and in fair numbers throughout the study area. Nowhere very abundant, it ranked 12th by numbers and 8th by weight for all species. The largest fish were caught by salmon trollers, being the most common incidental species taken on trolling gear north of San Francisco. It was primarily a shallow-reef species, but also frequented kelp beds, and was occasionally taken over deep reefs in mid-depth, and by trollers some distance from rocky areas. It is of minor importance south of Monterey.

Black-and-yellow rockfish (N—Eureka, but not observed north of Noyo Harbor during our survey). Average weight: 1.0 pounds. Maximum size: 15 inches.

A typical, shallow-water species taken by skiff fishermen, shore fishermen, and skindivers, with a few also landed by pier fishermen and partyboat fishermen. It is most frequently taken in and around kelp beds, and inshore in rocky situations to depths of 10 to 12 feet. It is rarely taken in water exceeding 60 feet in depth. In some areas such as Santa Cruz, it makes up a good part of the catch, but in relationship to the entire catch it is of minor importance.

Blue rockfish (T). Average weight: 1.31 pounds. Maximum size: 21 inches.

This was the most numerous fish taken on hook-and-line during our study. Because of its large numbers and average size, it ranked 2nd in weight for all species. It is primarily a shallow-reef species, schooling or concentrating over rocky pinnacles, feeding at middepth on plankton. It is also taken in and around kelp beds, as well as in deeper waters over offshore banks in depths to several hundred feet. Because of its varied distribution and large numbers, it appeared in all fishing methods, but primarily in the partyboat and skiff catches. At some ports, this species accounted for up to 50 percent of the partyboat and skiff catch by numbers. North of Fort Ross, blue rockfish abundance drops considerably, and it is only of minor importance. The juveniles appear in tide-pools and in shallow rocky areas. This species has shown signs of decline at several areas during recent years, and is now being studied intensively in central California.

Bocaccio (T). Average weight: 3.4 pounds. Maximum size: 36 inches.

This rockfish attains a large size, and adults are quite abundant in deeper waters. Bocaccio are very important in the commercial trawl catch, but made up only 3.4 percent of the sport catch by weight and only 1.4 percent by numbers. In some years, juveniles concentrate in shallow sandy areas near piers where they are easily taken on small, baited hooks; nearly 4,000 of these juveniles were taken at piers in 1958. Most bocaccio were taken by partyboat fishermen on deep, rocky reefs, with chilipepper, greenspotted rockfish, and yellowtail rockfish.

Brown rockfish (T). Average weight: 2.5 pounds. Maximum size: 21 ½ inches recorded Aug. 16, 1959 by Richard Nitsos at Bodega Bay.

This is one of the larger rockfishes found in shallow-reef areas and near kelp beds. The main catches were by partyboat and skiff fishermen, with some landed by pier fisherman, shore fisherman, and skindivers. Juveniles are often taken in shallow areas around piers and in bays. This species apparently is unevenly distributed, as only certain reef areas are very productive. As with the black rockfish, it is often taken on salmon trolling gear, indicating a somewhat wandering adult behavior.

Calico rockfish (N—Morro Bay). Average weight: 1.28 pounds. Maximum size: 10 inches recorded Sept. 10, 1960 by Don Johnson at Avila.

This small, unimportant rockfish appeared in the skiff and partyboat catch of the Avila-Morro Bay area. Most were discarded because of their small size, only the largest being retained. It was recorded only in the partyboat catch during our survey.

Canary rockfish (T). Average weight 1.65 pounds. Maximum size: 30 inches.

Most canary rockfish were taken by partyboat fishermen, although at certain localities, such as at Princeton and Santa Cruz, they were important in the skiff catches. Pier fishermen and skindivers failed to take this species, and it was recorded in the rocky shore catch only near Gualala. It is principally a shallow-reef species, but it does appear over deep banks as well. Juveniles appear in shallow areas, and large adults inhabit deeper water. This is an important commercial species, especially in the long-line catches of Monterey. It ranked 19th by numbers and 17th by weight for all species in the sport catch.

Chilipepper (N—Eureka). Average weight: 2.62 pounds. Maximum size: 22 inches.

Strictly a deep-water rockfish frequenting rocky areas as well as sand and mud bottoms, the chilipepper was of minor importance in the sport catch, but is one of the key commercial trawler species. Nearly all the sport catch was made from party boats. The seven skiff-caught fish were juveniles taken in shallow water off Santa Cruz and Monterey.

China rockfish (S—Point Buchon). Average weight: 1.86 pounds. Maximum size: 17 inches recorded Sept. 10, 1960 by Richard Nitsos at Bodega Bay.

This shallow-water, rocky-reef species, taken in 10 to 120 feet of water, is nowhere abundant, is always an incidental part of the catch, but is still not uncommon. There are usually a few in any partyboat catch from shallow water; some appeared in all fisheries except from piers.

Copper rockfish (T). Average weight: 2.53 pounds. Maximum size: 22 inches.

These heavy-bodied rockfishes live in shallow areas when young, and in deeper waters as adults. Actually, in our records we combined

two species, copper rockfish and whitebelly rockfish, in this category because they are very difficult to differentiate. Sizes, areas of occurrence, and depth of schooling are similar over the ranges of both species.

These fish were recorded in all fishing methods, with best catches by partyboat fishermen; they ranked 18th by numbers and 12th by weight of the total catch.

Cow rockfish (N—Usal). Average weight: 4 pounds. Maximum size: 37 inches.

Cow rockfish in small numbers in the partyboat and skiff catch, primarily in the Morro Bay area. Due to inexperienced samplers, a few turkey-red rockfish were called cow rockfish at Morro Bay in 1958, but since the numbers were so small, no attempt was made to adjust our figures for this error. It is primarily a deep-bank species, but juveniles and young specimens are taken in shallow areas.

Flag rockfish (T). Average weight: 1.7 pounds. Maximum size: 24 inches.

This deep, rocky-bank species taken occasionally by partyboat and skiff fishermen, is brightly-colored and adds considerably to the excitement of the catch.

Gopher rockfish (N—Eureka, not observed north of Shelter Cove during our survey). Average weight: 1.17 pounds. Maximum size: 15¼ inches recorded April 3, 1960 at Monterey.

This small, shallow-water rockfish was important to skiff and partyboat fishermen in some areas, but throughout the coast it failed to appear in the top 20 species either by weight or numbers. It appeared in the catches of all methods except pier fishing. It was especially important in the skiff catches at Cayucos and Avila. In behavior and distribution, it is quite similar to the black-and-yellow rockfish from which it is indistinguishable except by color.

Grass rockfish (T). Average weight: 1.9 pounds. Maximum size: 22 inches recorded Dec., 1962 by Dan Gotshall at Bodega Bay.

Taken only in the shallow water, rocky bottom, and kelp bed areas, this was one of the favored species by shore fishermen at Santa Cruz. Most of the catch was made by shore fishermen, followed by the skiff and pier fishermen. Grass rockfish appeared in all fisheries, although only one individual was seen in the partyboat catch, at Bodega Bay. Most of the pier catch was of juveniles, primarily from inside harbors near submerged debris.

Greenspotted rockfish (T). Average weight: 1.36 pounds. Maximum size: 20 inches.

A deep-water species rarely taken in shallow reef areas, they appeared only in the partyboat and skiff catches, usually with greenstriped rockfish, chilipepper, yellowtail rockfish, etc. Greenspotted rockfish were important in the partyboat catches in the Monterey Bay and Morro Bay areas. Juveniles and adults were taken in the same deep-water areas. No attempt was made to separate this species from the pink rockfish.

Greenstriped rockfish (T). Average weight: 0.70 pounds. Maximum size: 15 inches.

This deep-water species is small, and is usually thrown back. It was recorded only in the partyboat catch in small numbers.

Kelp rockfish (N—Bodega Jetty). Average weight: 1.25 pounds. Maximum size: 16-¾ inches recorded Sept. 14, 1960 at Monterey.

The kelp rockfish is a shallow-water, primarily kelp-bed species taken in all fisheries, but primarily by skindivers. Both juveniles and adults are taken in the same general area—the juveniles in shallower water, even intertidally, and the adults usually on the outer edges of kelp beds and occasionally on rocky reefs 70 to 80 feet deep off central California.

Olive rockfish (N—Shelter Cove, one specimen reported from Crescent City, but not confirmed). Average weight: 1.92 pounds. Maximum size: 24 inches. (The largest seen during our survey was a 23-inch fish taken on a partyboat at Morro Bay in 1960.

One of the more-important species, especially in the partyboat catch from Monterey southward, it inhabits kelp-bed areas, but is more available over shallow reefs and occasionally in mid-depth over deep banks. It ranked 16th by numbers and 14th by weight in the total catch. It is important only for partyboat fishermen and skindivers, even though it did appear in all fisheries.

Quillback rockfish (S—Point Sur). Average weight: 1.75 pounds. Maximum size: 24 inches.

This uncommon fish was taken only occasionally by skiff and partyboat fishermen in the Bodega Bay, Farrallon Island, Santa Cruz, and Monterey areas. It frequented rocky reefs, both shallow and deep.

Rosy rockfish (T). Average weight: 0.46 pounds. Maximum size: 14.2 inches recorded at Monterey, 1960.

This small, red rockfish is taken primarily on deep reefs along with greenspotted, greenstriped, and starry rockfish, but is occasionally taken on shallower reefs. Although excellent for eating, they are usually thrown back because of their small size. They are most important in the Monterey Bay and Morro Bay areas.

Speckled rockfish (N—San Francisco). Average weight: 1.5 pounds. Maximum size: 22 inches.

This deep-reef species was recorded only in the partyboat catch, and in small numbers, mostly at Santa Cruz and Monterey.

Squarespot rockfish (N—Farallon Islands). Average weight: 0.36 pounds. Maximum size: 11½ inches recorded Sept. 2, 1960 at Princeton.

A small, uncommon rockfish of shallow-reef areas, it usually is thrown back because of its size. It was recorded in the partyboat and skiff catches.

Starry rockfish (N—San Francisco). Average weight: 1.4 pounds. Maximum size: 18 inches.

This brightly-colored rockfish was taken in fair numbers on certain deep reefs, usually with rosy, greenspotted, and flag rockfish. A few were taken by skiff fishermen, but 90 percent were landed from partyboats. It was of minor importance.

Stripetail rockfish (T). Average weight: 0.60 pounds. Maximum size: 13 inches.

A small, uncommon species in the sport catch, the stripetail rockfish is commonly taken by commercial trawlers. It usually is caught in deep water, and often discarded because of its size.

Treefish (N—San Francisco). Average weight: 2.3 pounds. Maximum size: 16 inches.

This rockfish is a southern form that rarely is seen north of Santa Barbara. A few were recorded in the partyboat and skiff catches in the Morro Bay-Avila area. They usually inhabit shallow reefs and are of little importance in central California.

Turkey-red rockfish (T). Average weight: 5.3 pounds. Maximum size: 36 inches.

This large rockfish, found on both shallow and deep reefs, was recorded only in the skiff and partyboat catches. Few were taken, but they are a prized fish because of their large size, bright color, and splendid eating-qualities.

Vermilion rockfish (T). Average weight: 3.9 pounds. Maximum size: 30 inches.

This large, red rockfish is becoming more important each year in the partyboat and skiff catches from Montery south. It was not within the top 20 by numbers, but was 11th by weight of all species, contributing a little over 3 percent of the catch. It is found on shallow and deep reefs, with the largest individuals in deep water. Juveniles are sometimes taken from piers, but none appeared in the shore catch. Those taken by skin-divers were average-sized fish, speared during tournaments.

Widow rockfish (T). Average weight: 1.7 pounds. Maximum size: 21 inches.

A sometimes densely-schooling fish, adult widow rockfish are found over deep rocky-bank areas. Some small fish have been taken by skiff fishermen, but usually in water deeper than 80 to 90 feet. The main catches were by partyboat fishermen at Monterey, taken in association with yellowtail rockfish.

Yellowtail rockfish (T). Average weight: 1.73 pounds. Maximum size: 26 inches.

Yellowtail rockfish were one of the most important sport rockfishes ranking 8th in numbers and 7th by weight for all species. It was the major species at all deep-reef areas from the Farallon Islands southward. When blue rockfish became scarce at several ports, partyboat operators frequented deep-bank areas where large numbers of yellowtail

rockfish were available. This species was not recorded in shore and pier catches, but a few were taken by skindivers at Monterey. It apparently is not restricted to rocky bottom, for it is sometimes found by both partyboats and commercial trawlers over smooth bottom. It is usually found at mid-depth 80–150 feet beneath the surface.

Sablefish (T). Average weight: 0.25 pounds. Maximum size: over 3 feet.

This valuable commercial species appeared in small amounts in the sport catch. Most of these were small, schooling juveniles taken on the surface by skiff and partyboat fishermen. Adults are almost always found on smooth bottom in deeper waters. A few adults were taken by skiff fishermen off Moss Landing while fishing for Pacific sanddabs.

King salmon (T). Average weight: 8 pounds. Maximum size: 125 pounds, rarely over 60 pounds off California.

The king salmon is one of the most prized and sought-for species in the study area. It contributes primarily to a skiff and partyboat fishery, but pier fishermen and shore fishermen occasionally land some. It ranked only 17th by numbers, but 4th by weight of all species. It was taken at all ports, but was most numerous and predictable from San Francisco north. South of there its distribution and availability has been erratic over the past several years. This species is usually taken by trolling 20 to 60 feet beneath the surface by sport fishermen, but at greater depths by commercial fishermen. It is a pelagic species ranging from the shoreline to possibly several hundred miles to sea.

Pink salmon (S—northern California). Average weight: 5 pounds. Maximum size: 12 pounds.

Pink salmon rarely occur in California waters, and only in oddnumbered years. Four were taken by skiff fishermen at Humboldt Bay in 1959.

Silver salmon (T). Average weight: 7 pounds. Maximum size: 30 pounds.

This is a pelagic species similar in behavior and life history to the king salmon, except it is more northerly in its range, with the major catches made from Bodega Bay north. They are caught closer to the surface than king salmon and are noted for their fighting ability. Relatively few were taken and they ranked only 18th by weight for all species. At several river mouths from Bodega Bay north, they were probably the most important or, at least, sought-for species.

Pacific sanddab. (T). Average weight: 0.24 pounds. Maximum size: 16 inches.

These small flatfish are taken in deeper waters by skiff fishermen and occasionally by partyboat fishermen. They occasionally enter shallower, sandy areas and are taken by pier and shore fishermen. Despite its small size, it is one of the best-eating fishes, and is popular with many fishermen who ply for this species alone. Favorite sanddab beds are off Capitola, Moss Landing, and Pacific Grove.

Pacific sardine. (T). Average weight: 0.16 pounds. Maximum size: about 13 inches.

This small, pelagic, densely-schooling species was occasionally taken incidentally on small hooks, while fishing for small Pacific mackerel and rockfish. It was recorded in the skiff and partyboat catch. Is an important bait species for striped bass and salmon.

Sargo (N—Santa Cruz). Average weight: not sampled. Maximum size: 17.4 inches.

The sargo was not sampled but was reliably reported from Morro Rock by a skindiver who was familiar with the species. During this same year (1960) a commercial fisherman caught one in Monterey Bay where it was kept in the aquarium at Santa Cruz.

Buffalo sculpin (S—Monterey Bay—southernmost record during survey was at Capitola). Average weight: 1.2 pounds. Maximum size: 15 inches.

Buffalo sculpins are seldom caught. They are usually taken in tide pools, in shallow rocky areas, and sometimes around piers. The species was recorded in all the fisheries, with the most recorded in the skiff catch. They are small and have little meat on them for their size.

Pacific staghorn sculpin (T). Average weight: 0.20 pounds. Maximum size: 12 inches.

This small fish is important for pier fishermen, but solely because it is abundant and easy to catch. Along with shiner perch, it is readily taken by children from piers, but it also appeared in shore and skiff catches. Compared to all other species, it was of minor significance. Many staghorn sculpins were retained as bait for striped bass.

White seabass (T). Average weight: 18.2 pounds. Maximum size: 80 pounds.

This highly-esteemed sport and food fish sometimes appears in good numbers as far north as Tomales Bay. Even though they may be numerous, sport catches are usually quite small. Some are taken each year around Tomales Bay and in the Morro Bay-Avila area. During our survey, they appeared in the shore, skiff, and partyboat catches. Most were taken by skiff fishermen. The shore-caught individuals were caught by striped bass fishermen off San Francisco and near Rio Del Mar, Monterey Bay.

Señorita (N—Natural Bridges Beach State Park, central California). Average weight: 0.09 pound. Maximum size: 10 inches. Señoritas inhabit kelp beds, and are rarely taken by shore and skiff fishermen. They usually are brought in as a curiosity.

American shad (T). Average weight: 0.4 pounds. Maximum size: 30 inches.

Introduced from the Atlantic, American shad have become distributed over most of the western coastline. They spawn in fresh water and are occasionally taken by pier fishermen in San Francisco and San Pablo bays.

Blue shark (T). Average weight: 30 pounds. Maximum size: 13 feet.

This pelagic, surface shark is sometimes unintentionally caught by partyboat and skiff fishermen. Most are released or the line is cut, but at times a fisherman will bring one ashore for interest. They appear seasonally during summer and fall.

Leopard shark (T). Average weight: 8 pounds. Maximum size: about 7 feet.

This shallow-water, bottom shark is taken from piers and shore, mostly inside bays and from jetties. It is said to be good to eat, but not many people try it. We recorded small numbers in the shore, pier, and skiff catches.

Pacific angel shark (T). Average weight: 48 pounds. Maximum size: 60 pounds.

This warm-water form was occasionally taken on sandy bottom by shore and skiff fishermen, mostly in the Morro Bay area.

Swell shark (N—Monterey Bay). Average weight: 8 pounds. Maximum size: 3 feet.

A few swell sharks were caught at Cayucos pier. They often are found near kelp beds.

California sheephead (N—Monterey Bay, the farthest north during the survey was at Monterey). Average weight: 3.65 pounds. Maximum size: 36 pounds.

This inshore species is common off southern California, but only about 30 per year were taken at Monterey by skindivers.

Big skate (T). Average weight: 3.5 pounds. Maximum size: 6 to 8 feet.

Although big skates were taken in the shore, pier, and skiff catch in small numbers, most were landed by pier fishermen at Trinidad, Cayucos, and Pismo piers. The shore catch was made at Bodega jetty, and the skiff catch at Crescent City.

California skate (T). Average weight: 3.5 pounds. Maximum size: 30 inches.

California skates were taken only by pier fishermen, mostly at San Francisco Municipal pier.

Longnose skate (T). Average weight: 2 pounds. Maximum size: 4 to 5 feet.

Five longnose skates were taken from skiffs. This deeper-water species is rarely taken by sport fishermen.

Night smelt (S—taken near Point Arguello, but the southernmost-known spawning area is at Moss Landing). Average weight: 0.07 pound. Maximum size: 9 inches.

These valuable surf spawners were taken by surf netters along many northern California beaches. This fishery was not surveyed, and only data from spot checks and reports by fishermen and wardens were noted. No attempt was made to determine effort. The catch may exceed

100,000 pounds per year. A few were taken in the surf and from piers by hook-and-line. There is also a commercial fishery for this species.

Surf smelt (T—Long Beach—the southernmost known spawning area was near Davenport). Average weight: 0.10 pound. Maximum size: 10 inches.

This was one of the major species among all sport fishes by numbers and weight. They were not included in our catch data, as they were taken by nets rather than by hook-and-line or spear. Over 400,000 pounds were taken, ranking them among the highest for all species. These fish spawn during the daytime in sandy surf during early spring and summer. They were taken by A-frame nets from San Francisco north, and by A-frame and two-man jump nets from San Francisco south. There is also a commercial fishery for this species.

Smoothhounds (N—central California). Average weight: 3 pounds. Maximum size: gray smoothhound, 43 inches; brown smoothhound, 36 inches.

These small, shallow-water sharks were commonly taken in sandy surf, from piers, and inside harbors. Most were discarded. No attempt was made to separate the species.

Dover sole (T). Average weight: 0.43 pound. Maximum size: 10 pounds.

This deep-water species rarely enters the sport catch, a few dozen being landed by skiff fishermen at Fort Bragg.

English sole (T). Average weight: 1 pound. Maximum size: 21 inches.

This deep-water species is of considerable value to commercial fishermen. Occasionally, juveniles or a large adult will be taken from piers, skiffs, and partyboats.

Petrale sole (T). Average weight: 1.83 pounds. Maximum size: 24 inches recorded in Oregon.

The petrale sole is one of the most important flatfish for commercial and sport fishermen. They attain large sizes, and are fairly common over sandy bottoms deeper than about 60 feet. They were recorded in the skiff and partyboat catches in about equal numbers, but contributed little to the total catch.

Rex sole (T). Average weight: 0.5 pounds. Maximum size: 18 inches.

Rex sole were rarely taken by sport fishermen, but partyboat fishermen took a few and one was recorded in a skindiver's catch near San Francisco.

Rock sole (T). Average weight: 1.38 pounds. Maximum size: 18 inches.

This flatfish is found in shallower water and over a more-pebbly bottom than most other flatfish. It was important locally in the skiff catch, but nowhere was it taken in large numbers. It also appeared in skindiving, shore, and partyboat catches.

Sand sole (T). Average weight: 0.57 pounds. Maximum size: 20 inches.

Sand sole were taken in all fisheries, except skindiving; the greatest numbers were recorded in the shore catch. Juveniles are frequently taken by rock shorefishermen as well as by shore fishermen, especially from jetties at the mouths of harbors. This species was sometimes mistaken for small California halibut in Moss Landing and Morro Bay harbors.

Scaly-fin sole (T). Average weight: 2.26 pounds. Maximum size: 18 inches.

Rarely taken by sport fishermen, although it was recorded in the shore, partyboat, and skiff catches, the scaly-fin sole is a deeper-water species of some importance commercially.

Round stingray (N—Humboldt Bay). Average weight: 2 pounds. Maximum size: 22 inches.

Round stingrays were rarely caught by sport fishermen, but skindivers and skiff fishermen occasionally brought one ashore for curiosity.

Green sturgeon (T). Average weight: 15 pounds. Maximum size: 350 pounds (Columbia River).

A shore fisherman at Moss Landing jetty landed one of these fish in 1958, and one was reportedly taken by a skiff fisherman at Humboldt Bay.

Barred surfperch (N—Bodega Bay, not sampled north of Baker Beach during our survey). Average weight: 1 pound. Maximum size: 16 inches.

Barred surfperch ranked 3rd by numbers and 6th by weight of the total catch. They were the principal species in the surf from Princeton south, and were recorded in fair numbers in the pier fishery. Smaller numbers appeared in the skiff catch. They rarely venture into rocky areas, but were ubiquitous along sandy beaches.

Black perch (N—Fort Bragg). Average weight: 0.8 pounds. Maximum size: 14 inches.

A shallow-water species, found in both rocky and kelp areas as well as over sand bottom around piers, black perch rarely were taken in the surf. Most were taken by rocky-shore fishermen, closely followed by pier fishermen. Skiff fishermen and skindivers find these fish in kelp beds, and skiff fishermen catch fair numbers around bottom debris in bays and estuaries.

Calico surfperch (N—Trinidad Pier). Average weight: 0.8 pounds. Maximum size: 11.1 inches recorded at Santa Cruz, 1961.

This sandy-surf species is taken in the shore, pier, and skiff catches. More of these are taken in rocky areas, than its two nearest relatives, the redtail and barred surfperch. It is more common south of San Francisco, but nowhere does it yield the large catches the barred and walleye surfperches do.

Dwarf perch (N—Bodega Lagoon). Average weight: 0.2 pounds. Maximum size: 5.7 inches recorded at San Francisco, 1958.

This tide-pool, shallow rocky area herbivore is sometimes taken on very small baited hooks, especially at the base of San Francisco Municipal pier.

Pile perch (T). Average weight: 1.2 pounds. Maximum size: 17.4 inches recorded at Monterey, 1960.

This is one of the large surfperches. It was recorded in all fisheries except partyboat. Most were taken from piers, followed by the shore and skindiving catches. Mostly, it frequents rocky, kelp, and piling areas inside and outside harbors.

Rainbow seaperch (N—Cape Mendocino). Average weight: 0.6 pounds. Maximum size: 12 inches.

Strictly a rock-frequenting species, rainbow seaperch were taken mostly by rock shorefishermen. They appeared in catches from piers built over rocks or having protective habitat, such as the Cement Ship at Seacliff Beach State Park. The species was not recorded in the surf catch. This is never an abundant schooling or aggregating fish; no more than three or four can be expected in a given day's fishing.

Redtail surfperch (S—Monterey Bay). Average weight: 1.8 pounds. Maximum size: 16 inches.

The redtail surfperch was the most important surf species north of Princeton. Locally, striped bass are quite important from San Francisco south, but this surfperch is almost equally as important, and is far more numerous. It appeared in all fisheries except skindiving. It is dominantly a surf-dweller, but some have been taken in rocky areas next to sandy beaches. The best catches are in spring when they concentrate for spawning in harbors and the estuaries of larger rivers as well as along the surf line.

Reef perch (N—Tomales Bay). Average weight: 0.3 pounds. Maximum size: 7.1 inches recorded at Pacific Grove, 1960.

This species, like the dwarf perch, is an intertidal fish, and primarily a herbivore. Most of the catch was made by rock fishermen on the Monterey Peninsula. A few were taken by pier fishermen. Their total contribution to the catch was insignificant.

Rubberlip perch (N—Van Damme Beach State Park). Average weight: 2 pounds. Maximum size: 18 inches.

This large surfperch was taken in all fisheries except partyboat, with the greatest numbers recorded in the pier catch. Primarily a harbor and bay species in the survey area, it was also taken in rocky areas and kelp beds on the outer coast. Because of its relatively large size, it is desirable, but it is not abundant, making up only 0.15 percent of the total catch.

Sharpnose seaperch (N—Santa Cruz Pier). Average weight: 0.5 pounds. Maximum size: 11½ inches.

This uncommon species inhabits both shallow and deep water, and usually is found in small schools. It appeared in the pier and skindiving catches at Santa Cruz and Monterey.

Shiner perch (T). Average weight: 0.06 pounds. Maximum size: 6 inches.

This is probably the smallest fish consistently taken by sport fishermen, especially from piers. It was recorded at all piers in the study area, with the greatest concentrations inside harbors and bays. It also appeared in rocky-shore and skiff catches. This was the primary species taken by children from piers. It is abundant throughout the year, and is easy to catch. It ranked 5th by numbers of all species, but was insignificant by weight because of its small size.

Silver surfperch (T). Average weight: 0.10 pounds. Maximum size: 8½ inches recorded at Pescadero State Beach, 1960.

This small surfperch frequents primarily the sandy surf zone, but is also taken among shallow rocks and from piers. It is plentiful, easy to catch, and was recorded in large numbers in the shore and pier catches, and in smaller numbers from skiffs. It ranked 9th by numbers, but because of its small size was insignificant by weight.

Spotfin surfperch (N—Russian River). Average weight: 0.1 pounds. Maximum size: around 5 to 6 inches.

Rarely taken in sport catch. A few taken by surf and pier fishermen.

Striped seaperch (T). Average weight: 1.2 pounds. Maximum size: 15 inches.

This is one of the most important species in the rock shorefishing catch. During spring, large concentrations appear in rocky areas to spawn. They also frequent kelp beds where they are taken by skindivers, skiff, and partyboat fishermen throughout the year. This was the only surfperch appearing in all fisheries. It is occasionally taken in sandy surf, but not far from nearby rocky areas. It ranked 11th by numbers and 15th by weight for all species.

Walleye surfperch (T). Average weight: 0.3 pounds. Maximum size: 12 inches.

This is one of the most widespread, ubiquitous species along the coast. It is found in all shallow-water habitats, apparently in about equal abundance. It is a relatively small fish, but not as small on the average as the silver surfperch and shiner perch. It is more popular than these latter two, because an occasional large fish is taken. It was the most frequently-taken surfperch in the skiff catch, because of its kelp bed habitation and ease of catching, especially near Capitola. It ranked 7th by numbers and 19th by weight of all species.

White seaperch (T). Average weight: 0.6 pounds. Maximum size: 12 inches.

A more erratic-behaving species, the white seaperch was present in large numbers at times, but usually was only caught incidentally with

other pier and shore species. It appeared in all but the partyboat catch, and was taken in almost equal numbers by pier and shore fishermen. Most of the shore catch was from jetties at the mouths of harbors. Overall, it was of minor importance.

Pacific tomcod (S—Point Sal). Average weight: 0.15 pounds. Maximum size: 12 inches.

This rather uncommon fish was taken in all fisheries except skindiving. Most were juveniles taken at Princeton Pier and along the shore south to Año Nuevo Point.

Topsmelt (T). Average weight: 0.25 pounds. Maximum size: 12 inches.

A small relative of the jacksmelt, topsmelt sometimes appeared in large concentrations around piers and inside bays, but not as abundantly nor widespread as the jacksmelt. A large concentration of these at Santa Cruz pier in 1958 accounted for most of the recorded catch. Only a few were taken by shore fishermen, and they did not appear in the skiff, skindiving, or partyboat catches.

Steelhead rainbow trout (T). Average weight: 4 pounds. Maximum size: 30 pounds.

Only a few steelhead were taken by shore and skiff fishermen, mainly around the mouths of rivers during the fall and winter spawning run. Some were taken each year by shore casters in Monterey Harbor.

Diamond turbot (N—Cape Mendocino). Average weight: 1.25 pounds. Maximum size: 18 inches reported, largest on record, 15 inches.

A skindiver brought one of these to shore at Monterey. Others have been taken inside Morro Bay by skiff fishermen since our study ended. They were rare in the sport catch.

C-O turbot (T). Average weight: 0.51 pounds. Maximum size: 12 inches.

Shore fishermen at Princeton East Jetty took a few of these fish in 1960.

Ocean whitefish (N—San Francisco). Average weight: 1.2 pounds. Maximum size: 40 inches.

Occasionally, a skiff or partyboat fishermen will land one of these during the warmer summer months. It is common south of the Channel Islands, but seldom seen north of there, mostly off Morro Bay and Avila.

California yellowtail (N—Monterey Bay). Average weight: 20 pounds. Maximum size: 80 pounds.

This popular fish of southern California and Baja California, only occasionally appears in central California, mostly around Avila during summer and fall.

13. SUMMARY

1) All sportfishing methods between Pt. Arguello and Oregon were surveyed for effort, species composition, enumeration of facilities, and to obtain specific data on most species, including length frequencies and life history notes.

2) Two fish identification booklets (field guides) were prepared and printed for distribution to sportsmen.

3) Optimum and proportional random sampling procedures were not applicable in this study. Stratified sampling procedures were adhered to when possible, but in general the available sampling intensity was applied to the area sampled. Over-sampling was more common than under-sampling; especially with the partyboat species-composition data.

4) In lieu of random-type sampling procedures to obtain effort of shore and pier fisheries, turnover determinations were utilized to estimate total daily angler effort at key locations. Instantaneous counts were then made at all fishing localities from shore and from an airplane. These counts were converted to full-day effort estimates by turnover curve data derived from intensive sampling at the key locations.

5) It was not possible to sample all fishing methods simultaneously, hence pier fishing and surf casting were sampled in 1958, skiff fishing in 1959, and partyboat, skindiving, and rocky-shore fishing in 1960.

6) Volunteer log data were submitted by skindivers, skiff concessionaires, owners of private shore-access areas, and State and County Park personnel. Skindiving logs of daily diving activity and catch proved reliable with no evident bias.

7) Annual yearly estimates of catch and effort for each fishing method were collated over the several years of sampling to represent an average annual catch and effort. No oceanographic or biological extremes occurred during this period to obviate use of such average estimates. During the study period, salmon landings were below average; blue rockfish showed a decline at some areas from 1959 on; striped bass were above average in abundance; and lingcod landings remained fairly steady.

8) Hook-and-line effort averaged around 1,410,000 angler-days per year with an additional 42,000 angler-days expended by daytime surf smelt netters. The night smelt fishery was not surveyed. The largest effort was expended from shore, followed by pier fishing, skiff fishing, partyboat fishing, and skindiving.

9) Approximately 3,218,000 fish were landed by hook-and-line fishermen during the average year, with the greatest numbers appearing in the pier catch and the greatest weight in the partyboat catch.

10) Blue rockfish, barred surfperch, jacksmelt, white croaker, and redtail surfperch were the top five ranking species by numbers. By major groupings, surfperch contributed 39.0 percent of the total number followed by rockfishes with 28.6 percent.

11) Approximately 4,370,000 pounds of sport fish were landed during the average year by hook-and-line fishermen. The daytime surfnet fishery accounted for an additional 400,000 pounds of surf smelt. Lingcod, blue rockfish, striped bass, king salmon, and redtail surfperch were the top five ranking species by weight. By major groupings, rockfish accounted for 38.6 percent of the total poundage, followed by surfperch and lingcod with 21.2 and 9.6 percent, respectively.

12) The major piers from Trinidad south were surveyed in 1958. Piers at Crescent City, Point Arena, and inside Noyo Harbor, Bodega Bay, Monterey Pier No. 2, and San Simeon were only sporadically checked, and none of the piers inside the Golden Gate (except for Berkeley and San Francisco Municipal Piers) and Morro Bay was surveyed.

About 40 percent of all pier fishing was by children under 16 years of age. Species varied from pier to pier depending upon the type of bottom, but those most frequently taken throughout the study area were jacksmelt, shiner perch, walleye surfperch, silver surfperch, and Pacific staghorn sculpin; a total effort of 530,700 angler-days was expended on piers during the average year. About 1,034,000 fish were recorded for this effort.

13) Skindivers expended the least effort, with only 39,700 angler-days or 2.7 percent of the total. Questionnaire and sampling data revealed that about 58 percent of the skindivers plying ocean waters belonged to organized skindiving clubs.

Skindiving activities were divided between freediving and SCUBA, with freediving taking 78.4 percent of the total time. The most common activity for both was spearfishing, followed by observing for SCUBA divers, and abalone picking for free divers. Blue rockfish, lingcod, striped seaperch, black rockfish, and kelp greenling were the most frequently speared fish by combined SCUBA and freediving. Lingcod were the primary fish for SCUBA divers, and blue rockfish for free divers.

14) Partyboat catches were grouped by trolling and bottomfish methods. The bottomfish catch made up 89.5 percent of the total partyboat catch by numbers and 73.0 percent by weight. The principal troll-caught fish were king salmon, silver salmon, striped bass, black rockfish, and jack mackerel. The principal bottomfish were blue rockfish, yellowtail rockfish, lingcod, olive rockfish, and bocaccio. Live bait was used by partyboat anglers from Cayucos south. A total of 115,700 angler-days and 800,380 fish was recorded for the partyboat fishery in 1960.

15) Shore fishing was the most popular ocean fishing method in terms of angler-days with 603,100 recorded, for 43 percent of the total. Jetty fishing was included with shore fishing even though jetties are legally "piers," where no fishing license is required. A total of 1,024,000 fish was landed by shore fishermen in 1958. Barred surfperch, redtail surfperch, silver surfperch, jacksmelt, striped seaperch, kelp greenling, and striped bass were the dominant species. Shore

fishing included surf casting, rocky shore fishing, jetty fishing, and poke-poling.

16) Surf netters were active from Oregon to Moss Landing. The southernmost area where surf smelt were known to spawn was in the Scott Creek-Davenport area, and the southernmost known spawning area for night smelt was at Moss Landing. About 42,000 angler-days were expended by daytime surf netters.

17) Skiff fishermen were surveyed at all skiff-launching sites except those inside the Golden Gate. A total of 121,000 angler-days and 337,000 fish was estimated during 1959. Bottomfishing made up the greatest effort and catch, especially from Bodega Bay south. Blue rockfish and white croaker were two of the most frequently landed species from Princeton south; however, there was considerable variation along certain areas of the coast among the most frequently-recorded species. King salmon, striped bass, silver salmon, black rockfish, and lingcod were the principal troll fish.

18) Over 66 percent of the total sport fishing effort was expended from San Francisco to Monterey, an area encompassing 18 percent of the coastline surveyed.

19) The commercial catch of an average year (1959 and 1960) was about 20 times that of the sport catch in the area from Oregon to Point Arguello. There was very little overlap among species taken by both fisheries. The fishing areas were also separated, except for salmon trolling and some inshore long-lining, skiff hook-and-line fishing, and gill netting. Only four species were of primary importance to both fisheries: king salmon, silver salmon, lingcod, and bocaccio. Two special studies on the trawl and partyboat operation in the Avila-Morro Bay and Monterey Bay areas demonstrated clearly there could not be any interfishery competition in these areas.

20) Northcoast sportfishing can be enhanced by constructing new piers and improving old ones, by acquiring shore access, by constructing skiff-launching sites, and by marking natural reef areas for full utilization before initiating artificial reef construction. Life history studies on blue rockfish, lingcod, and other species are needed, and an ecological study of natural reef areas, including tagging experiments is recommended. Inshore sandy-bottom fisheries for flatfish should also be investigated.

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APPENDIX

APPENDIX

Common and Scientific Names

Albacore	*Thunnus alalunga*
Anchovy, northern	*Engraulis mordax*
Barracuda, California	*Sphyrana argentea*
Bass, giant sea	*Stereolepis gigas*
kelp	*Paralabrax clathratus*
sand	*Paralabrax nebulifer*
spotted	*Paralabrax maculatofasciatus*
striped	*Roccus saxatilis*
Bonito, Pacific	*Sarda chiliensis*
Cabezon	*Scorpaenichthys marmoratus*
Crab, market	*Cancer magister*
Croaker, white	*Genyonemus lineatus*
Dogfish, spiny	*Squalus acanthias*
Eel, monkeyface	*Cebedichthys violaceus*
rock	*Xiphister mucosus*
wolf	*Anarrhichthys ocellatus*
Eulachon	*Thaleichthys pacificus*
Flounder, starry	*Platichthys stellatus*
Fringehead, onespot	*Neoclinus uninotatus*
sarcastic	*Neoclinus blanchardi*
Greenling, kelp	*Hexagrammos decagrammus*
painted	*Oxylebius pictus*
rock	*Hexagrammos superciliosus*
Guitarfish, shovelnose	*Rhinobatos productus*
Hagfish, Pacific	*Polistotrema stouti*
Hake, Pacific	*Merluccius productus*
Halfmoon	*Medialuna californiensis*
Halibut, California	*Paralichthys californicus*
Pacific	*Hippoglossus stenolepis*
Herring, Pacific	*Clupea pallasi*
Irish Lord, brown	*Hemilipidotus spinosus*
red	*Hemilipidotus hemilipidotus*
Jacksmelt	*Atherinops californiensis*
Kelpfish, giant	*Heterostichus rostratus*
Lamprey, Pacific	*Entosphenus tridentata*
Lingcod	*Ophiodon elongatus*
Mackerel, jack	*Trachurus symmetricus*
Pacific	*Scomber diego*
Mola	*Mola mola*
Octopus	*Octopus* sp.
Opaleye	*Girella nigricans*
Pompano, Pacific	*Palometa simillima*
Queenfish	*Seriphus politus*
Ratfish	*Hydrolagus colliei*
Ray, bat	*Myliobatis californicus*
Pacific electric	*Torpedo californica*
Rockfish, black	*Sebastodes melanops*
black-and-yellow	*Sebastodes chrysomelas*
blue	*Sebastodes mystinus*
bocaccio	*Sebastodes paucispinis*
brown	*Sebastodes auriculatus*
calico	*Sebastodes dalli*
canary	*Sebastodes pinniger*
chilipepper	*Sebastodes goodei*
china	*Sebastoes nebulosus*
copper	*Sebastodes caurinus*
cow	*Sebastodes levis*
flag	*Sebatodes rubrivinctus*
gopher	*Sebastodes carnatus*
grass	*Sebastodes rastrelliger*
greenspotted	*Sebastodes chlorostictus*
greenstriped	*Sebastodes elongatus*
kelp	*Sebastodes atrovirens*
olive	*Sebastodes serranoides*
pink	*Sebastodes eos*
quillback	*Sebastodes maliger*
rosy	*Sebastodes rosaceus*
speckled	*Sebastodes ovalis*
squarespot	*Sebastodes hopkinsi*
splitnose	*Sebastodes diploproa*
starry	*Sebastodes constellatus*
stripetail	*Sebastodes saxicola*
tiger	*Sebasodes rubrivinctus*
treefish	*Sebastodes serriceps*
turkey-red	*Sebastodes ruberrimus*
vermilion	*Sebastodes miniatus*
widow	*Sebastodes entomelas*
yellowtail	*Sebastodes flavidus*
Sablefish	*Anoplopoma fimbria*
Salmon, king	*Oncorhynchus tshawytscha*
pink	*Oncorhynchus gorbuscha*
silver	*Oncorhynchus kisutch*
Sanddab, Pacific	*Citharichthys sordidus*
Sardine, Pacific	*Sardinops caeruleus*
Sargo	*Anisotremus davidsoni*
Sculpin, buffalo	*Enophrys bison*
Pacific staghorn	*Leptocottus armatus*
rosylip	*Ascelichthys rhodorus*
Seabass, white	*Cynoscion nobilis*
Senorita	*Oxyjulis californica*
Shad, American	*Alosa sapidissima*
Shark, blue	*Prionace glauca*
leopard	*Triakis semifasciata*
Pacific angel	*Squatina californica*
swell	*Cephaloscyllium uter*
Sheephead, California	*Pimelometopon pulchrum*
Skate, big	*Raja binoculata*
California	*Raja inornata*
longnose	*Raja rhina*
Smelt, night	*Spirinchus starksi*
surf	*Hypomesus pretiosus*
whitebait	*Allosmerus elongatus*
Smoothhound, gray	*Triakis californicus*
brown	*Triakis henlei*
Sole, Dover	*Microstomus pacificus*
English	*Parophrys vetulus*
petrale	*Eopsetta jordani*
rex	*Glyptocephalus zachirus*
rock	*Lepidopsetta bilineata*
sand	*Psettichthys melanostictus*
scaly-fin	*Isopsetta isolepsis*
Stingray, round	*Urolophus halleri*
Sturgeon, green	*Acipenser medirostris*
Surfperches	
barred surfperch	*Amphistichus argenteus*
black perch	*Embiotoca jacksoni*
calico surfperch	*Amphistichus koelzi*
dwarf perch	*Micrometrus minimus*
pile perch	*Rhacochilus vacca*
pink seaperch	*Zalembius rosaceus*
rainbow seaperch	*Hypsurus caryi*
redtail surfperch	*Amphistichus rhodoterus*
reef perch	*Micrometrus aurora*
rubberlip perch	*Rhacochilus toxotes*
sharpnose seaperch	*Phanerodon atripes*
shiner perch	*Cymatogaster aggregata*
silver surfperch	*Hyperprosopon ellipticum*
spotfin surfperch	*Hyperprosopon anale*
striped seaperch	*Embiotoca lateralis*
walleye surfperch	*Hyperprosopon argenteum*
white seaperch	*Phanerodon furcatus*
Tomcod, Pacific	*Microgadus proximus*
Topsmelt	*Atherinops affinis*
Trout, steelhead rainbow	*Salmo gairdneri gairdneri*
Turbot, diamond	*Hypsopsetta guttulata*
C-O	*Pleuronichthys coenosus*
curlfin	*Pleuronichthys decurrens*
Whitefish, ocean	*Caulolatilus princeps*
Yellowtail, California	*Seriola dorsalis*

Common and Scientific Names

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