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RESULTS OF THE BAY AREA SPORTFISH ECONOMIC STUDY (BASES)

Cynthia J. Thomson
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NOAA-TM-NMFS-SWFC-78

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Center

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I. INTRODUCTION

In 1985, the National Marine Fisheries Service, Southwest Fisheries Center, initiated the Bay Area Sportfish Economic Study (BASES). At that time the agency contracted with CIC Research, Inc. of San Diego to conduct a survey of saltwater recreational anglers residing in selected Central and Northern California counties. The purposes of this survey were:

1. To obtain descriptive information on the anglers and on their fishing activities in the San Francisco Bay and Ocean Area (SFBOA).

2. To estimate the economic value of fishing trips made in the area.

3. To estimate changes in value associated with changes in catch rates of designated species/species groups.

This information would be useful for analyzing the impact of water projects, habitat protection policies and fishery management decisions which affect the availability of particular species to sport anglers.

This report contains the results of our descriptive analysis of the fishery. While it focusses largely on the coastal county residents covered by the BASES survey effort, we also attempt to provide some limited information (from a separate data source) on non-coastal county and out-of-state residents who also fish in the SFBOA. The report also provides estimates of economic value associated with hypothetical changes in salmon/striped bass catch rates. These values were obtained by a direct elicitation technique known as the contingent valuation method (CVM). Further evaluation of the CVM data and other types of modelling pertaining to valuation of the fishery will be undertaken in a separate report.

Section II discusses the survey design underlying the data collection effort. Section III describes sources of sampling bias and how they were handled. Section IV contains results of our descriptive analysis of the fishery and its coastal county participants. Section V describes available information on non-coastal and out-of-state anglers, who were not included in the BASES survey effort. Section VI contains the contingent valuation results, and Section VII summarizes the results of the previous sections.

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II. SURVEY DESIGN

A. Target Population

The individuals targetted by this survey were recreational anglers who engage in saltwater finfishing activities in the San Francisco Bay and Ocean Area (SFBOA). Here the SFBOA is loosely defined to include adjacent areas to the north and south of the Bay, as well as the Bay itself. It includes: (1) San Francisco Bay, which is divided into three connecting bodies of water: San Francisco Bay proper, San Pablo Bay and Suisun Bay; and (2) the Pacific Ocean area between Monterey (Pt. Lobos) and Bodega Bay.

Sampling efforts for the study were directed at anglers residing in the following California counties: Alameda, Contra Costa, Del Norte, Humboldt, Marin, Mendocino, Monterey, Napa, Sacramento, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Trinity and Yolo (see Figure 1). According to results from the 1984 Marine Recreational Fishery Statistics Survey (MRFSS), approximately 86% of all recreational fishing trips in Central and Northern California were made by coastal county residents. On this basis, it was felt that relatively little information on fishing activity would be lost by the omission of non-coastal and out-of-state anglers from this survey effort.

B. Sampling Procedure

The data were collected as an "add-on" to the Marine Recreational Fishery Statistics Survey (MRFSS), which is a nationwide telephone and intercept survey of recreational saltwater anglers sponsored annually by the National Marine Fisheries Service. CIC Research, Inc. of San Diego, California conducted the telephone portion of the MRFSS on the Pacific Coast according to the following protocol: CIC personnel contacted households in selected counties in California, Oregon and Washington by a random digit dialing procedure. The interviewer determined how many household members had gone saltwater finfishing in the state in the previous twelve months and in the previous two months. The interviewer then attempted to interview all two-month anglers to extract specific information on each non-salmon/striped bass trip made over the last two months (more on the salmon/striped bass exclusion later in this paper). This procedure of random identification and interview of saltwater anglers was repeated every two months over the course of the year.

The BASES add-on to the MRFSS proceeded for seven two-month survey waves, covering the period July 1985 through August 1986. Over this time period all twelve-month anglers contacted in the Central and Northern California counties targetted by BASES were asked (at the end of the MRFSS portion of the interview) if they were willing to fill out an additional mail questionnaire.

offering a set of maps from NMFS's Anglers' Guide to the United States Pacific Coast (Squire and Smith, 1977) as an incentive, CIC Research sent the BASES questionnaire to all willing respondents. CIC Research also followed up its BASES mailing with a second mail contact reminding those who had not returned the BASES questionnaire to do so.

In order to obtain the desired sample size for BASES, CIC Research found it necessary to augment the number of Central and Northern California telephone contacts made for purposes of the MRFSS. Over the seven survey waves CIC Research supplemented the 20,759 MRFSS contacts with 12,919 additional interviews. Of the 33,678 households contacted, 4,031 (12%) contained at least one member who had gone saltwater fishing in the year prior to the interview. Of these, 3,184 (79%) were willing to participate in the BASES mail survey, and 1,543 (48%) actually completed and returned the questionnaire. Table 1 describes the number of MRFSS and augmented household contacts made in each survey wave. It also describes the number of households containing a twelve-month angler, the number of twelve-month anglers willing to participate in the mail survey, and the number returning the questionnaire for each survey wave.

It should also be noted that the number of households contacted represented only about 45% of the numbers dialed. The other 55% consisted largely of numbers which were not in service, business numbers and no answers. Given that only about 12% of households contain an angler, only 5% (.45x.12) of the calls made resulted in positive identification of an potential respondent. In a situation such as this, in which the general population is randomly canvassed for the purpose of identifying members of the target population, adding this survey to an existing random canvass (the MRFSS) was a particularly cost-effective way to obtain information.

C. Content of Mail Questionnaire

Information requested on the BASES survey instrument will be used to determine the statistical relationship between the amounts and types of fishing activity taken and selected catch rate and socioeconomic variables. The survey form includes questions on angler characteristics such as household income and size, wage, occupational status, zipcode of residence, boat ownership, fishing avidity and the like. It includes a number of contingent valuation questions regarding hypothetical changes in salmon and striped bass catch rates. It asks for the number of trips made in the previous two months categorized by mode (shore vs. boat) and by area (inside vs. outside the 3FDOA). It also asks for specific information (e.g., target species, catch by species, fishing mode and area, travel distance, and travel and on-site expenditures) on the three most recent trips made in the past year .

A copy of the mail questionnaire is contained in Appendix I. Included in the questionnaire is a map defining fishing areas which respondents used as the basis for describing their three most recent trips.

III. SAMPLING BIAS

The 1,378 questionnaires returned in the first six survey waves were analyzed to determine the pattern of fishing activity experienced in the SFBOA over the period of a year. Preliminary examination of the data revealed that the distribution of the BASES sample across counties did not follow the "true" distribution of the angling population. This section describes the nature of this sampling bias and the methods used to correct for it.

A. Sources of Sampling Bias

Defining an "angler" as a Central or Northern California coastal county resident who took at least one saltwater fishing trip in the year prior to the telephone interview, we estimated the number of anglers in each county (A_j) according to the following formula.

$$A_j = H_j \cdot P_j \cdot AVG_j$$

where H_j = number of households in county j as of 12/31/84, as measured by number of postal deliveries to residences; (Number of households by zipcode obtained from: Western Economic Research Co., "Mid-Decade Demographic Data by Zip Codes." Zipcodes allocated to counties on the basis of: U.S. Postal Service, "1985 National Five-Digit ZIP Code and Post Office Directory.")

P_j = prevalence rate (percent of households in county j containing at least one 12-month angler); (Source: CIC Research, Inc., as computed from MRFSS telephone survey data).

AVG_j = average number of 12-month anglers per angling household in county j. (Source: CIC Research, Inc., as computed from MRFSS telephone survey data).

The results of these computations (Table 2) were used to determine the expected geographic distribution of 12-month anglers across counties.

Preliminary analysis revealed significant differences between this expected distribution and the distribution of the returned questionnaires. We attribute this sampling bias to two sources: (1) the sampling design, which explains the non-proportionality between the expected and MRFSS distributions across counties, and (2) respondent self-selection, which explains the non-proportionality between the MRFSS and BASES distributions.

1. Sampling Design

The number of telephone contacts made in each county for purposes of the MRFSS was roughly proportional to the square root of the county population. This non-proportional method of sampling was used to ensure that each county was sufficiently represented in the sample to obtain statistically valid estimates of catch and effort (the major purpose of the MRFSS). Thus by sampling design, the number of MRFSS telephone interviews made in each county was not intended to be proportional to the number of residents (or the number of anglers) in the county.

Figure 2 illustrates the systematic nature of this bias. For purposes of illustration, the nineteen counties covered by BASES were divided into three groups: (i) the six counties with the largest number of 12-month anglers in residence, (ii) the six counties with the smallest number of anglers, and (iii) the seven counties in between. Figure 2 compares the "true" distribution of anglers among these three county groups to the corresponding MRFSS sample distribution of anglers over the six survey waves. For the top six counties, the MRFSS undersamples anglers by about 15%. For the middle seven counties, the MRFSS oversamples anglers by about 10%. For the bottom six, the MRFSS oversamples by a very large 250%. This pattern was found to be consistent across all six survey waves.

2. Respondent Self-Selection

The geographic distribution of 12-month anglers contacted in the MRFSS differed significantly from the distribution of those who actually returned the BASES questionnaire. We attributed this self-selection bias to the fact that response rates to the BASES questionnaire were strongly correlated with recent patterns of fishing activity, which varied among counties. Our hypothesis regarding the relationship between fishing activity and response rates took the following form:

1. Those anglers who had fished around the time that they received the BASES questionnaire were more likely to remember details of their trips and therefore more likely to complete and return the BASES questionnaire.

2. To the extent that interest in the questionnaire is related to the level of recent fishing activity, those anglers

who had made many recent trips were likely to be more motivated to return the questionnaire than those who had made only one or two such trips.

3. Because an entire page of the questionnaire was devoted to salmon and striped bass fishing, the respondents were also expected to include a disproportionate number of salmon and striped bass anglers.

In order to test the above hypothesis, it was necessary to compare the fishing behavior exhibited by BASES and MRFSS respondents. This task was complicated by the fact that MRFSS coverage of recreational fisheries in the SFBOA was not complete. In particular, because the State of California assumes responsibility for the collection of recreational salmon and striped bass catch and effort data, salmon and striped bass trips are systematically excluded from the (federal-sponsored) MRFSS survey effort.

Recalling the MRFSS protocol as described in Section II.B., each MRFSS respondent was asked to provide details of all non-salmon/striped bass trips made in the previous two months. Those who fished only salmon/striped bass over that period were deemed ineligible to participate further in the survey and the interview was terminated. Thus the telephone survey provides no information on the number of salmon/striped bass trips made by the households contacted. (MRFSS definition of a salmon or striped bass trip over the BASES survey period is detailed in Table 3.)

However, CIC Research was able to provide information from the MRFSS intercept survey regarding (a) the number of 12-month anglers identified in each 2-month survey wave and county who did not fish at all during the wave, (b) the number of ineligible salmon/striped bass anglers encountered in each wave, and (c) the number of non-salmon/striped bass trips made by eligible anglers in each wave. Using these data, we were able to address the question of whether recent patterns of fishing activity affected the response rate to the BASES questionnaire.

We divided the MRFSS and BASES samples into five mutually exclusive "avidity categories": (a) 12-month anglers contacted during the survey wave who had not fished at all during the wave; (b), (c), (d) anglers who had made one, two and >2 non-salmon/striped bass trips respectively during the wave; and (e) anglers who had made at least one salmon/striped bass trip and no non-salmon/striped bass trips during the wave (i.e., the ineligibles). Note that while it would have been preferable to measure avidity for the anglers in categories (b), (c) and (d) by the total number of trips made during the wave, regardless of species, the lack of information on salmon/striped bass trips from the MRFSS precluded us from doing this.

The results of Table 4 show a very consistent pattern of non-response bias. Response rates ranged from a mere 24% for those who had not fished at all in the previous two months to 72%

for those who had made more than two recent trips. The response rate was highest of all (75%) for salmon/striped bass anglers.

B. Correcting for Sampling Bias

In order to correct for the sampling bias arising from sampling design and respondent self-selection, a series of weights was constructed for each county of residence i and avidity category j. The actual formulas for the weights varied, depending on whether they would be applied to anglers or to their fishing trips.

1. Computation of Angler Weights

The angler weights for each county i and avidity category j were computed as follows:

$$(E1) \quad w_{ij} = (a_{ij}/a_i) \cdot (A_i/A)$$

where a_{ij} = number of twelve-month anglers identified in MRFSS telephone canvass who live in county i and fall in avidity category j

a_i = total number of twelve-month anglers identified in MRFSS telephone canvass who live in county i

A_i = total number of twelve-month anglers residing in county i (see Table 2)

A = $\sum A_i$, total number of twelve-month anglers residing in the nineteen Central and Northern California coastal counties

$$\sum_i \sum_j w_{ij} = 1.$$

Each w_{ij} represents the "true" proportion of anglers who live in county i and fall in avidity category j.

While the distribution of anglers across counties is invariant with respect to survey wave, the distribution across avidity categories could conceivably vary from wave to wave. In order to determine whether this was indeed the case, we computed a single "composite" set of weights by pooling the MRFSS results over the six survey waves. We then computed a separate set of weights for each of the six survey waves. Chi-square tests were used to make pairwise comparisons of wave results with the composite, and the results (Table 5) revealed no statistically significant difference between the two. On this basis, the composite weights were used to correct the angler data for sampling bias. The weights are described in Table 6.

In order to properly compute angler statistics separately for boatowners and non-boatowners, separate weights for these two angler categories were computed by the following procedure.

$$(E2) \quad w_{ijb}^{*} = w_{ij} \cdot k_{ijb}$$

where w_{ij} = angler weight for county i, avidity category j, as computed in (E1);

k_{ijb} = percent of BASES sample in county i, avidity category j, who fall in boatowner category b (b=0 for nonboatowner, b=1 for boatowner, so that $k_{ij0} = 1-k_{ij1}$).

$$(E3) \quad w_{ijb} = w_{ijb}^{*} / \sum_i \sum_j w_{ijb}^{*}$$

where w_{ijb}^{*} defined in (E1);

$\sum_i \sum_j w_{ijb}^{*}$ is the estimated (weighted) proportion of the angling population which falls in boatowner category b.

The weight w_{ijb} represents the "true" proportion of the angling population in boatowner category b that lives in county i and falls in avidity category j.

Using these results, the bias-corrected mean value for each angler characteristic z was computed for each boatowner category as follows:

$$E(z_b) = \sum_i \sum_j ((w_{ijb}/n_{ijb}) \sum_r z_{ijbr})$$

where z_{ijbr} = value of variable z for respondent r from county i, avidity category j, boatowner category b;

w_{ijb} = weight for county i, avidity category j, boatowner category b, as described in (E3) above;

n_{ijb} = # of BASES respondents from county i, avidity category j, boatowner category b.

2. Computation of Trip Weights

Because the numbers and "types" of trips (in terms of mode, area and target species) were expected to vary seasonally, the trip data were analyzed on a wave-by-wave basis. The angler weights used in the trip analysis were computed by the following two-step procedure.

$$(E1') \quad w_{ij}^{t} = (a_{ij}^{t}/a_i^{t}) \cdot (A_i^{t}/A^{t})$$

where a_{ij}^t = number of anglers identified in MRFSS telephone canvass from county i, avidity category j, who fished in survey wave t;

a_i^t = number of anglers identifed in MRFSS telephone canvass from county i who fished in survey wave t;

A_i^t = estimated total number of anglers living in county i who fished in survey wave t;

$A^t = \sum A_i^t$, estimated total number of anglers living in all nineteen coastal counties who fished in survey wave t;

$$\sum_i \sum_j w_{ij}^t = 1.$$

$$(E2') \quad w_{jb}^{t*} = k_{jb}^t \cdot \sum_i w_{ij}^t$$

where w_{ij}^t is defined in (E1');

k_{jb}^t = percent of DAODD sample in avidity category j, boat-owner category b, who fished in wave t (b=0 for non-boatowner, b=1 for boatowner, so that $k_{j0}^t = 1-k_{j1}^t$).

$$(E3') \quad w_{jb}^t = \begin{cases} .7 \cdot w_{j0}^{t*} / \sum_j w_{j0}^{t*} & \text{if } b=0 \\ .3 \cdot w_{j1}^{t*} / \sum_j w_{j1}^{t*} & \text{if } b=1 \end{cases}$$

where w_{jb}^{t*} defined in (E2');

the proportion of the angling population that owns a boat is 30% - see Section IV.A.1.

Regarding (E1'):

a. The variable A_i^t was computed according to the formula for twelve-month anglers contained in Section III.A., except that here the prevalence rate and number of anglers per household in each county were computed on a two-month rather than a twelve-month basis. The number of participants in each survey wave, as estimated in this manner, is described in Table 7. Note that the total number of participants over the entire survey period cannot be obtained by summing the numbers for each wave. This will result in double-counting to the extent that anglers fish in more than one survey wave.

b. Each weight w_{ij}^t describes the "true" proportion of active anglers in wave t who come from county i, avidity category j. Note that because these weights were applicable only to those individuals who actually fished during the survey wave, the "0

trips" avidity category that was included among the angler weights does not apply here.

Regarding (E2'):

a. Our analysis of the angler data (Section IV.A.) revealed significant differences in fishing activity between boatowners and nonboatowners, both in terms of average number of trips taken and in the distribution of trips between shore and boat modes. I.e., just as the angler characteristics tended to vary significantly between boatowners and nonboatowners, we expected trip characteristics to do the same. Our sample of active participants in each survey wave was too small to correct for sampling bias along all three relevant dimensions (boatownership, county and avidity). However, each boatowner-avidity combination was sufficiently represented in the sample to allow us to correct for these two sources of bias. Because the probability of an angler residing in county i is not independent of the probability that he will fall in avidity category j, (see chi-square test results, Table 8), it was necessary to compute the avidity weights in (S2') as $\sum w_{ij}^t$ rather than as a_j^t/a^t (where a_j^t is the number of anglers identified in MRFSS telephone canvass from avidity category j who fished in survey wave t, and a^t is the total number of anglers identified in the canvass who fished in wave t).

b. Multiplication of the (E1') avidity weights by the factor k_{jb}^t was done to allocate the weight in each avidity category between boatowners and non-boatowners.

Regarding (E3'):

a. Multiplication of the (E2') weights by the factor .7 (for non-boatowners) and .3 (for boatowners) was done to ensure that the "true" proportion of boatowners was reflected in the weighted sample.

b. The w_{jb}^t's, as computed above, are described in Table 9. These weights were used to obtain the bias-corrected distribution of trips across target species and fishing areas (Tables 17 and 20). The general formula used to derive the number of trips taken in survey wave t in some species (or area) category c (X_c^t) was as follows.

$$X_c^t = A^t \sum_j \sum_b (w_{jb}^t / n_{jb}^t) \sum_r w_{jrbc}^t$$

where w_{jb}^t = weight for avidity category j, boatowner category b, survey wave t as described in (E3');

n_{jb}^t = # of BASES respondents from avidity category j, boatowner category b, who fished in survey wave t;

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A^t = estimated total number of anglers who fished in survey wave t;

$w_{jrbc}{}^t = NTRP_{jrb}{}^t \cdot RTRP_{jrbc}{}^t / RTRP_{jrb}{}^t$

$NTRP_{jrb}{}^t$ being the number of trips made by respondent r from avidity category j, boatowning category b in survey wave t;

$RTRP_{jrbc}{}^t$ being the number of trips in category c made by respondent r from avidity category j, boatowning category b in survey wave t--details of which were reported on the BASES questionnaire;

$RTRP_{jrb}{}^t$ being the number of trips made by respondent r from avidity category j, boatowning category b in survey wave t--details of which were reported on the BASES questionnaire.

The inclusion of the variable $w_{jrbc}{}^t$ in the above formula was necessitated by the fact that BASES respondents were asked to provide detailed information on only the three most recent trips made in the past year. For those respondents who had made three or fewer trips in the past two months, the information provided on the questionnaire represented a complete record of their recent fishing activity. For those respondents who had made more than three recent trips, it was necessary to assume that the three reported trips were representative of all trips made over the two month period. To this end, the variable $w_{jrbc}{}^t$ was computed for each active angler in survey wave t in order to "scale" the number of reported trips to the total number taken by the respondent in each category c over the two-month period in question.

IV. SUMMARY STATISTICS FROM BASES

This section describes the angling population targetted by the BASES survey in terms of socioeconomic characteristics and patterns of fishing activity. The trips made by these anglers are further described in terms of mode, target species and area fished. All angler statistics were computed in accordance with the weighting procedures described in Section III.B.1. The trip weights described in Section III.B.2. were used to estimate the distribution of trips across target species and geographical areas (Tables 17 and 20).

A. Recreational Anglers

1. Comparison of Percent Boatowner with Other Data Sources

Our survey results indicate that, of the more than 473,000 twelve-month anglers residing in the nineteen Central and Northern California counties, approximately 30% own a boat that can be used for saltwater fishing. On average, these individuals actually use their boats for saltwater fishing (rather than for freshwater fishing, cruising and other activities) about 46% of the time. According to the frequency distribution described in Table 10, three-fourths of these vessels fall in the 10-20 foot length category.

Our estimate of boatownership (30%) compares with information from other data sources as follows:

a. According to results of the 1981 Socioeconomic Survey (KCA Research, Inc., 1983), saltwater anglers residing on the Pacific Coast fish an average of 11.9 days per year; 30.3% of these individuals owns one or more boats that can be used for saltwater fishing. While the percent boatowners is very close to our estimate for the Central and Northern California residents covered by BASES, the average number of trips taken annually is at least three times higher than the BASES average. The participation rate is also three times higher than the participation rates estimated from the Marine Recreational Fishery Statistics Survey (U.S. Dept of Commerce, Jul 1986) for anglers residing in California, Oregon and Washington coastal counties. Given the sampling protocol used in the Socioeconomic Survey (intercept interview with telephone follow-up), it is likely that more avid anglers (including boatowners, who tend to participate more frequently than non-boatowners) were probably over-represented in the sample. These results suggest that 30% may be an over-estimate of the proportion of boatowners in the Pacific Coast angling population.

b. According to results of the 1980 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (U.S. Dept of the Interior, 1982b, Table 21), 24.7% of all sportsmen (fishers and hunters) in California "purchased, had available or already owned" an outboard motor boat in 1980 that could be used for fishing and/or hunting. Although this statistic refers to the hunting and fishing populations combined, it pertains largely to fishermen, since individuals who hunt but do not fish comprise less than 5% of the sportsmen who reside in California (USDI, 1982b, Table 1). Moreover, the 24% figure may over-estimate boatownership to the extent that it includes individuals who "had available" (but did not necessarily own) a boat.

Results from both the KCA and Department of Interior studies (covering Pacific Coast and California anglers, respectively) suggest that the proportion of boatowners is somewhat less than

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30%. The discrepancy between these and the BASES results may be due (at least in part) to the fact that San Francisco Bay is the largest protected estuary on the Pacific coast. As such it probably provides more small boat fishing opportunities than are available elsewhere in the area.

2. Comparison of Boatowner and Non-Boatowner Characteristics and Behavior

Comparative analysis of the boatowner and non-boatowner data revealed both similarities and differences between the two groups in terms of personal characteristics and fishing patterns.

1. According to Table 11, the median annual household income for boatowners falls in the $35K-50K range for boatowners and in the $25K-35K range for non-boatowners.

2. Boatowners perceive themselves as more skilled at angling than do non-boatowners. Table 12 indicates that 37% of boatowners but only 19% of non-boatowners perceive themselves to be at least intermediate-advanced in ability. At the lower end of the range, 45% of non-boatowners but only 25% of boatowners perceive themselves as no better than novice-intermediate in ability.

3. Average household size is virtually the same (2.9 persons/household) for the two groups.

4. As indicated in Table 13, occupational status is roughly the same for the two groups. Approximately 17% of boatowners and 11% of non-boatowners are retired. About 71% of both groups are employed full-time, and an additional 7% are employed part-time. The small fraction remaining are homemakers, students or unemployed.

5. Boatowners spend an average of $238. and non-boatowners spend $57. annually on purchase and repair of salwater fishing gear and equipment (excluding boats, motors, trailers and boat-related equipment).

6. Boatowners tend to be more avid anglers, making an average of 7.86 trips per year (as opposed to 4.03 trips/year for non-boatowners). According to Table 14, boatowners on average make at least as many trips in each survey wave as do non-boatowners, indicating that their more active participation tends to persist throughout the year.

7. Table 14 also indicates that approximately three-fourths of the trips made by boatowners occur in boat mode. There are several reasons why the boatowners in our sample did not fish exclusively from boat mode:

a. We define a boatowner as one who owns a boat that <u>can</u> be used for saltwater fishing. About 9% of our boatowning

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anglers, however, do not use their boat for this purpose at all. That is, although these individuals are classified as boatowners, their fishing behavior (in terms of the distribution of trips among modes) probably more resembles that of non-boatowners than of other boatowners.

b. Boatowners may consider shore modes to be attractive alternatives during those times of year when popular target species (e.g., striped bass) are available in significant numbers from shore. They may also opt for party/charter boat mode in order to gain access to offshore fishing grounds for such target species as albacore and salmon.

8. According to Table 14, non-boatowners (on "average") tend to diversify their fishing activity among modes much more than do boatowners. Depending on the time of year, they make 28% of their trips from beach mode, 20% from pier mode, 26% from party/charter boats, and 26% from private/rental boats.

B. Recreational Fishing Activity

This section discusses the distribution of trips across survey waves, fishing modes, target species and geographic areas; it also describes average catch rates and expenditures. It is important to note that the results contained here pertain to fishing activity over the period July 1985 - June 1986 and that the fishery is subject to changes from year to year.

1. Distribution of Trips Across Survey Waves and Modes

According to Table 15, almost 2.5 million fishing trips were made over the survey period by the angling population covered in the BASES survey. Approximately 48% of these trips were made from private/rental boats, 17% from party/charter boats, 15% from piers, and 19% from beaches.

The distribution of trips varied by survey wave and mode. The seasonal patterns may be due to a variety of factors, including weather, seasonal availability of certain target species (e.g., salmon and striped bass), and the willingness of anglers to substitute one mode for another. Fishing activity in beach, party/charter and private/rental boat modes tended to be considerably higher in late spring/summer/early fall than at other times of year. This was due to a number of factors, including: (a) the spring and fall chinook runs, (b) the movement of striped bass into the saltwater bays and ocean in summer and fall, and (c) the increased spring availability of surfperch and other seasonal immmigrant fishes in the Bay area. Pier fishing activity took on a distinctively different pattern, being significantly lower in summer than at other times of year. While one might expect some diversion of shore-based fishing

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effort to beaches during the striped bass season, this result remains curious, given that the mild summer weather would also be expected to increase fishing activity of all types.

a. **Comparison with Other Data Sources.**--In order to give the reader some sense of whether our trip estimates are in the "ballpark" with respect to other data sources, we attempted to compare our numbers with those from the Marine Recreational Fishery Statistics Survey (MRFSS) and the California Department of Fish and Game (CF&G).

Table 16 compares our trip estimates with those from the 1985 MRFSS. Although the time period covered by these estimates are somewhat different (July 1985-June 1986 for BASES, Jan 1985-Dec 1985 for the MRFSS), the fishing areas (Central and Northern California) and the anglers' counties of residence (nineteen coastal counties) are the same. According to the table, our numbers for boat-based trips are higher (and for shore-based trips lower) than those from the MRFSS. A large part of this discrepancy may be due to the fact that salmon and striped bass trips are included in our figures but excluded from the MRFSS.

However, party/charter boat information obtained from CF&G (Paul Gregory, California Department of Fish and Game, Long Beach, pers. commun.) suggests that, even considering the salmon/striped bass factor, we may be overestimating the number of party/charter boat trips. According to CF&G, 220,228 party/charter boat trips were made in Central and Northern California in 1985 and approximately 200,465 were made in 1986 (including salmon and striped bass trips). CF&G makes these estimates on the basis of partyboat logbook information. Because of underreporting by partyboat operators, these estimates probably represent about 80% of the true total, which is on the order of 250,000-275,000 trips. The discrepancy between this estimate and the 418,000 trips estimated by BASES is quite large, especially considering that the BASES estimate covers only coastal county residents, while the CF&G estimate covers all anglers who fish in the area.

To the extent that BASES overestimates the number of party/charter boat trips, it may also underestimate the number of trips taken in other fishing modes. This bias, if it exists, will carry over into Tables 17 and 20, which describe the distribution of trips among target species and fishing areas. However, there is no reason to expect the relative importance of each target species to a given mode or the relative importance of each fishing area to a given mode/target species combination to be affected by this bias, if it exists.

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2. Distribution of Trips Across Modes and Target Species

For each of their three most recent fishing trips, BASES respondents were asked to identify their target species from the following six categories: (1) no particular species, (2) salmon, (3) striped bass, (4) rockfish/lingcod, (5) halibut/sole/flatfish, and (6) other species. In order to identify the most popular target species, we reconstructed the original six categories into twenty-one mutually exclusive species groups as follows: (1) each of the six original categories, (2) fourteen additional groups encompassing all combinations of two categories, and (3) a final catch-all group encompassing all combinations of three or more categories.

According to Table 17, the seven most popular species groups, accounting for 85% of the trips taken over the survey period, were as follows: (1) no particular species, (2) salmon, (3) striped bass, (4) striped bass-other, (5) rockfish/lingcod, (6) rockfish/lingcod-other and (7) other. "All Else" is a catch-all category that includes all target species groups other than the seven mentioned above. The importance of each target species group varied among fishing modes, as follows.

a. About 37% of the beach trips and 43% of the pier trips, but fewer than 10% of the party/charter and private/rental boat trips, were targetted on "No Particular" species. The large proportion of shore-based trips falling into this category may reflect the fact that trips in beach and pier mode often provide an opportunity to catch a mix of species. This does not necessarily imply that anglers who make such trips do not know or care what they catch.

b. Striped bass and rockfish/lingcod were important components of shore-based fishing effort. Striped bass (either alone or in combination with other species) was targetted on 28% of all beach trips. Rockfish/lingcod was targetted on 21% of all pier trips.

c. Approximately 70% of all party/charter boat trips were targetted on salmon or rockfish/lingcod, with effort being divided approximately equally between these two species groups. Striped bass or striped bass/other were targetted on about 8% of trips.

d. About 27% of all private boat trips were targetted on salmon, another 23% on striped bass (either alone or in combination with other species). Rockfish/lingcod was targetted on 11% of trips and "other" species (i.e., species other than salmon, striped bass, rockfish/lingcod and halibut/sole/flatfish) were targetted on 12% of trips.

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a. **Comparison with Other Data Sources.**--According to information provided by the Pacific Fishery Management Council (PFMC), California ocean recreational chinook and coho effort over the period July 1985-June 1986 totalled 179.8 thousand trips (PFMC, March 1987). This is much lower than the 463 thousand salmon trips estimated with the BASES data (Table 17). Some of this discrepancy can be explained as follows.

a. The PFMC's estimate refers only to party/charter and private/rental boat effort since virtually all of the salmon catch is made in these modes, whereas our estimate includes trips in all modes.

b. The possible overestimation of party/charter boat activity in Table 15 (as discussed in Section IV.B.1.) is reflected in Table 17. That is, to the extent that the estimated number of party/charter boat trips is biased upward, the number of salmon trips in this mode will also be biased upward.

3. Catch Rates by Mode and Major Target Species

Table 18 describes the catch rates in five species categories for each mode and major target species. These catch rates refer to the number of fish caught and released as well as the number bagged. Some observations on the table:

a. For each of the mode/target species combinations described in the table, the catch rate for the targetted species was consistently higher than the catch rates for the non-targetted species. This apparent congruence between motivation and outcome suggests one or both of the following:

i. Anglers can and do affect the probability of catching a target species (at least in the short term) by their choice of mode, season, fishing area, fishing method and/or gear.

ii. Anglers are more likely to recall and report their catch of target species than their incidental catch of other fish.

b. Respondents reporting catches of "other" species (i.e., species other than salmon, striped bass, rockfish/lingcod and halibut/sole/flatfish) were not asked to identify the particular species. Readers interested in learning more about these "other" fisheries are referred to Anglers' Guide to the United States Pacific Coast (Squire and Smith, 1977), which provides an excellent qualitative description of recreational fishing activity in the area covered by BASES.

c. For trips where the angler did not target on any particular species, rockfish/lingcod and "other" appeared to be major components of catch.

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d. The species composition of catch tended to vary between striped bass and striped bass-other trips. In particular, striped bass catch was higher and "other" catch was lower on striped bass than on striped bass-other trips made in beach and private boat modes. The same held true for rockfish/lingcod and rockfish/lingcod-other trips in beach mode. This pattern may be the result of (i) real variations in the species composition of catch and/or (ii) an ex post tendency for respondents to report target species that coincided with actual catch.

e. The salmon catch rate for salmon trips made from private/rental boats exceeded the California Department of Fish and Game bag limit of two fish per trip (minimum size 20"). One reason for this discrepancy is that the catch rates reported here refer to the number caught, not the number bagged. Because a significant number of "shakers" (under-legal size fish) are caught and presumably released during certain months of the year, the salmon catch rate in the table is likely to over-estimate the number bagged.

f. Rockfish/lingcod catch rates were two to three times higher in boat modes than in shore modes, probably because boats provide better access to the resource than could be obtained from shore. Rockfish/lingcod, however, was a popular target in all modes.

a. **Comparison with Other Data Sources.**--Table 19 compares salmon catch rate estimates provided to the Pacific Fishery Management Council (PFMC) by CF&G with the BASES estimates. Although boatowners tend to be more skilled anglers than non-boatowners, partyboat passengers (who are largely non-boatowners) have the fishing and fish-finding expertise of the partyboat operator at their disposal. Therefore salmon catch rates are likely to be higher in party/charter boat mode than in private/rental boat mode. According to Table 19, the PFMC catch rate estimates are consistent with this hypothesis; the BASES estimates are not.

Estimates of current striped bass catch rates are not available from any published sources. However, creel census data collected by the California Department of Fish and Game in past years indicate that striped bass catch rates have historically been higher in charter boat than in private boat mode. According to White et. al. (1986, p. 30), mean charter boat angler success (0.20 bass/angler hour) was twice that of private boat anglers (0.10 bass/angler hour) in the San Francisco Bay Area over the period 1969-1979. This pattern of higher charter boat catch rates also appears in the BASES data.

According to Stevens et. al. (1985), the striped bass catch/angler day from charter boats in the San Francisco Bay area declined from 1.96 to .78 fish from 1958 to 1977. On the basis of this and other more current biological evidence, the authors conclude, "There is no question that the population of adult

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striped bass in the [Sacramento-San Joaquin] estuary has fallen to a low level--much lower than when estimates were first available 20 years ago." The striped bass catch rates estimated with the BASES data (1.38 in party/charter boat mode, 1.00 in private/rental boat mode) are considerably higher than what Stevens' results would suggest.

The difference between BASES and other estimates of salmon and striped bass catch rates is quite large. Part of this difference can be explained by the fact that the BASES estimates include the number of fish caught-and-released as well as the number bagged, while the respective PFMC and CF&G salmon and striped bass catch rates include only the number bagged. However the difference between BASES and these other sources is probably too large to be attributable to this one cause. One plausible explanation is that the BASES respondents tended to recall and report catches that are higher than what actually occurred.

4. Distribution of Trips Across Major Target Species and Geographic Areas

Table 20 describes the geographical distribution of trips over the survey period for each mode and major target species. The areas referred to in the table are graphically depicted in Figure 3--which duplicates the map contained in the BASES questionnnaire (Appendix I). The table can be summarized as follows.

a. **Striped Bass.**--Striped bass fishing effort from private boats was concentrated in San Pablo Bay (Area D) and Suisun Bay (Area E). Party/charter boat activity targetted on striped bass/other occurred largely in San Pablo Bay (Area D)--the "other" in this case probably referring to sturgeon. A significant number of beach trips took place in the Suisun Bay-Carquinez Strait area (Area 5) and also along the shore area between Pacifica and the Golden Gate (Area 11).

b. **Salmon.**--Salmon fishing effort from party/charter boats was concentrated in the Gulf of the Farallons (Area G). Private boats, whose ocean-going range is limited by their size and by weather conditions, tended to operate closer to shore. Most of the private boat activity took place in Monterey Bay (Area I), and to a lesser extent, in the nearshore ocean areas outside the Golden Gate (Area G), and north of Bodega Bay.

c. **Rockfish/Lingcod.**--Most of the pier fishing for rockfish/lingcod took place in Monterey Bay (Area 13). Partyboat trips took place all along the ocean area between Monterey Bay and Bodega Bay (Areas F, G, H, I). Private boat activity was concentrated in these same areas and also extended to ocean areas north of Bodega Bay.

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5. Trip Expenditures by Mode

Table 21 describes average trip expenditures in four categories for each of the four fishing modes. The expenditure categories covered in the table are: (a) tackle--lures, sinkers, lines, rental equipment, licenses, fish cleaning; (b) boat--fuel and fees for private, rental or charter boats; (c) amenities--food, beverages, lodging; and (d) travel--round trip transportation between home and the fishing/launching site. Average expenditures summed over all categories vary from a low of $21.51 for pier trips to a high of $71.84 for party/charter boat trips. Trips in beach mode cost an average of $31.07, while private/rental boat trips cost approximately $47.88.

V. ANGLERS NOT COVERED BY BASES

All of the results presented thus far pertain to fishermen who had a telephone and resided in the nineteen Central and Northern California coastal counties over the survey period. Two segments of the angling population were not included in our survey effort: (a) coastal county residents who do not own a telephone and therefore could not be contacted via the MRFSS telephone canvass, and (b) non-coastal county and out-of-state residents.

Using results from the MRFSS intercept survey regarding (a) the percent of coastal county residents intercepted who do not own a phone and (b) the percent of anglers intercepted who reside outside the coastal counties, we were able to estimate the number of trips made in Central and Northern California by anglers who were not covered by the BASES survey. Note that the intercept survey results provide us with a random sample of trips but not a random sample of anglers, since more avid anglers are more likely to be intercepted at site.

According to Table 22, 10% of the Northern California residents (i.e., from Del Norte, Humboldt, Mendocino, Trinity) intercepted over the BASES survey period did not own a telephone. The percentage of non-telephone owners was much lower in the other counties, ranging from 0% to 2.5%. Overall, only 2% of the trips made by coastal county residents were made by non-telephone owners. Assuming that these individuals, on average, made the same number of trips as telephone owners, we have missed only 2% of anglers residing in coastal counties by our use of the MRFSS telephone survey to identify potential respondents for the BASES survey.

Table 23 describes the percent of anglers intercepted in each of the fourteen fishing counties in Central and Northern California who resided (a) in one of the nineteen counties of residence covered by BASES, (b) elsewhere in California, and (c)

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outside California. The proportion of trips made by coastal county residents was lowest (a) in the three northernmost counties of intercept (Del Norte 58%, Mendocino 67% and Humboldt 82%) and (b) in the southernmost county of intercept (Monterey 84%). For the counties in between, the coastal county proportion was quite high, ranging from 93% to 100%.

Table 24 describes the total number of trips made by coastal county, non-coastal county and out-of-state residents. The number of trips made by coastal county residents (from Table 22) was distributed among fishing counties according to the BASES sample results. The number of trips made by non-coastal county and out-of-state residents was computed by inflating the coastal county figures for each fishing county according to the factors described in Table 23. Results of the table indicate that over 2.7 million trips were made in Central and Northern California over the period July 1985 - June 1986. Approximately 89% of these trips were made by coastal county residents who owned a phone, 2% by coastal county residents who did not own a phone, 6% by non-coastal residents, and 3% by out-of-state residents.

VI. CONTINGENT VALUATION RESULTS

Economic values associated with environmental goods may be estimated by one of three methods. First, the value may be based upon revealed preferences as displayed in actual market purchases and behavior of individuals. In rare instances of privately owned and marketed environmental goods, the market price would correspond to the marginal economic value of the good. For site-specific public recreational resources, the economic value is frequently derived from a demand analysis that uses the cost of travelling to the site as a pseudo-price (the popular travel cost demand model).

Second, the value may be revealed through actual simulations of private markets. In this method the individuals using the environmental good are offered additional access to the good at some specific price, or actual payments are offered for the individual's rights to use the environmental good. The prices paid or accepted under the experimental market may be treated as equivalent to prices in an actual market. Because it can be applied only to goods for which potential users can be excluded and charged a price, opportunities for applying this valuation method are extremely limited.

The third method, the contingent valuation method (hereafter abbreviated as CVM), presents the individual with a hypothetical environmental good (or with a specific change in a real good) and elicits a value for that good or change. Because the change in environment (e.g. change in fish population) and the proposed payment mechanism (e.g. contribution to a preservation fund) are

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hypothetical, the CVM is probably the most problematic of the three methods in terms of potential measurement errors and biases.

However, a recent assessment of CVM (Cummings, et. al., 1986) expresses cautious optimism about the potential of obtaining adequate accuracy for user values associated with public environmental goods. Contingent valuation studies of outdoor recreational activities have had substantial apparent success (Bishop and Heberlein, 1979; Cameron and James, 1987; Devousges, Smith and McGivney, 1983; Sellar, Stoll and Chavas, 1985; Roberts, Thompson and Pawlyk, 1985). To test a variant of the contingent value method, three questions regarding salmon and striped bass catch rates in the San Francisco Bay area were included in the BASES questionnaire.

To estimate a value for changing the size of anadromous fish runs available to saltwater anglers, a contingent value approach is one of only two apparent approaches. Fish availability to anglers has varied significantly through time, and it varies among specific sites during a given fishing season. Consequently, one can use a variant of the travel cost method to determine how recreational fishing demand responds to fish abundance. Modelling of recreational demand, however, requires substantial data manipulation and statistical testing. A multi-site travel cost approach is being applied to the BASES data; results of that will be reported in a separate report later. The CVM approach is more direct, requiring at minimum only a simple tabulation of estimated values. These tabulated values are summarized below.

After establishing a context (i.e. indicating the nature of the possible changes in salmon and striped bass fish populations), three hypothetical questions were asked. The first asked for the respondent's maximum willingess to pay into a fund to support hatcheries and habitat restoration which would prevent the anadromous fish catch rates from declining by 50% from their current levels. This is a willingness to pay (WTP) to avoid a loss (in economics jargon, an equivalent variation measure of a potential loss). The second question asked the respondent's maximum WTP for a 100% increase in salmon/striped bass catch rates (i.e. a compensating variation for a gain). The third question elicited the minimum compensation that the respondents would accept (WTA) to endure a 50% drop in catch rates. Each of these values was expressed by circling one of twenty numbers on a payment card.

Respondents who circled a zero value were asked whether this meant that the hypothetical change in catch rate really had no value to them. It was expected that some respondents objecting to this line of questioning for ideological or ethical reasons would answer zero as a protest. Others might simply not feel comfortable with expressing a positive dollar value even though they did place positive subjective value on improved or diminished salmon/striped bass catch. Those answering that zero was not really their valuation and those not circling any entry

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(i.e. missing values) were not included in the calculation of mean values.

Because the number circled on the WTP questions represented the respondent's maximum WTP from among the options presented, it was not an unbiased point estimate of the actual WTP. We do know however that the respondent was willing to pay at least the amount circled and was unwilling to pay the next larger amount presented. Hence, we took the midpoint of the interval above the circled amount as an estimate of WTP. The average of the midpoint values was calculated for each county and activity category, then multiplied by the number of anglers appropriate to that category. This procedure provided sufficient accuracy for this summary report. More statistically rigorous procedures for deriving a point estimates from grouped data are described in Cameron (1986).

Only actual salmon or striped bass anglers were asked to express WTP to avoid a reduced catch and WTP to get an enhanced catch. Every questionnaire respondent was asked to express a WTA compensation for a loss in catch rate. Thus the WTP values apply only to salmon/striped bass anglers, while WTA values were computed separately for salmon/striped bass anglers and for the angling population as a whole. The total values were derived in four steps.

1. The total number of anglers falling in each county/avidity category was estimated by multiplying total estimated number of saltwater anglers from Table 2 (473,235) by the weights contained in Table 6.

2. The number of salmon/striped bass anglers falling in each county/avidity category was estimated by multiplying the estimated total number of anglers in each county/avidity category (from Step 1) by the corresponding percent of the BASES sample that reported salmon or striped bass fishing in the S.F. Bay area in the past 12 months (Table 25).

3. The average value for each of the three questions was computed for salmon/striped bass anglers by county and avidity category (Tables 26-28). Average WTA was also computed by these same categories for the angling population as a whole (Table 29).

4. Each average value was multiplied by the appropriate estimate of angler population (from Steps 1 or 2).

Total estimated values for each of the three measures are presented on a county-by-county basis in Table 30. An overall summary of the estimates is provided in Table 31.

The total willingness-to-accept compensation for a 50% decline in salmon/striped bass catch rates for all coastal county anglers was $38.7 million/year. For salmon/striped anglers, total willingness-to-accept was $20.7 million/year, while total willingness-to-pay to avoid a 50% decline in salmon/striped bass

catch rates was $7.9 million/year. Salmon/striped bass anglers would also be willing to pay $9.8 million/year to obtain a doubling of salmon/striped bass catch rates.

VII. SUMMARY

The Bay Area Sportfish Economic Study (BASES) is a data collection and research project sponsored by the National Marine Fisheries Service, Southwest Fisheries Center. The purpose of BASES is to obtain descriptive information on anglers and on their fishing activities in the San Francisco Bay and Ocean Area, and to determine the net economic value of these activities to the anglers themselves.

The data were collected as an "add-on" to the telephone portion of the Marine Recreational Fishery Statistics Survey. The sampling protocol was to use the MRFSS random telephone canvass to locate individuals who had gone fishing in the last twelve months, ask them the MRFSS questions over the phone, then ask if they were willing to fill out an additional mail questionnaire. This mail questionnaire constituted the BASES survey instrument.

Using this sampling technique, 1,543 responses to the mail questionnaire were collected over the sample period July 1985-August 1986. Analysis of data collected over the first twelve months (July 1985-June 1986) revealed several sources of sampling bias: (a) an "avidity" bias, whereby anglers who had fished more frequently in the past two months were more likely to return the questionnaire, (b) over(under) representation of anglers from counties with small(large) angling populations, and (c) overrepresentation of boatowners relative to non-boatowners. A series of weights were devised to correct (wherever possible) for these sources of sampling bias. These weights were then used to compute descriptive statistics on the anglers and their fishing activities.

Results from BASES indicate that more than 473,000 saltwater recreational anglers reside in the nineteen Central and Northern California counties. About 30% of these individuals own a boat (average length: 10-20 feet) that can be used for saltwater fishing. On average, boatowners actually use their boat for this activity about 46% of the time.

Survey results indicate that boatowners and nonboatowners differ significantly, both in terms of personal characteristics and fishing behavior. The median annual household income is $35-50K for boatowners, $25-35K for nonboatowners. Boatowners make an average of 7.86 trips per year (as compared to 4.03 trips/year for nonboatowners). Approximately 37% of boatowners but only 19% of nonboatowners perceive themselves to be at least intermediate-advanced in fishing ability. Boatowners spend an average of

$238. and nonboatowners spend $57. annually on purchase and repair of saltwater fishing gear and equipment (excluding boats, motors, trailers and boat-related equipment).

The angling population covered by BASES made almost 2.5 million fishing trips over the survey period July 1985 - June 1986. Approximately 48% of these trips were made from private/rental boats, 17% from party/charter boats, 15% from piers, and 19% from beaches. While three-fourths of all trips by boatowners occurred in private/rental boat mode, nonboatowners tended to divide their fishing effort roughly equally among the four modes.

Fishing activity tended to take on distinctly seasonal pattern, being higher in the spring/summer/fall than in the winter months. This pattern was due to a variety of factors, including weather and the seasonal availability of certain target species (e.g., salmon, striped bass, surfperch). The most popular target species (in order of descending importance) varied by mode as follows.

Beach	- No particular species, striped bass
Pier	- No particular species, rockfish/lingcod, other
Party/Charter	- Rockfish/lingcod, salmon
Private/Rental	- Salmon, striped bass, other, rockfish/lingcod

("Other" denotes all species other than salmon, striped bass, rockfish/lingcod, and halibut/sole/flatfish).

For each of the mode/target species combinations, the catch rate for the targetted species was consistently higher than the catch rates for the non-targetted species. This seemed to suggest: (1) that anglers can affect the probability of catching a target species (at least in the short term) by their choice of mode, season, fishing area, fishing method and/or gear, and/or (2) that anglers are more likely to recall and report their catch of target species than their incidental catch of other fish.

There was a tendency for fishing activity to be concentrated in certain geographical areas, depending on the target species. Most of the striped bass effort takes place in San Pablo Bay and Suisun Bay and along the shore area between Pacifica and the Golden Gate. Salmon fishing effort tends to concentrate in the Gulf of the Farallons and in Monterey Bay. Many of the pier trips targetted on rockfish occur in Monterey Bay, while boat-based trips for this species tend to be geographically distributed in the ocean area between Monterey Bay and Bodega Bay.

Average trip expenditures varied from a low of $21.51 for pier trips to a high of $71.84 for party/charter boat trips. Trips in beach mode cost an average of $31.07, while private/rental boat trips cost approximately $47.88. The items included in these estimates are tackle (lures, sinkers, lines, rental equipment, licenses, fish cleaning), boat (fuel and fees

for private, rental or charter boats), amenities (food, beverages, lodging) and travel cost.

The results above pertain only to anglers having telephones and residing in the nineteen Central and Northern California coastal counties. Two other segments of the angling population fish in the area but were not included in our survey effort: (a) coastal county residents who do not own a telephone and therefore could not be contacted in the MRFSS telephone canvass, and (b) non-coastal county and out-of-state residents. Using results from the MRFSS intercept survey, we found that approximately 11% of the trips in our survey area were made by individuals excluded from the BASES survey effort. Adding the trips made by these individuals to the 2.5 million trips made by the anglers covered by BASES brings our estimate of total trips to over 2.7 million per year.

Respondents to the BASES questionnaire were also asked to respond to three hypothetical questions regarding: (a) maximum willingness-to-pay to avoid an 50% decrease in salmon/striped bass catch rates, (b) maximum willingness-to-pay to double current salmon/striped bass catch rates, and (c) minimum dollar amount required to compensate angler for 50% decline in salmon/striped bass catch rates. The two willingness-to-pay questions were asked only of anglers who had fished salmon/striped bass in the last year, while the willingness-to-accept compensation question was asked of all respondents. Results indicate that salmon/striped bass anglers as a group would be willing to pay $7.9 million/year to avoid a 50% decline in catch rates but would have to receive $20.7 million/year in order to be adequately compensated for this loss. These same individuals would be willing to pay $9.8 million/year to obtain a doubling of salmon/striped bass catch rates. Finally, the minimum dollar amount required to compensate anglers as a whole for a 50% decline in catch rates is $38.7 million/year.

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Table 1. General survey statistics, by survey wave.

	Jul/ Aug 1985	Sep/ Oct 1985	Nov/ Dec 1985	Jan/ Feb 1985	Mar/ Apr 1986	May/ Jun 1986	Jul/ Aug 1986	Total
No. MRFSS household contacts	3740	3546	2349	1856	2439	3084	3745	20,759
No. augmented household contacts	3754	3575	3519	0	2071	0	0	12,919
Total no. household contacts	7494	7121	5868	1856	4510	3084	3745	33,678
No. 12-month anglers identified in telephone canvass	790	847	712	205	562	350	565	4,031
No. 12-month anglers willing to participate in BASES survey	745	688	571	149	385	278	368	3,184
No. 12-month anglers completing BASES questionnaire	370	341	267	91	199	110	165	1,543

Table 2. Estimated number of 12-month anglers residing in central and northern California, by county.

County	Number of households*	Angling prevalence rate**	Anglers per household**	Estimated number of anglers***
Alameda	455,489	.097	1.56	68,950
Contra Costa	264,106	.121	1.64	52,295
Del Norte	7,272	.276	1.43	2,876
Humboldt	43,850	.204	1.53	13,673
Marin	92,158	.147	1.57	21,228
Mendocino	27,470	.191	1.51	7,880
Monterey	100,131	.128	1.46	18,585
Napa	34,551	.130	1.53	6,856
Sacramento	324,371	.082	1.33	35,014
San Benito	9,007	.140	1.64	2,062
San Francisco	305,734	.076	1.51	35,296
San Joaquin	142,375	.117	1.75	29,271
San Mateo	233,119	.113	1.55	40,815
Santa Clara	491,555	.099	1.47	71,558
Santa Cruz	80,162	.143	1.68	19,201
Solano	92,287	.146	1.50	20,170
Sonoma	130,851	.115	1.47	22,052
Trinity	4,979	.110	1.70	828
Yolo	46,682	.070	1.41	4,625
Total	2,886,149	.117	1.53	473,235

*Source: Western Economic Research Co. "Mid-Decade Demographic Data by Zip Codes."

**Source: CIC Research, Inc.

***Number of households x angling prevalence rate x anglers per household.

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Table 3. MRFSS exclusions of salmon/ striped bass fishing trips, by survey wave.

Wave	MRFSS exclusions	
	Fishing area*	Trip type**
Jul-Aug 85	C,N	SAL,SB
Sep-Oct 85	C	SAL,SB
Nov-Dec 85		
Jan-Feb 86	C***	SAL
Mar-Apr 86	C	SAL
May-Jun 86	C,N	SAL,SB
Jul-Aug 86	C,N	SAL,SB

*C=Central California counties (Alameda, Contra Costa, Marin, Monterey, Napa, Sacramento, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma).

N=Northern California counties (Del Norte, Humboldt, Mendocino, Trinity).

**SAL=Boat trips for which salmon was target species SB=Party or charter boat trips for which striped bass was target species.

***Central California counties excluding Monterey and Santa Cruz.

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Table 4. Response rates to BASES questionnaire, by avidity category*.

Avidity category	Response rate
0 trips	24%
1 trip	42%
2 trips	60%
>2 trips	72%
Sal/SB	75%

*First four avidity categories refer to individuals who made 0, 1, 2 and >2 non-salmon/striped bass trips respectively during the survey wave. Last category refers to individuals who fished exclusively for salmon/striped bass during the survey wave. Thus, for example, the table tells us that 24% of the MRFSS telephone respondents who made zero non-salmon/striped bass trips during the survey wave actually responded to the BASES questionnaire.

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Table 5. Chi-Square test results comparing "composite" weights with weights computed separately for each survey wave.

Survey wave	Estimated Chi-Square	Degrees of freedom	Level of significance
Jul-Aug 85	9.488	18	.900
Sep-Oct 85	6.801	18	.990
Nov-Dec 85	2.858	18	.999
Jan-Feb 86	7.540	18	.975
Mar-Apr 86	6.204	18	.995
May-Jun 86	7.356	18	.975
	40.247	108	.999

Table 6. "Composite" angler weights, by county of residence and avidity category.

County of residence	Avidity category					
	0 trips	1 trip	2 trips	>2 trips	Sal/SB	Total*
Alameda	.094	.021	.010	.014	.007	.146
Contra Costa	.071	.017	.007	.008	.008	.111
Del Norte	.003	.001	.001	.001	.001	.006
Humboldt	.018	.004	.002	.002	.002	.029
Marin	.025	.006	.006	.006	.003	.045
Mendocino	.010	.003	.001	.001	.002	.017
Monterey	.022	.008	.002	.002	.005	.039
Napa	.009	.003	.001	.001	.001	.014
Sacramento	.054	.012	.001	.005	.003	.074
San Benito	.003	.001	.000	.000	.000	.004
San Francisco	.045	.010	.005	.009	.006	.075
San Joaquin	.040	.010	.007	.003	.002	.062
San Mateo	.053	.014	.005	.011	.004	.086
Santa Clara	.100	.034	.004	.006	.007	.151
Santa Cruz	.021	.005	.006	.006	.002	.041
Solano	.026	.006	.004	.003	.003	.043
Sonoma	.033	.003	.005	.001	.005	.047
Trinity	.001	.000	.000	.000	.000	.001
Yolo	.006	.003	.001	.000	.000	.010
Total	.636	.160	.067	.077	.060	1.000

Table 7. Number of active anglers* in each survey wave, in total and as percent of 12-month angling population.

Survey wave	Active anglers	
	Total	Percent
Jul-Aug 85	211,556	.45
Sep-Oct 85	187,556	.40
Nov-Dec 85	143,739	.30
Jan-Feb 86	112,641	.24
Mar-Apr 86	166,687	.35
May-Jun 86	182,541	.39

*Individuals who made at least one fishing trip during the survey wave.

Table 8. Chi-Square test results for hypothesis that county and avidity are independent events.

Survey wave	Estimated Chi-Square	Degrees of freedom	Level of significance
Jul-Aug 85	130.235	72	.001
Sep-Oct 85	118.601	72	.001
Nov85-Feb86*	72.875	72	.250
Mar-Apr 86	110.835	72	.001
May-Jun 86	171.306	72	.001
Total	603.852	360	.001

*Results of Nov-Dec 85 and Jan-Feb 86 survey waves combined to increase sample size.

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Table 9. Trip weights for each survey wave, by boat ownership and avidity category.

	Avidity category				
	1 trip	2 trips	>2 trips	Sal/SB	Total
Jul-Aug 85:					
Boatowners	.078	.050	.091	.073	
Non boatowners	.350	.097	.155	.098	
Total	.428	.155	.246	.171	1.000
Sep-Oct 85:					
Boatowners	.113	.094	.113	.041	
Non boatowners	.426	.092	.125	.057	
Total	.539	.126	.238	.098	1.000
Nov-Dec 85:					
Boatowners	.162	.065	.072	.000	
Non-boatowners	.454	.138	.109	.000	
Total	.616	.203	.181	.000	1.000
Jan-Feb 86:					
Boatowners	.142	.029	.035	.094	
Non-boatowners	.498	.017	.050	.134	
Total	.640	.046	.085	.228	1.000
Mar-Apr 86:					
Boatowners	.078	.061	.087	.073	
Non-boatowners	.328	.123	.147	.102	
Total	.406	.184	.234	.175	1.000
May-Jun 86:					
Boatowners	.104	.074	.077	.045	
Non-boatowners	.281	.189	.148	.082	
Total	.385	.263	.225	.127	1.000

Table 10. Length distribution of boats used for saltwater recreational fishing.

Boat length (ft.)	Frequency
0 - 10	.03
10 - 20	.74
20 - 30	.17
30 - 40	.05
40 - 50	.01
Total	1.00

Table 11. Distribution of annual household income for boatowners and non-boatowners.

	Relative frequency	
Income category	Boatowners	Non-boatowners
< $10,000	.05	.05
$10,000-14,999	.05	.07
$15,000-19,999	.05	.07
$20,000-24,999	.10	.12
$25,000-34,999	.19	.21
$35,000-49,999	.30	.23
$50,000 and up	.27	.25
Total	1.00	1.00

Table 12. Distribution of fishing ability for boatowners and non-boatowners.

Fishing ability	Relative frequency	
	Boatowners	Non boatowners
Novice	.11	.24
Novice-intermediate	.14	.21
Intermediate	.39	.37
Intermediate-advanced	.20	.12
Advanced	.17	.07
Total	1.00	1.00

Table 13. Distribution of occupational status of boatowners and non-boatowners.

	Relative frequency	
Occupational status	Boatowner	Non-boatowner
Employed fulltime	.71	.71
Employed parttime	.09	.07
Retired	.17	.11
Student	.02	.07
Homemaker	.01	.02
Unemployed	.01	.02
Total	1.00	1.00

Table 14. Average number of fishing trips made by boatowners and non-boatowners by survey wave and distribution of trips between shore and boat modes.

	Survey wave						
	7/85 to 8/85	9/85 to 10/85	11/85 to 12/85	1/86 to 2/86	3/86 to 4/86	5/86 to 6/86	Total
Boatowners:							
Average # trips	1.58	1.38	.96	.61	1.53	1.80	7.86
% beach							9%
% pier							10%
% party/charter							7%
% private/rental							75%
Non-boatowners:							
Average # trips	.63	.71	.60	.65	.66	.78	4.03
% beach							28%
% pier							20%
% party/charter							26%
% private/rental							26%

Table 15. Estimated number of recreational fishing trips by survey wave and mode.

	Number of trips				
Survey wave	Beach	Pier	Party	Private	Total
Jul-Aug 85	90,831	40,419	80,913	221,051	433,214
Sep-Oct 85	96,109	43,274	85,329	206,405	431,117
Nov-Dec 85	50,638	71,264	48,287	164,862	335,050
Jan-Feb 86	53,454	67,984	50,357	130,129	301,924
Mar-Apr 86	82,065	70,221	70,331	213,233	435,849
May-Jun 86	96,869	82,843	83,061	251,160	513,933
Total	469,966	375,800	418,279	1,186,839	2,450,884

Table 16. Comparison of BASES and MRFSS estimates of total number of fishing trips made in central and northern California by coastal county residents*.

	Beach	Pier	Party/ charter	Private/ rental	Total
MRFSS					
Number**:	643	464	179	888	2,174
% of total:	30%	21%	8%	41%	
BASES					
Number**:	470	376	418	1,187	2,451
% of total:	19%	15%	17%	48%	

*MRFSS estimates cover the period Jan 1985-Dec 1985 and do not include trips targetted on salmon or striped bass. BASES estimates cover the period Jul 1985-Jun 1986 and include trips covering all target species.

**Thousands of trips.

Table 17. Total number of recreational fishing trips by mode and target species.

Target species	Number of trips				
	Beach	Pier	Party	Private	Total
No particular	175,759	159,947	32,603	120,906	489,215
Salmon	7,783	4,184	134,518	316,291	462,776
Striped bass	85,772	9,517	10,645	127,710	233,644
SBass/other	47,623	7,065	21,303	147,272	223,263
Rockfish	25,930	78,996	160,603	130,352	395,881
Rockfish/other	28,363	0	1,889	0	30,252
Other	21,698	62,970	19,150	140,324	244,142
Subtotal	392,928	322,679	380,711	982,855	2,079,173
All else*	77,038	53,121	37,568	203,984	371,711
Total	469,966	375,800	418,279	1,186,839	2,450,884
Subtotal as % of total	84%	86%	91%	83%	85%

*"All Else" is a catch-all category that includes all target species groups other than those included in the subtotal.

Table 18. Catch rates* in five species categories, by mode and major target species.

Target species	Salmon	Str bass	Rck/ling	Flatfish**	Other
Beach					
No particular	.06	.15	.80	.21	2.75
Striped bass	.03	.71	.05	.00	.74
Rock/ling/other	.00	.00	.95	.00	4.31
Other	.00	.00	.02	.00	15.80
Striped bass/other	.00	.39	.03	.00	2.76
Rock/ling	.02	.00	3.98	.00	.82
Pier					
No particular	.03	.19	.62	.29	3.53
Other	.27	.05	.09	.00	11.09
Rock/ling	.00	.00	4.63	.00	.00
Party/charter					
Rock/ling	.00	.00	12.13	.18	.21
Salmon	1.38	.05	.03	.00	.06
No particular	.11	.26	4.59	.44	1.63
Striped bass/other	.00	1.38	.00	.00	.50
Private/rental					
Salmon	2.11	.02	.28	.02	.43
Striped bass/other	.00	.96	.00	.04	.84
Other	.00	.18	.63	.07	2.97
Rock/ling	.09	.01	10.94	.44	1.04
Striped bass	.04	1.03	.00	.02	.25
No particular	.34	.10	2.09	.30	9.59

*Catch rate measured as number of fish per angler trip. Includes number caught-and-released as well as number bagged.
**Halibut, sole, and flatfish.

Table 19. Comparison of BASES and PFMC estimates of salmon catch rates (number of fish/angler trip).

		Fishing mode	
		Party/charter	Private/rental
Salmon:			
BASES	7/85-6/86	1.38	2.11
PFMC*	1985	1.11	.80
	1986	1.07	.69

*Source: Pacific Fishery Management Council, "Review of 1986 Ocean Salmon Fisheries", Mar 1987, Table IV-9.

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Table 20. Distribution of trips across geographical areas, by fishing mode and target species.

Beach

Area	NoPart	SBass	SB-oth	Rck/ling	Rck-oth	Other
2	12,373	--	--	--	--	--
3	35,172	--	--	--	--	--
5	--	31,704	--	--	--	--
10	16,523	--	--	--	--	--
11	25,513	12,646	18,506	--	22,581	--
12	26,524	--	--	10,046	--	--
13	26,135	13,093	--	--	--	--

Pier

Area	NoPart	Other	Rck/ling
7	10,558	17,718	--
9	--	12,638	--
10	17,182	--	--
11	34,032	--	--
12	28,291	--	--
13	34,984	21,036	74,559

Party/charter boat

Area	NoPart	Salmon	SB-oth	Rck/ling
D	--	--	12,767	--
F	--	--	--	29,479
G	15,396	110,686	--	20,715
H	--	--	--	20,978
I	--	--	--	84,352

Private/rental boat

Area	NoPart	Salmon	SBass	SB-oth	Rck/ling	Other
B	22,599	--	13,454	--	--	13,453
C	--	13,696	--	22,305	--	14,021
D	--	--	20,295	53,777	--	31,339
E	27,773	--	74,236	63,369	--	--
F	--	26,871	--	--	31,592	15,714
G	--	42,820	13,434	--	12,071	--
H	--	--	--	--	10,683	--
I	32,741	156,163	--	--	27,014	--
North*	15,137	62,625	--	--	46,751	--

*North of Bodega Bay and south of the Oregon border.
-- Denotes fewer than 10,000 trips.

Table 21. Average trip expenditures on tackle, boat, amenities and travel,* by fishing mode.

Expenditure category	Average trip expenditures			
	Beach	Pier	Party/ charter	Private/ rental
Tackle	9.79	7.89	17.11	12.89
Boat	0.00	0.00	34.92	17.76
Amenities	16.48	9.48	10.67	12.17
Travel	4.80	4.14	9.14	5.06
Total	31.07	21.51	71.84	47.88

*"Tackle" refers to lures, sinkers, lines, rental equipment, licenses, and fish cleaning.
"Boat" refers to fuel and fees for private, rental or charter boats.
"Amenities" refers to food, beverages and lodging.
"Travel" computed as round trip distance between home and fishing site multiplied by operating cost per mile. Cost per mile estimated at 7.25 cents and covers gasoline, oil, maintenance and tires (American Automobile Association, Your Driving Costs, 1986).

Table 22. Augmentation of trips made by coastal county residents to include anglers who do not own a telephone.

Coastal county	% trips by non-phone owners*	# trips by phone owners	Total # trips**
Alameda/ContraCosta	1.0%	637,966	644,410
Marin/Napa/Solano/ Sonoma	1.2%	402,767	407,659
SanFran/SanMateo	1.8%	468,001	476,579
Monterey/SanBenito/ StaClara/StaCruz	1.8%	488,021	496,966
Sacmento/SJoaquin/ Yolo	.9%	277,344	279,863
DelNorte/Humboldt/ Mendocino/Trinity	10.1%	176,786	196,647
Total		2,450,885	2,502,124

*Based on MRFSS intercept survey results for central and northern California, covering the period July 1985-June 1986. These numbers represent the proportion of intercepted anglers who lived in the corresponding county area described in the preceding column and did not own a telephone.

**Obtained by dividing # trips by phone owners by (1 - % trips by non-phone owners).

Table 23. Percent of trips made in central and northern California by coastal county, non-coastal county and out-of-state residents, by fishing county*.

Fishing county	Coastal county residents	Non-coastal county residents	Out-of-state residents
Alameda	.972	.012	.016
Contra Costa	.963	.028	.009
Del Norte	.975	.025	.000
Humboldt	.821	.168	.011
Marin	.960	.023	.017
Mendocino	.672	.301	.028
Monterey	.843	.115	.042
San Francisco	.995	.005	.000
San Mateo	.963	.017	.020
Santa Cruz	.926	.049	.025
Solano	.994	.000	.006
Sonoma	.932	.055	.014

*Source: MRFSS intercept survey results covering the period July 1985-June 1986.

Table 24. Estimated number of trips made in central and northern California by coastal county, non-coastal county and out-of-state residents, by fishing county.

Fishing county	Coastal county residents*	Non-coastal county residents**	Out-of-state residents**	Total
Alameda	138,704	1,712	2,283	142,700
Contra Costa	143,643	4,177	1,342	149,162
Del Norte	102,683	60,181	15,715	178,580
Humboldt	34,344	7,028	460	41,832
Marin	332,868	7,975	5,895	346,737
Mendocino	16,060	7,193	669	23,922
Monterey	383,161	52,270	19,090	454,521
San Francisco	121,512	611	0	122,122
San Mateo	738,122	13,030	15,330	766,482
Santa Cruz	197,381	10,445	5,329	213,155
Solano	207,564	0	1,253	208,817
Sonoma	86,082	5,080	1,293	92,455
Total	2,502,125	169,702	68,659	2,740,485

*Obtained by distributing the total number of trips made by coastal county residents (Table 22) across fishing counties according to the distribution observed in the BASES sample.

**Number of trips made by non-coastal county and out-of-state residents (T_j^{nc} and T_j^{os} respectively) computed according to the following formulas:

$$T_j^{nc} = T_j^{c} \cdot P_j^{nc} / P_j^{c}$$

$$T_j^{os} = T_j^{c} \cdot P_j^{os} / P_j^{c}$$

where T_j^{c} = number of trips made by coastal county residents in fishing county j;

P_j^{c}, P_j^{nc}, P_j^{os} = percent of all trips made in county j by coastal, non-coastal and out-of-state residents respectively (as described in Table 23).

Table 25. Fraction of respondents reporting salmon or striped bass angling in San Francisco Bay and ocean area in previous 12 months.

County of residence	Fishing activity category					
	0 trips	1 trip	2 trips	>2 trips	SSB only	Row average
Alameda	.42	.42	.60	.35	.88	.45
Contra Costa	.36	.29	.83	.88	.89	.51
Del Norte	.20	.29	.00	.00	.67	.27
Humboldt	.47	.55	.17	.56	.50	.47
Marin	.54	.36	.88	.91	1.00	.69
Mendocino	.63	.50	.50	.40	.40	.58
Monterey	.30	.17	.38	.67	.70	.46
Napa	.50	.44	.40	.20	.80	.47
Sacramento	.46	.36	.75	.86	1.00	.56
San Benito	.36	.50	.00	1.00	1.00	.47
San Francisco	.31	.67	.80	.40	1.00	.49
San Joaquin	.36	.50	.33	.71	1.00	.50
San Mateo	.39	.39	.86	.71	.43	.48
Santa Clara	.44	.27	.58	.59	.86	.50
Santa Cruz	.29	.50	.44	.56	.80	.48
Solano	.47	.47	.38	.67	.56	.50
Sonoma	.50	.57	.50	.60	.60	.60
Trinity	.50	.00	.50	.00	1.00	.50
Yolo	.27	.38	.43	.67	.75	.42
Total	.41	.41	.60	.62	.79	.51

Table 26. Average WTP ($ per salmon/striped bass angler) to avoid a 50% drop in salmon/striped bass catch rates.

County of residence	Fishing activity category					Row average
	0 trips	1 trip	2 trips	>2 trips	SSB only	
Alameda	43.00	17.50	10.00	30.83	44.17	35.90
Contra Costa	13.67	26.25	46.11	60.00	37.08	23.36
Del Norte	52.50	83.75	0.00	0.00	12.50	46.53
Humboldt	12.14	9.50	17.50	46.00	27.50	15.88
Marin	27.71	22.50	27.50	65.71	7.50	26.86
Mendocino	35.63	0.00	17.50	14.17	30.00	23.86
Monterey	18.00	0.00	42.50	47.08	20.42	20.61
Napa	58.00	6.50	73.75	12.50	48.75	42.15
Sacramento	41.61	56.88	15.93	230.00	40.50	59.10
San Benito	19.17	0.00	0.00	35.00	17.50	17.34
San Francisco	21.94	44.58	18.33	25.00	18.13	22.94
San Joaquin	46.25	8.75	40.00	17.50	39.58	30.39
San Mateo	41.61	26.67	27.06	44.38	24.17	33.92
Santa Clara	33.91	40.63	79.58	33.13	32.50	34.65
Santa Cruz	12.50	264.38	20.00	29.50	118.33	63.98
Solano	24.42	20.94	50.00	58.75	32.50	28.70
Sonoma	22.08	33.21	30.83	46.56	46.00	27.38
Trinity	12.50	0.00	17.50	0.00	17.50	13.61
Yolo	15.00	8.33	15.83	12.50	40.83	14.30
Column average	31.77	38.88	36.46	60.15	35.98	33.04

Table 27. Average WTP ($ per salmon/striped bass angler) to get a 100% increase in salmon/striped bass catch rates.

County of residence	Fishing activity category					
	0 trips	1 trip	2 trips	>2 trips	SSB only	Row average
Alameda	49.21	21.07	39.17	33.33	43.57	41.93
Contra Costa	24.67	34.50	43.33	74.64	40.00	30.63
Del Norte	52.50	93.75	0.00	0.00	15.00	49.20
Humboldt	15.00	24.58	0.00	50.00	42.50	21.64
Marin	30.62	55.83	30.83	83.21	7.50	33.01
Mendocino	80.83	0.00	17.50	11.67	17.50	45.60
Monterey	20.50	0.00	52.50	55.36	32.08	25.34
Napa	45.50	27.08	143.75	12.50	98.13	50.93
Sacramento	50.89	68.13	15.83	138.21	40.50	55.01
San Benito	24.17	7.50	0.00	45.83	22.50	22.77
San Francisco	35.56	62.50	18.33	32.50	25.62	33.47
San Joaquin	62.63	6.25	40.00	27.50	42.75	38.62
San Mateo	41.96	30.62	38.33	63.44	39.17	38.69
Santa Clara	64.13	43.13	84.58	48.13	32.50	54.02
Santa Cruz	15.00	264.38	20.00	46.00	126.70	67.15
Solano	29.42	30.31	66.67	59.38	43.33	34.87
Sonoma	28.54	36.88	32.50	81.88	58.50	35.72
Trinity	22.50	0.00	22.50	0.00	17.50	20.12
Yolo	28.33	6.25	25.83	15.00	55.83	21.43
Column average	43.29	46.35	42.02	62.77	40.76	41.06

Table 28. Average WTA compensation ($ per salmon/striped bass angler) for a 50% reduction in salmon/striped bass catch rates.

County of residence	Fishing activity category					
	0 trips	1 trip	2 trips	>2 trips	SSB only	Row total
Alameda	98.75	274.00	22.50	122.50	99.00	120.15
Contra Costa	32.71	28.33	290.56	136.00	136.00	90.61
Del Norte	22.50	675.00	0.00	0.00	10.00	173.95
Humboldt	0.50	35.00	0.00	233.75	0.00	33.04
Marin	10.42	13.75	13.50	54.64	3.00	16.33
Mendocino	158.33	42.50	42.50	6.25	0.00	98.89
Monterey	101.00	17.50	425.00	384.93	101.00	173.55
Napa	0.00	4.00	675.00	17.50	58.33	45.12
Sacramento	58.75	190.63	6.25	29.50	147.00	72.00
San Benito	178.13	0.00	0.00	675.00	0.00	234.96
San Francisco	88.93	34.17	23.33	6.25	8.75	56.08
San Joaquin	121.79	0.00	42.50	238.75	13.75	91.06
San Mateo	120.45	66.07	106.25	173.75	24.17	112.40
Santa Clara	120.80	9.38	359.38	164.44	36.39	126.13
Santa Cruz	10.63	243.33	11.25	239.17	175.00	102.55
Solano	60.00	87.50	17.50	102.50	291.88	84.46
Sonoma	13.06	367.92	0.00	144.17	151.25	115.41
Trinity	42.50	0.00	17.50	0.00	0.00	28.85
Yolo	41.67	0.00	0.00	7.50	11.25	17.51
Column average	77.86	115.16	138.04	142.69	83.56	95.83

Table 29. Average WTA compensation ($ per angler) for a 50% reduction in salmon/striped bass catch rates.

County of residence	Fishing activity category					
	0 trips	1 trip	2 trips	>2 trips	SSB only	Row total
Alameda	103.39	117.89	26.50	153.03	86.61	105.73
Contra Costa	58.76	17.51	242.06	134.62	120.86	73.60
Del Norte	6.90	210.24	0.00	675.00	6.65	60.03
Humboldt	68.11	25.34	9.38	129.68	320.68	71.85
Marin	58.47	9.77	17.13	49.64	3.00	44.50
Mendocino	119.56	23.11	21.21	2.50	0.00	62.37
Monterey	31.46	164.43	163.28	232.56	111.97	84.40
Napa	2.09	102.66	308.18	20.84	46.56	57.94
Sacramento	44.06	111.74	4.68	25.27	146.92	54.57
San Benito	129.96	88.03	0.00	670.31	0.00	154.12
San Francisco	37.83	36.95	18.66	2.50	8.74	32.76
San Joaquin	47.47	95.85	23.61	363.58	13.74	70.01
San Mateo	116.93	136.04	91.05	124.07	10.35	115.55
Santa Clara	110.17	42.56	265.86	144.25	31.19	108.23
Santa Cruz	4.54	121.63	12.87	144.63	139.88	43.10
Solano	90.23	100.96	187.67	125.30	161.90	106.41
Sonoma	6.53	228.09	122.27	142.63	90.68	81.55
Trinity	27.47	12.50	8.65	0.00	0.00	18.69
Yolo	23.17	140.76	63.33	231.59	8.42	68.23
Column average	71.45	89.90	110.73	129.36	75.96	81.77

Table 30. Total annual WTP to avoid a 50% decrease, WTP to get a 100% increase, and WTA compensation for a 50% in salmon and striped bass catch ($).

	Salmon/striped bass anglers			All anglers
County of residence	WTP-50% decrease	WTP-100% increase	WTA-50% decrease	WTA-50% decrease
Alameda	$1,122,720	$1,311,408	$3,631,669	$7,289,752
Contra Costa	617,439	809,655	2,068,044	3,849,052
Del Norte	36,500	38,591	124,373	172,695
Humboldt	101,667	138,492	202,795	982,524
Marin	392,029	481,707	209,406	944,588
Mendocino	109,665	209,587	411,668	491,562
Monterey	177,795	218,641	1,208,777	1,568,481
Napa	134,848	162,949	146,240	397,200
Sacramento	1,153,455	1,073,525	1,297,844	1,910,702
San Benito	16,942	22,245	199,484	317,944
San Francisco	397,734	580,315	836,714	1,156,489
San Joaquin	444,730	565,227	1,158,316	2,049,270
San Mateo	668,281	762,381	2,030,510	4,716,080
Santa Clara	1,250,267	1,949,079	4,140,600	7,744,990
Santa Cruz	589,698	618,932	773,202	827,653
Solano	289,388	351,656	822,608	2,146,144
Sonoma	362,299	472,610	1,386,136	1,798,315
Trinity	5,636	8,329	11,078	15,490
Yolo	28,063	42,057	30,003	315,572
Column total	$7,899,155	$9,817,387	$20,689,465	$38,694,501

Table 31. Summary of willingness to pay and accept values for marine anglers in counties surrounding the San Francisco Bay area.

	Fishing avidity category					
	0 trips	1 trip	2 trips	>2 trips	SSB only	Total
Mean WTP1/2	31.77	38.88	36.46	60.15	35.98	33.04
Mean WTP2	43.29	46.35	42.02	62.77	40.76	41.06
Mean WTA1/2 - S.F. anglers	77.86	115.16	138.04	142.69	83.56	95.83
Mean WTA1/2 - all anglers	71.45	89.90	110.73	129.36	75.96	81.77
Est. # anglers	304,504	74,836	32,942	36,443	24,810	473,235
Percent that fished salmon/ striped bass in S.F. area	40.7	41.3	59.5	61.5	78.8	50.5
Total values weighted	- - - - - - - thousands of dollars - - - - - - -					
WTP1/2	3936.2	1201.6	705.7	1348.9	706.6	7899.2
WTP2	5363.5	1432.4	813.4	1407.7	800.5	9817.4
WTA1/2 - S.F. anglers	9645.5	3557.9	2672.8	3198.0	1616.6	20689.5
WTA1/2 - all anglers	21756.8	6727.5	3603.5	4714.5	1892.2	38694.5

Notes:

1. WTP1/2 is Willingness to Pay to avoid a 50% reduction in combined salmon and striped bass runs.
2. WTP2 is Willingness to Pay to get a 100% increase in fish runs
3. WTA1/2 is Willingess to Accept compensation for a 50% reduction in fish runs.
4. Weighted values are adjusted to compensation for differing response rates among avidity classes (i.e. 0 trips, 1 trips, etc.).
5. "SSB only" means only salmon and striped bass trips were taken by the angler.
6. WTP1/2 and WTP2 were asked only of anglers that fished for salmon or striped bass in the S.F. area during the previous year. Therefore WTP1/2 and WTP2 total values cover only that subset of anglers. WTA1/2 was elicited from all anglers.

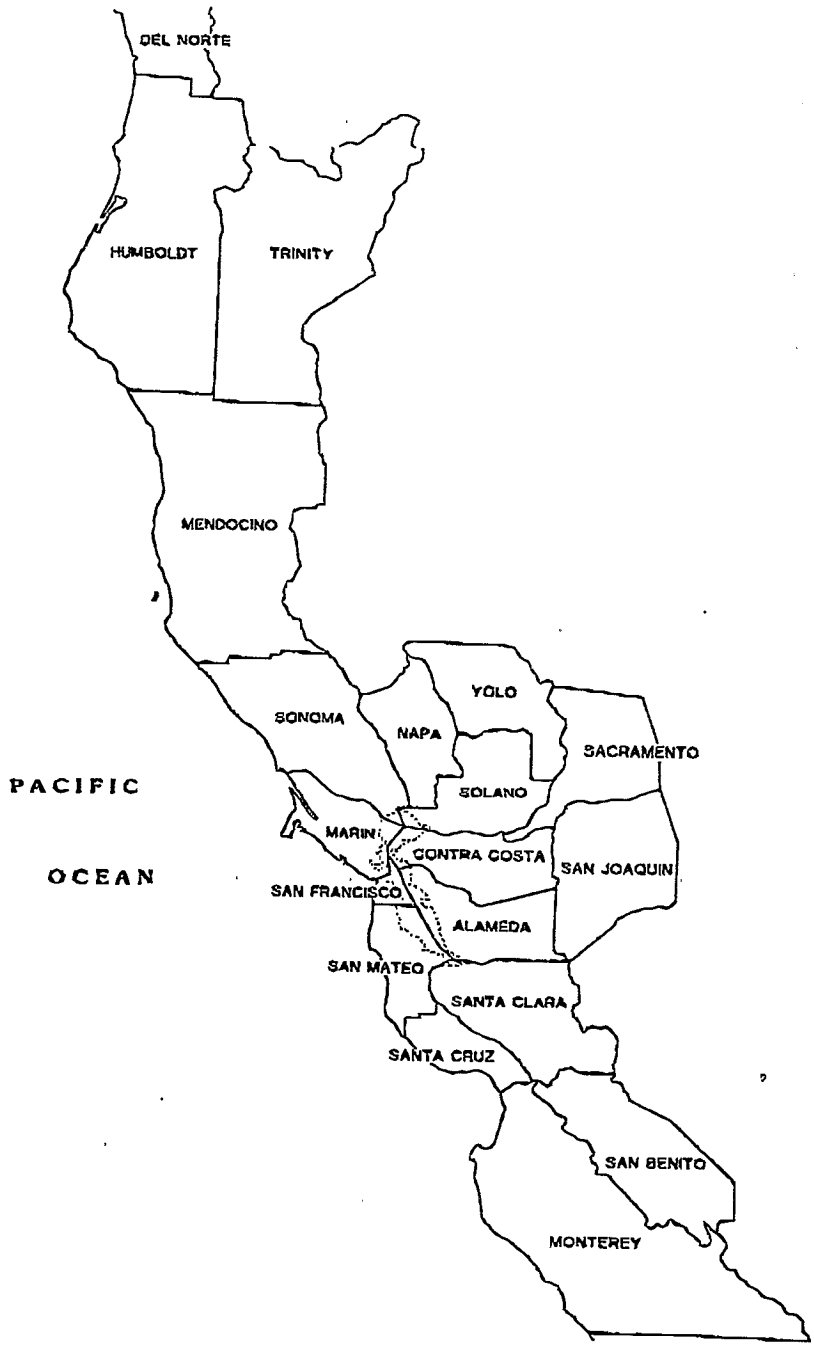


Figure 1. Coastal counties covered by the Bay Area Sportfish Economic Study. (dashed lines denote San Francisco Bay)

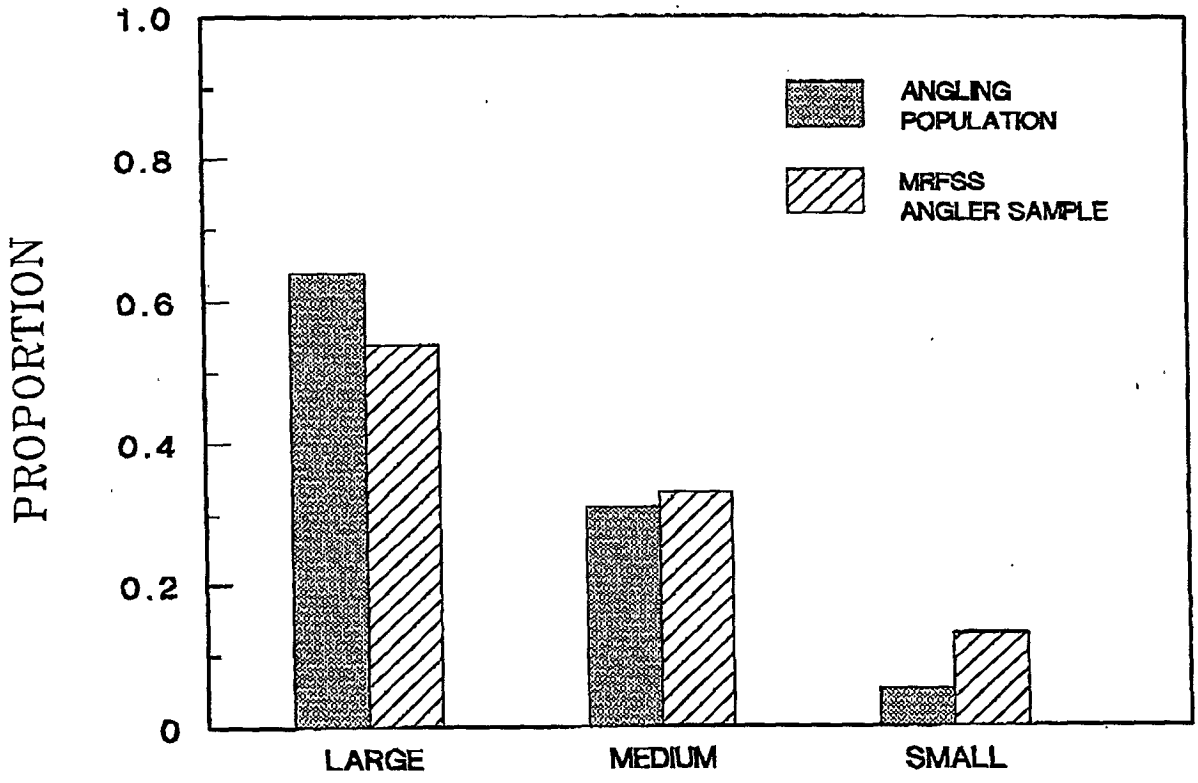


Figure 2. Proportion of Angling Population and of MRFSS Angler Sample residing in counties with large, medium and small Angling Populations.

C-110837

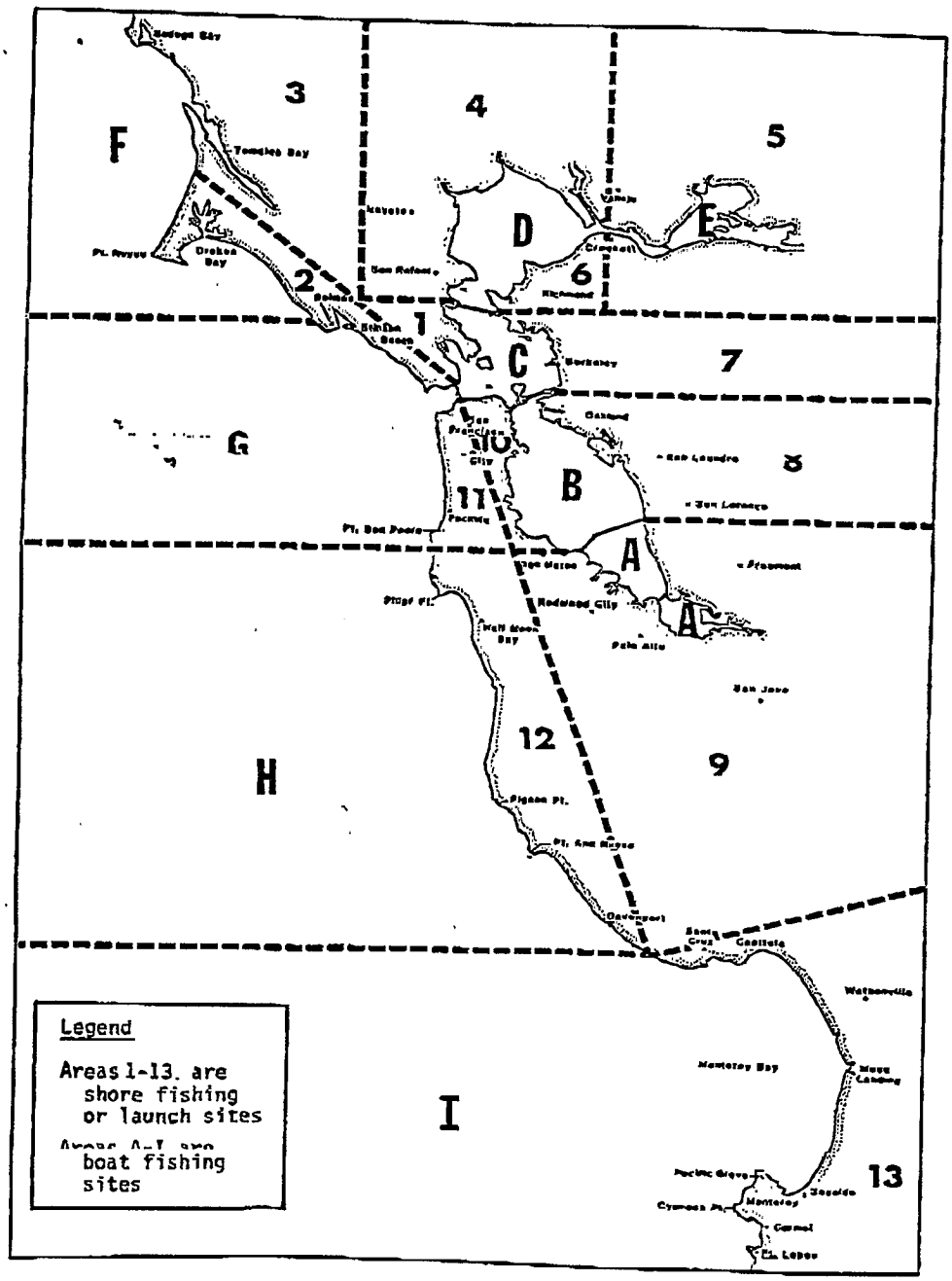


Figure 3. Shore and boat fishing areas used in BASES questionnaire.

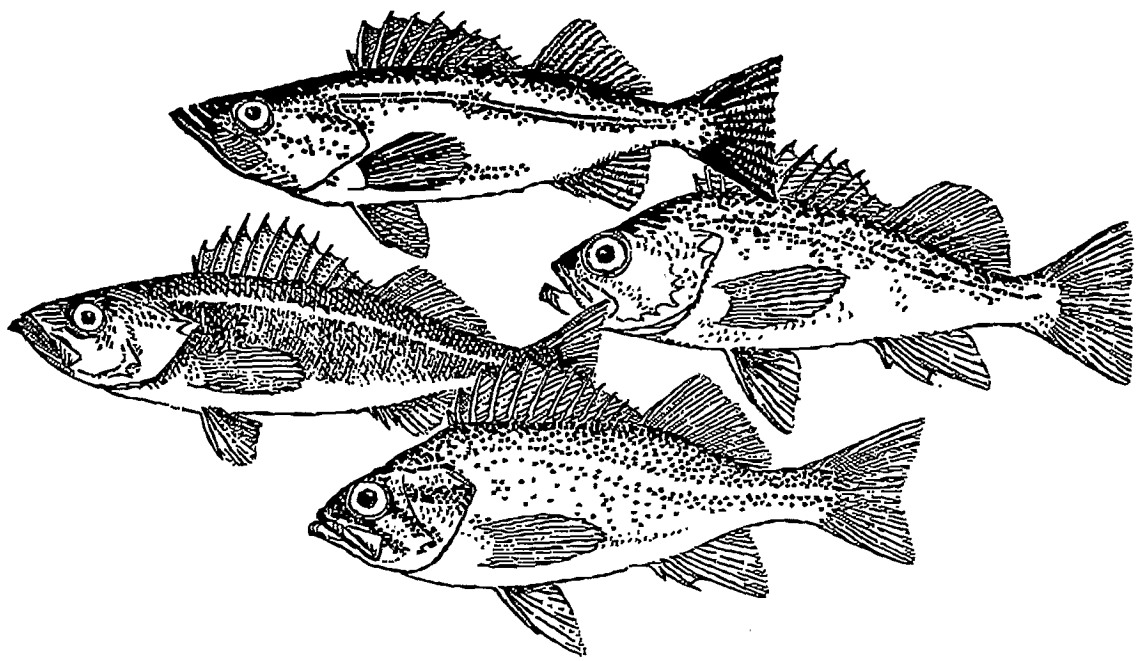
APPENDIX I

BASES Survey Instrument

C-110839

U.S. Department of Commerce
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
National Marine Fisheries Service

SALTWATER RECREATIONAL FISHING SURVEY



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OMB No. 0648-0155

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C-110840

These questions concern your most recent saltwater recreational fishing trips in oceans, sounds, bays, or tidal portions of rivers. Please consider each time you went fishing as a trip whether it was for a couple of hours or a couple of days. Some questions may be difficult to answer exactly. Please provide the best answers that you can. Thanks!

1. How many saltwater fishing trips did you take in the last 12 months? ☐ trips

2. How many saltwater fishing trips did you take in the last 2 months? ☐ trips

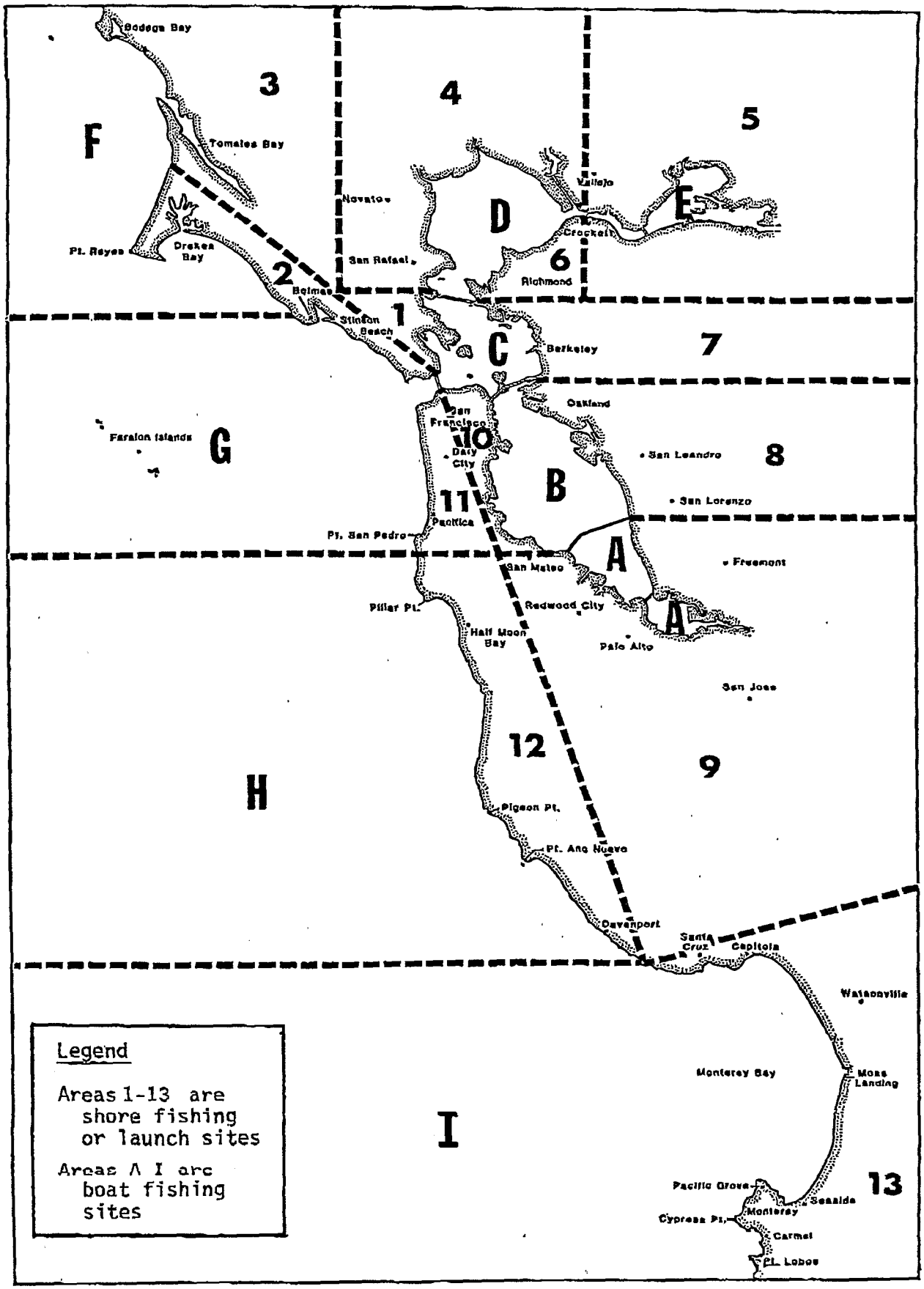
3. How many of the trips reported in Question 2 were taken:
   a. From shore in the area depicted in the map on page 2? ☐
   b. From shore outside the area depicted on the map? ☐
   c. From a boat in the area depicted on the map on page 2? ☐
   d. From a boat outside the area depicted on the map? ☐

Note: The number of trips in 3a, b, c, & d must equal the total number of trips in Question 2.

RECENT FISHING TRIPS

Please answer questions 4 through 15 for each of your 3 most recent saltwater fishing trips. If you went on fewer than 3 trips in the last 12 months, answer the questions only for those trips which you took in the last 12 months.

	most recent trip	2nd most recent trip	3rd most recent trip
4. In what month did you take this trip?	_____	_____	_____
5. On this trip did you fish primarily from a ...			
a. beach or bank	☐	☐	☐
b. pier, jetty, dock or other man-made structure	☐	☐	☐
c. party or charter boat	☐	☐	☐
d. private or rental boat	☐	☐	☐
6. What county (or nearby city if you don't know the county) did you fish or launch from?	_____	_____	_____
7. If you fished in the area depicted on the attached map, from what coastal area did you fish or launch your boat? (See map on page 2 for NUMBERED areas)	_____	_____	_____
8. If you fished from a boat in the area shown on the map, please note the area in which you fished. (See map on page 2 for LETTERED areas)	_____	_____	_____
9. About how many miles is it from your residence to the fishing or boat launching site?	_____	_____	_____



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	most recent trip	2nd most recent trip	3rd most recent trip
10. About how long was this fishing trip? *(Include boating time to the site)* *(For example: 2 hours, ½ day, etc.)*	_____	_____	_____
11. Sometimes people combine fishing trips with other activities. Was this trip just for fishing?	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
12. Including yourself, how many friends and/or family members went on this trip?	_____	_____	_____
13. How much did you personally spend on this fishing trip for the following items? *(Enter $0 if you did not spend anything on that item)*			
a. lures, sinkers, lines, rental equipment, licenses, and fish cleaning	$_____	$_____	$_____
b. fuel & fees for private, rental or charter boats	$_____	$_____	$_____
c. food, beverages and lodging	$_____	$_____	$_____
14. Please check the category that describes the fish you were hoping to catch on this trip:			
a. no particular species, whatever I could catch	☐	☐	☐
b. salmon	☐	☐	☐
c. striped bass	☐	☐	☐
d. rockfish or lingcod	☐	☐	☐
e. halibut, sole or flatfish	☐	☐	☐
f. other species	☐	☐	☐
15. Please list the number of fish of each species that you caught on each fishing trip. *(Enter "0" if no fish of that species were caught)*			
a. salmon	_____	_____	_____
b. striped bass	_____	_____	_____
c. rockfish or lingcod	_____	_____	_____
d. halibut, sole or flatfish	_____	_____	_____
e. other species	_____	_____	_____

C-110843

STRIPED BASS AND SALMON FISHING

The water in rivers where salmon and striped bass spawn is also used by households, businesses and agriculture. Continuing demand for these waters may adversely affect fisheries. Without additional hatcheries or restoration of habitat, catch rates in the San Francisco Bay and ocean area (SHOWN ON THE MAP ON PAGE 2) could decline from current levels. Additional hatcheries or restoration of habitat could be provided by contributions from each of us to a special fund for this purpose.

16. How many saltwater salmon or striped bass trips did you take in the past year? ☐

17. In the past year, how many saltwater salmon or striped bass trips did you take in the area covered by the map on page 2? ☐ *(IF NONE, SKIP TO QUESTION 20)*

18. What is the MOST you would be willing to pay each year to support hatcheries and habitat restoration that would maintain current expected catch rates for salmon and striped bass in the San Francisco Bay and ocean area if without these efforts your expected catch in this area would be one-half of the current levels? *(Circle the amount)*

$ 0	$15	$50	$150	$300	$450	$600
$ 5	$20	$75	$200	$350	$500	$750
$10	$25	$100	$250	$400	$550	or more

Did you circle $0 because you feel this change has no value to you? ☐ yes ☐ no

19. What is the MOST you would be willing to pay each year to support hatcheries and habitat restoration that would result in a doubling of current salmon and striped bass catch rates in the San Francisco Bay and ocean area if without these efforts your expected catch in this area would remain at current levels? *(Circle the amount)*

$ 0	$15	$50	$150	$300	$450	$600
$ 5	$20	$75	$200	$350	$500	$750
$10	$25	$100	$250	$400	$550	or more

Did you circle $0 because you feel this change has no value to you? ☐ yes ☐ no

20. If no additional efforts were undertaken and catch rates in the San Francisco Bay and ocean area decreased to one-half of current levels, what is the LEAST amount you would have to receive each year so that you would feel adequately compensated for this decline in expected salmon and striped bass catch? *(Circle the amount)*

$ 0	$15	$50	$150	$300	$450	$600
$ 5	$20	$75	$200	$350	$500	$750
$10	$25	$100	$250	$400	$550	or more

Did you circle $0 because you feel this change has no value to you? ☐ yes ☐ no

C-110844

BACKGROUND QUESTIONS

21. Please circle the number on the following scale that you feel best describes *your* saltwater fishing ability.

Novice		Intermediate		Advanced
1	2	3	4	5

22. Do you own or operate a boat that can be used for saltwater fishing?

☐ yes ⟶ 21A. How long is your boat? _____ feet

☐ no

21B. About what percent of the time is your boat used for saltwater fishing rather than for freshwater fishing, cruising, or other activities?

_____ %

23. In the last 12 months, how much did you spend for purchases or repairs on saltwater fishing gear and equipment (excluding boats, motors, trailers, and boat-related equipment)? *(Enter "0" if nothing was spent)*

$_____

These last few questions will help us group your answers with those of others. All information will be kept in the strictest confidence.

24. Check the box for the category that best describes your employment status.

☐ employed full-time
☐ employed part-time
☐ unemployed
☐ homemaker
☐ retired
☐ student

25. Including yourself, how many people live in your household? _____ persons

26. Check the category that best describes your household's annual income before taxes.

☐ less than $10,000
☐ $10,000 to $14,999
☐ $15,000 to $19,999
☐ $20,000 to $24,999
☐ $25,000 to $34,999
☐ $35,000 to $49,999
☐ $50,000 or more

27. Please check the category that includes your own wage per hour.

☐ $ 0.00-$ 5.00/hour
☐ $ 5.01-$10.00/hour
☐ $10.01-$15.00/hour
☐ $15.01-$20.00/hour
☐ $20.01-$25.00/hour
☐ over $25.00/hour

28. Please verify your ZIP code and correct if necessary. _____

Thanks very much for your help!