SOUTHWEST FISHERIES CENTER

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SURVEY OF PARTYBOAT PASSENGERS TO SUMMARIZE AND ANALYZE RECREATIONAL DEMAND FOR PARTYBOAT FISHING IN CALIFORNIA

SUBMITTED BY:

CENTER FOR NATURAL AREAS
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PREFACE

This study was prepared by the Center for Natural Areas under contract No. 03-7-208-35265 with the Southwest Fisheries Center, La Jolla, California. The contract objectives were (1) to collect a substantial body of socio-economic information regarding the marine recreational anglers, (2) to edit, computerize and summarize the economic and demographic data on partyboat anglers in California, (3) to examine the demand for and value of marine angling through application of a travel-cost model. Completion of these objectives is evidenced by this report. Further economic research is planned by the Southwest Fisheries Center staff on the data base established. These data will be made available to researchers in universities, public agencies and private business.

Because the report has been prepared under contract, the statements, findings, conclusions and recommendations herein are those of the Center for Natural Areas and do not necessarily reflect the views of the National Marine Fisheries Service.

Daniel D. Huppert
Southwest Fisheries Center
November 1980

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FINAL REPORT

Presented To

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1.0 INTRODUCTION

Effort on this study began in October 1977 when the Center For Natural Areas began preparation of a package for submission to the Office Of Management And Budget (OMB). The OMB package, containing the survey design and information on the respondents to be interviewed was submitted in December 1977. Through the diligent efforts of National Marine Fisheries Service personnel, OMB approved the design and permission to begin field survey operations was received in late August 1978. Field operations therefore began in September 1978 and continued for approximately five weeks in Southern California. Data from the initial field season was processed and analyzed from October 1978 to January 1979. After field procedures were evaluated and appropriate revisions implemented, survey operations began again in February 1979 and ran continuously until August 1979.

Numerous difficulties were encountered and overcome both in the field survey effort and in the data compilation-analysis efforts. The field operation was hampered by the gasoline crisis that occurred March through June 1979. The effect of that crises was to reduce loads on the commercial passenger fishing vessels and to make it extremely difficult for field personnel to obtain gasoline. Some of the primary problems were encountered because of the large size of the sample collected. During the field season, a total of 367 vessel trips were surveyed resulting in 4,238 fishermen interviewed. The data collected resulted in approximately two million bytes of information contained on some 25,000 computer card images. Needless to say, the data processing problems associated with a data set of this size are enormous.

The study team believes that this data set represents one of the most extensive and tightly controlled compilations of accurate, high quality information ever assembled on recreational participants. Indeed, even the extensive analysis undertaken by the

study team, and the concurrent analysis being undertaken by National Marine Fisheries Service (NMFS) personnel in La Jolla will only scratch the surface of the information contained in this data.

1.1 Background

The Fisheries Conservation and Management Act (FCMA) requires that each regional council establish a fisheries management plan based upon the optimum sustainable yield for each commercially valuable species of fish indigent to the extended U.S. fisheries management zone. This plan must allocate the allowable catch between foreign and domestic fishermen. In addition, the plan, in its attempt to achieve management of the fisheries at an optimum sustainable yield, may adopt various mechanisms including licensing, entry limitations, quotas, gear restrictions and other regulatory apparatus to allocate the allowable domestic catch among domestic fishermen. However, because the FCMA also requires that fishery management plans specifically consider economic and social effects of any promulgated fishery regulations, the councils must understand the extent of economic and social involvement of the various participants in the fishery, so that the impact of proposed regulatory practices can be assessed.

Recreational sportfishing is, perhaps, the most difficult portion of the fishery industry to quantify because recreational fishermen tend to be widely scattered and relatively unorganized. In addition, recreational fishermen have not been required to submit the detailed catch and effort statistics reported by commercial fishermen. Even if reporting requirements could be imposed and enforced (an unlikely and probably undesirable occurrence) they would not be sufficient to provide insights into the economic, demographic, and motivational qualities of the sportsfisherman. It was to begin assessing these factors for California partyboats that the National Marine Fisheries Service (NMFS) commissioned this study.

1.2 Study Objectives

This study was designed with three general objectives:

1) Conduct passenger surveys and other appropriate data gathering activities to compile a substantial collection of information pertinent to the demographic characteristics of Commercial Passenger Fishing Vessel (CPFV) passengers, the economic characteristics of the passenger's angling activities, and the monetary valuations and motivational importance of various marine angling qualities.

2) Summarize demographic information and angler expenditure information by major ports to facilitate regional impact analyses which may be conducted later.

3) Analyze the recreational demand for CPFV fishing paying particular attention to the effects on willingness-to-pay of marginal changes in catch rates of desired species, crowding and prices charged for equipment and passage on the CPFV.

1.3 Study Coverage

This study covers all landings and ports from the California/Mexican border up to and including San Francisco Bay. The only exception to this coverage is the Monterey/Santa Cruz area. Monterey was excluded from the study because participants in the Moneterey area had recently been surveyed (by others) for other purposes and were upset by both the survey methods used and the nature of the questions asked. These participants were, therefore uncooperative and in fact openly antagonistic to field personnel. After contact with some 400 fishermen resulted in four usable responses, Monterey was dropped from the study. Santa Cruz was not surveyed because the facility was not running on a regularly scheduled basis due to probate problems resulting from the death of an owner.

1.4 The Commercial Passenger Fishing Vessel Industry

The California Commercial Passenger Fishing Vessel industry is composed of a number of individual boat/facility owners and operators. The industry operates from landing facilities along the

entire California coast and is organized into two associations - the Sportfishing Association in Southern California and Goldengate Sportfishers in Central and Northern California. Membership in these associations is voluntary but the majority of owners/operators are members.

The vessels provide a service to fishermen in transporting them to fishing grounds, they rent fishing gear, sell tackle, and often sell food and refreshments on board. The vessels operate in a variety of modes with attendant pricing schedules. For example, owners can run 1/2 day, 3/4 day, full day, over-night, long range and/or charter operations. Not all operators use each type of trip and most provide at least two types. The definitions of each type of trip often differ across landing operations. Thus the length (fishing day) of the full day trip from one landing may be identical to the 3/4 day trip from another landing. In addition, the difference in cost between a 1/2 day and 3/4 or full day trip often does not reflect a longer fishing time but instead reflects a longer running time to fishing grounds and may therefore reflect a premium for "better fishing." Both the species sought and the average number of fishermen on a vessel are related to the season of the year. In fact, some boats are only operated in specific seasons. This seasonal lay off of operations is more prevalent as one goes North along the coast but also occurs to a limited extent in some Southern California operations.

The industry has the capacity to carry well in excess of 1 million passengers per year and, at least in Southern California, has been upgrading both its vessels and facilities in recent years in an attempt to attract a larger family oriented trade. There can be little doubt that the industry was affected by the recent gas shortage, especially in the more remote areas of the coast and in those areas that are heavily dependent upon tourist fishermen.

As with every industry, the entrepreneurial and management skills of the owners/operators runs the gamut from the marginal to the

well run highly imaginative and innovative operation. The industry, however, appears to be generally healthy judging from the perspective of the fishermen. The vast majority (77%) were happy enough with the experience that they planned return trips.

2.0 DATA PROCEDURES AND SAMPLE DESCRIPTION

2.1 Data Collection

The data for this study was collected via three survey instruments (See Appendix 1). The first and second instruments, titled "On-Board Passenger Questionnaire" and "On-Board Party Boat Skipper Questionnaire" respectively were placed on the commercial passenger fishing vessel before each trip began. The fishermen were asked to complete the passenger instrument during the run to the fishing grounds. The Skipper completed the Skipper instrument during the return to the landing.

The third instrument titled, "Telephone Interview Form" was administered via telephone after the trip was completed. The first call was made within a week of the trip. Approximately 30% of the respondents were reached on the first call. The remaining 70% required an additional 1 to 20 telephone calls to complete the interview. However, approximately 80% of the respondents were reached within 4 calls. 12% of the respondents to the "On-Board Passenger Instrument" did not give their telephone number or gave an incorrect number.

Data was collected in three rounds; 1) Summer 1978, 2) Winter 1978-1979, and 3) Summer 1979. Response rates varied between instruments and among rounds. However, the overall response rate for the On-Board Instrument was 46% while the response for the telephone instrument averaged 81%. Table 1 shows the response by survey round.

The survey was attempted at all landings in Central and Southern California. However, some landings were not surveyed. The reasons for not surveying at some landings were varied: unwillingness to cooperate, operational problems of landings, negative experience from past surveys, and geographic location. A total of 367 trips were surveyed. Table 2 contains a complete list of landings

surveyed in each region and the number of trips surveyed at each.

TABLE 1
Response By Round And Instrument

Round 1 - Summer 1978

Telephone 420 out of 529 = 79%

On-Board 529 out of 1154 = 46%

Round 2 - Winter 1978 - 1979

Telephone 1440 out of 1669 = 86%

On-Board 1669 out of 3038 = 54%

Round 3 - Summer 1979

Telephone 1585 out of 2040 = 78%

On-Board 2040 out of 5059 = 40%

TABLE 2

Trips By Region And Landing

Region 1 - Total Trips 68

	Trips
Fisherman's Landing	12
Pt. Loma Sport Fishing	19
H & M Sport Fishing	8
Seaforth Sportfishing	17
Islandia Sportfishing	5
Dana Wharf Sportfishing	1
Davey's Locker	5
Art's Landing	1

Region 2 - Total Trips 94

	Trips
Seal Beach Sportfishing	15
Belmont Landing	5
Ports O'Call Sportfishing	2
Redondo Sportfishing	20
Betty-O Enterprises	11
Santa Monica Sportfishing	7
Malibu Pier Landing	14
Paradise Cove Sportfishing	20

Region 3 - Total Trips 103

	Trips
Port Hueneme Sportfishing	24
Channel Island Sportfishing	11
Ventura Sportfishing	18
Sea Landing	27
Port San Luis Sportfishing	13
Hittles Landing	3
Graham's Landing	6
Brebes Landing	1

Region 4 - Total Trips 102

	Trips
Pillar Pt. Fishing Trips	12
Fisherman's Wharf	29
Hank Schramm's Emmeryville	14
Berkley Marina	11
Caruso's Sportfishing	36

A complete list of vessels surveyed is contained in Appendix 2. 57 vessels participated in the survey more than once.

2.2 Data Cleaning

Cleaning data is perhaps the most difficult and time consuming task involved in collecting and analyzing a large complex sample. Two types of error can occur in empirical research: (1) measurement error and (2) sampling error. Stratification schemes and large sample sizes are used to control sampling error. Data cleaning and careful quality control must be used to control measurement error. The objective of the data cleaning process is to minimize (ideally reduce to zero) measurement error in the sample. Measurement error can be introduced into the sample from numerous sources: (1) inaccurate answers by respondents, (2) inaccurate recording of responses by interviewers, (3) inaccurate coding of responses by coders, (4) inaccurate keypunching of coded responses.

Error introduced by inaccurate respondent answers is controlled by pretesting to insure that respondents understand each question and answer the question asked. While this cannot eliminate deliberately untruthful answers, it does minimize confusion. The instruments used for this study underwent extensive pretests and were revised accordingly. The instruments attempt to isolate deliberate inaccuracies by their redundant design. That is, similar questions are asked in both passenger instruments, and responses among some questions in the instruments should correlate.

Recording, coding and keypunching errors were eliminated or minimized by the data cleaning process outlined in Figure 1. In addition, the process checked for internal consistency of respondents answers.

FIGURE 1

Data Cleaning Procedure

1. Run frequency distributions check for
   a. Invalid codes
   b. Believability of responses
2. Identify cases with bad codes or numbers
3. Physically check respondent interview
4. Make corrections
5. Repeat steps 1-4 until clean frequencies result
6. Check for internal consistency
7. Make corrections or delete bad cases
8. Repeat steps 6 & 7 until all tests are met
9. Run final frequency distributions

When this process was executed, the data set was broken into groups of 100 - 500 cases. Each set of cases was examined for codes that were outside the allowable response codes in the code book. Each set of cases was also examined for "believability of responses." That is, any response that indicated an expected or actual catch in excess of the established legal limit, or that seemed large in comparison with probable catches was physically examined. In addition, any dollar amounts spent on gear, food, trip price, lodging and so forth that seemed excessive was physically examined.

Once clean frequencies were obtained, five tests for internal consistency were run. The majority of errors identified by these tests were coding and keypunch errors. The entire data cleaning process resulted in the elimination of only 12 cases as completely unresponsive to the instruments.

Finally, during the data analysis phase, additional errors were detected and eliminated in zip codes. Zip code errors survived the normal data cleaning steps because they could only be checked by assigning a city to each zip code. This was not done until distance zones were constructed for the travel/transfer cost model.

2.3 Sample Description

The sample of commercial passenger fishing vessels consists of 4,238 responses from Southern and Central California. The sample is designed around the four strata of Table 3.

TABLE 3

Strata For Sample

1. Season:	Summer/Winter
2. Region:	Region 1 - San Diego to Newport Beach Region 2 - Seal Beach to Paradise Cove Region 3 - Port Hueneme to Morro Bay Region 4 - Half Moon Bay to Sausalito
3. Type Of Fish Sought:	Surface/Bottom
4. Day Of Fishing:	Weekday/Weekend

Table 4 shows the number of responses in each cell of the sample.

TABLE 4

Response By Cell And Total Response

	Summer				Winter				
	Weekday		Weekend		Weekday		Weekend		
	Surf	Bottom	Surf	Bottom	Surf	Bottom	Surf	Bottom	Totals
R1	119	7	184	20	181	20	217	25	773
R2	324	62	251	80	136	59	161	98	1171
R3	359	135	262	84	28	22	123	241	1254
R4	337	17	274	54	21	6	300	31	1040
Totals	1139	221	971	238	366	107	801	395	4238

Surf = Surface Fish

Bottom = Bottom Fish

By totaling combinations of columns from Table 4, various subtotals by stratum and region can be obtained. Strata totals for the full sample are presented in Table 5.

TABLE 5
Strata Totals

Stratum	Total Responses	
Weekday	1833	4238
Weekend	2405	
Summer	2569	4238
Winter	1669	
Surface Fish	3277	4238
Bottom Fish	961	

The "type of fish sought" stratum needs some additional explanation for complete understanding. When completing the "on-board" survey, each fisherman was asked to list the species of fish he expected to catch on the trip. In addition, each skipper was ask to identify his target species for each trip. In many cases, the passenger's expectations and the skipper's targets were different. However, because the passenger makes his decision to take a trip on the basis of his expectations, presumably, based at least in part on the skipper's target, the fish sought stratum was constructed from passengers expectations. It is interesting to note that some 77% of the fishermen interviewed on commercial passenger fishing vessels expected to catch surface fish and 73% actually caught 1 or more surface fish.

The sample appears to be well distributed between summer and winter fishing and between weekday and weekend trips. However, given the expressed preference for surface fish and the resulting distribution

of respondents in the sample cells, it is not particularly surprising that, with some notable exceptions, the best results from the econometric analysis were obtained from the surface related data.

Further descriptions of the respondents characteristics are presented in the following chapter.

3.0 ECONOMIC, DEMOGRAPHIC AND MOTIVATIONAL CHARACTERISTICS

All the data discussed in this chapter is summarized in TABLE 6, Section 3.2 of the chapter. The table is constructed so that both full sample and regional characteristics can be examined and compared.

3.1 Sample Characteristics And Regional Differences

The sample of commercial passenger fishing vessel fishermen drawn for this study was relatively large. It appears to be large enough to allow accurate generalization to both the full population of commercial passenger fishing vessel fishermen and the subpopulation of fishermen in each region. The sample shows a great deal of uniformity of characteristics across the regions. There are also some marked differences in some characteristics between regions. The regional differences that occur are consistent both with the overall regional character of the commercial passenger fishing vessel experience and with the on-site observations of the field crews.

The characteristics are discussed below in the order presented in Table 6.

Sex: Eighty-five (85) percent of the sample is male and eleven (11) percent is female. The sex of the other 4% is unknown. There is no significant variation among regions in this characteristic.

Income Class: The median household income of the sample is in the $18,000 to $23,000 per year range. This is also the median income in Regions 1,2 and 3. The median income in Region 4 is slightly higher - the $23,000 to $28,000 range. All the frefrency distributions for the sample are skewed slightly towards the higher end. However, the tendency toward higher incomes

increases as one moves up the coast from regions 1 and 2 into regions 3 and 4.

This tendency toward higher income participants in trips originating farther north is supported by two other variables in the sample: (1) the fare paid for the trip and (2) the distance traveled to the fishing site.

Size Of Group: In regions 1 and 2 there is a relatively strong tendency to fish alone or with one friend. Sixty-three (63) percent in region 1 and sixty-six (66) percent in region 2 fall into this category. The tendency begins to weaken in region 3 where the proportion fishing alone or with one friend declines to 52%. In region 4, the tendency has completely reversed and only 39% of the sample fishes alone or with one friend.

In region 3, the increase in groups of 3 or more tends to correlate highly with the increased median distance traveled and the increased median trip price. Thus, as the cost of traveling to the site increases, there appears to be a tendency to travel to the site in "car pools." The dramatic reversal of the trend in region 4 reflects a tendency of companies in the Bay area to sponsor "company trips" on non-chartered boats for salmon fishing. This tendency is particularly prevalant early in the salmon season but appears to occur throughout the season. This tendency in region 4 also correlates well with the proportion of fishermen using rental equipment.

Fare Paid For Trip: The fare paid for the fishing trip reflects the length of the fishing trip (1/2 day, 3/4 day, full day). Various discount and promotional fares sometimes apply (such as for seniors and children) and some people ride free as guests of the owner/operator. In addition, some passengers pay for more than one person (one father took seven of his child's friends on a salmon trip during a birthday party) and others pay only part

of their fare while a friend or relative pays the rest. These and other fare arrangements result in a distribution of fare's paid throughout the sample and within each region.

Median fares in regions 1 and 2 are $10-$15 and $1-$10 respectively. The cluster of respondents in the $20-$35 range in region 1 is primarily indicative of anglers on the full day Albacore and Yellowtail trips. The median fare in region 3 is in the $15-$20 range. The median fare in region 4 falls in the $20-$35 range. The median fares in each region tend to reflect the increase in fares charged for trips as fishermen travel up the coast.

These fares correlate very well with the income distribution reported earlier in this chapter. Thus as the ticket price increases, both the median income and the skewness of the income distribution tends toward the higher end of the scale.

Cost Of Rental Equipment: Two conclusions can be drawn from the data presented for this variable. The first conclusion is that the median price for rental of fishing equipment is relatively uniform throughout the sample. The cost is $3-$4 in regions 1, 3 and 4 and $4 to $5 in region 2.

The second conclusion is much more interesting. The code (12) for no answer was constructed such that those respondents who gave "no answer" did not rent equipment. Thus, in region 1, 24% of the sample rented equipment; in region 2, 20% of the sample rented equipment; in region 3, 30% of the sample rented equipment and; in region 4, 42% of the sample rented equipment. This distribution of persons renting fishing gear at the landing correlates well with the planned frequency of future trips. This correspondence is shown in Table 7. It is clear from Table 7 that there is a direct correspondence between the proportion of fishermen using rental equipment and the planned frequency of future trips.

TABLE 7

% Of Sample Using Rental Gear And
% Planning 5 Or Fewer Trips/Year
By Region

	% Of Sample Using Rental Equipment	% Of Sample Planning 5 or Fewer Trips/Year
Region 1	24%	41%
Region 2	20%	33%
Region 3	30%	54%
Region 4	42%	64%

It is highly probable that the proportion of fishermen using rental gear is a much higher quality indicator of the general experience level of the fishermen on commercial passenger fishing vessels in each region than the length of experience variable discussed below.

Length Of Experience: This variable was constructed by asking the fisherman how long he had considered himself a partyboat fisherman. For the full sample, 17.4% of the respondents had fewer than two years experience. This proportion holds throughout all regions. The median experience level is 6 - 10 years for the full sample and for every region. However, this variable does not weigh the quality of the fisherman's experience. Simply stated, the length of experience variable does not distinguish between the fisherman that has taken 1 or 2 trips/year for six years and the fisherman that has taken 15 - 20 trips/year for the last six years. The use of rental equipment appears to be able to make this distinction.

It is possible that ownership of fishing equipment is also related to income. However, the regional trends in rental equipment are the complete opposite of the regional trends in income. Thus, the proportion of fishermen using rental equipment appears to be

an accurate indicator of the general experience level of fishermen using commercial passenger fishing vessels in each region.

Travel Distance: This variable displays the distances traveled by fishermen to participate in a day of CPFV fishing. In region 1 passengers travel a median distance of 15 to 25 miles. In region 2 the median distance traveled is 6 to 15 miles while in region 3 the median distance is 50 - 100 miles and in region 4 the median travel distance is 25 - 35 miles.

The distribution of distances traveled indicates that regions 3 and 4 draw from market areas extending out 150 to 200 miles while region 2 draws from a relatively localized market area. Region 1 appears to draw participants from both a localized market and a more distant market. It is probable that these two market areas correspond to the 1/2 and 3/4 day trips and the full day Albacore/ Yellowtail trips respectively.

Expected And Actual Catches: Both the total expected catch and the total actual catch add to more than the 4238 sample size. This occurs because each respondent was first asked which species he expected to catch. Each respondent was also asked which species he actually caught. In the vast majority of cases, fishermen expected to catch more than one species. In many cases, more than one species was actually caught.

To evaluate this information, a second expected catch variable was constructed (not shown). This variable was constructed to identify any fisherman that expected to catch at least one species of surface fish and any fisherman that expected to catch at least one species of bottom fish. This variable (displayed in Table 6) shows that 77% of the fishermen expected to catch surface fish. Examination of the reported actual catch shows that 73% of the sample caught surface fish.

Priority Rating Of Fish: This variable displays the respondents species preference by region. Clear preference is shown for one species in region 1. Forty percent of the respondents stated a first preference for Yellowtail. Twenty percent chose Yellowtail as a second preference and 17% chose Bass as a third preference.

First preferences are divided in region 2 among Bass (22%), Rock Cod (21%) and Halibut (17%) with Yellowtail running a close fourth. First preference in region 3 is split between Bass (31%) and Rock Cod (28%). These same species account for 17% and 19% of the second preferences while 19% chose Rock Cod as third preference. Halibut and Ling Cod are also relatively important in region 3.

Region 4 shows a clear (80%) first preference for salmon with second preference divided between Bass (25%) and Rock Cod (25%).

Congestion: Forty-nine percent of the sample in region 1 felt that their trip was"not crowded". In regions 2, 3, and 4 the "not crowded" response was chosen by 36%, 43% and 56% respectively. On the other hand, only 9% of the sample felt that the trip was "too crowded for good fishing." The proportion who felt that their trip was "too crowded for good fishing" rose slightly in region 1 and nearly doubled in regions 2 and 3.

Liklihood That Passengers Will Return: It is possible that the responses given on the crowding question carry little operational significance since 95% of the sample contacted indicated that they would continue to fish on commercial passenger fishing vessels in the future. In addition, of those passengers who said they would not return, only 7% (26% of the full sample) gave "too crowded" as the reason they would not fish from commercial passenger fishing vessels in the future.

Reasons For Not Using Commercial Passenger Fishing Vessels In The Future: One hundred and fifty-eight fishermen indicated that they would not fish from CPFV's in the future. Of the 158 respondents, 18% gave "poor fishing" as their response. 31% indicated that it was "too expensive," either directly or by stating that they did not live close enough to the ocean. Only 7% gave "crowding" as their reason and 4% gave "reduced salmon limits" as their reason. 26% gave "sea sickness" and 6% indicated that they planned to use their own boat in the future.

During the Winter 1978-1979 and Summer 1979 Survey Rounds, an additional question was asked each respondent. Each fisherman during these rounds was asked "What single thing could most improve the fishing experience?" Responses to this question are presented in Table 8. The three most frequent responses among fishermen who could answer this question were "improved boat facilities" (31%), "improve live bait" (17%) and "provide more fish" (9%).

TABLE 8

Frequency Response On How To Improve Fishing

How Best To Improve Fishing	Total
(01) More fish	170
(02) Improve boat facilities	580
(03) Control commercial fishing	149
(04) Reduce cost	73
(05) Don't know	1083
(06) Enforce limits	118
(07) Fish hatcheries	36
(08) Other	296
(09) Return limit to 3 salmon	82
(10) Improve bait	314
(11) Arteficial reefs	36
(99) No answer	1301
	4238

Of the respondents who answered "Other" to this question, approximately 85% said that "Pollution should be cleaned up."

3.2 Sample Summary Table

This section summarizes the demographic, economic and motivational characteristics of the commercial passenger fishing vessel fisherman by region in tabular form. A data tape, containing all the data collected during this study was delivered to National Marine Fishery Service in February 1980. Manipulation of the data contained on that data tape will allow National Marine Fishery Service or other users to display the data on any basis chosen. For example, the data may be displayed by landing or landing group, by point of origin, by income group, by sex and so forth.

The data set gathered for this study may be used to test innumerable hypotheses and address many questions about commercial passenger fishing vessel fishermen. The following chapter of this report presents estimates of the demand for commercial passenger fishing vessel fishing by developing and estimating a travel/transfer cost model. The model is used to estimate the effect of travel/transfer cost, type of fish sought, income and investment in equipment on demand for commercial passenger fishing vessel fishing.

TABLE 6

Data By Subarea (Landing Groups)

	Region 1 San Diego & Orange County	Region 2 Santa Monica Bay	Region 3 Oxnard Santa Barbara	Region 4 San Francisco	Whole Sample Total
A. DEMOGRAPHIC DATA					
1. Sex					
(1) Male	654	972	1066	886	3578
(2) Female	88	138	148	100	474
(3) No Answer	31	61	40	54	186
2. Income Class					
(01) Under $3,000	4	4	7	5	20
(02) $3,000 - $6,000	11	13	14	5	43
(03) $6,001 - $9,000	33	44	45	19	141
(04) $9,001 - $12,000	42	78	95	56	271
(05) $12,001 - $15,000	68	99	98	35	300
(06) $15,001 - $18,000	62	104	102	51	319
(07) $18,001 - $23,000	100	136	166	111	513
(08) $23,001 - $28,000	86	111	159	120	476
(09) $28,001 - $35,000	72	91	117	143	423
(10) $35,001 - $50,000	51	70	84	114	319
(11) Over $50,000	35	71	42	80	228
(12) No Answer	209	350	325	301	1185
3. Size Of Group					
(01) I am alone	195	321	194	136	846
(02) With a friend	296	445	465	276	1482
(03) More than one	278	395	586	623	1882
(04) No answer	4	10	9	5	28

TABLE 6 CONTINUED

	Region 1 San Diego & Orange County	Region 2 Santa Monica Bay	Region 3 Oxnard Santa Barbara	Region 4 San Francisco	Whole Sample Total
B. ECONOMIC FACTORS					
1. Fare Paid For Trip					
(1) $1 - $10.00	161	533	166	5	865
(2) $10.01 - $15.00	215	297	359	9	880
(3) $15.01 - $20.00	46	95	361	108	610
(4) $20.01 - $35.00	184	71	180	770	1205
(5) $35.01 - $40.00	44	11	12	9	76
(6) Over $40.00	35	9	26	47	117
(7) No answer	88	155	150	92	485
2. Cost Of Rental Equipment					
(1) .50 - $1.00	4	4	3	5	16
(2) $1.01 - $2.00	4	13	7	13	37
(3) $2.01 - $3.00	22	28	88	51	189
(4) $3.01 - $4.00	56	68	122	101	347
(5) $4.01 - $5.00	71	59	61	65	256
(6) $5.01 - $6.00	16	8	44	26	94
(7) $6.01 - $7.00	1	3	4	4	12
(8) $7.01 - $8.00	3	18	11	13	45
(9) $8.01 - $10.00	10	14	19	19	62
(10) $10.01 - $15.00	2	9	9	6	26
(11) Over $15.00	0	7	4	5	16
(12) No answer	584	940	882	732	3138
3. Length Of Experience					
(1) Less than 1 year	62	103	12	57	234
(2) 1 - 2 years	43	72	148	71	334
(3) 2 - 3 years	51	66	55	62	234
(4) 3 - 4 years	34	44	39	39	156
(5) 4 - 6 years	71	110	133	81	395
(6) 6 - 10 years	110	200	152	143	605
(7) 10 - 15 years	34	118	110	87	349
(8) 15 - 25 years	132	153	159	133	577
(9) 25 - 35 years	47	65	67	52	231
(10) Over 35 years	15	49	58	18	140
(11) No answer	174	191	321	297	983

TABLE 6 CONTINUED

	Region 1 San Diego & Orange County	Region 2 Santa Monica Bay	Region 3 Oxnard Santa Barbara	Region 4 San Francisco	Whole Sample Total
4. Travel Distance					
(1) 0 - 6 miles	99	172	139	9	419
(2) 6 - 15 miles	189	538	122	110	959
(3) 15 - 25 miles	118	286	115	193	712
(4) 25 - 35 miles	14	59	119	304	496
(5) 35 - 50 miles	23	36	109	160	328
(6) 50 -100 miles	170	18	360	132	680
(7) 100 -150 miles	52	7	127	24	210
(8) 150 -200 miles	2	0	62	21	85
(9) 200 -300 miles	15	1	23	21	60
(10) 300 -400 miles	30	7	9	11	57
(11) 400 -500 miles	8	1	5	2	16
(12) 500 -600 miles	2	0	6	1	9
(13) 600 -700 miles	1	1	4	2	8
(14) Over 700 miles	40	35	47	44	166
(15) No answer	10	10	7	6	33

C. MOTIVATIONAL FACTORS

1.& 2. Catch

	Expected/Actual		Expected/Actual		Expected/Actual		Expected/Actual		Exp./Actual	
(01) Albacore	87	11	42	5	34	0	25	0	188	16
(02) Barracuda	366	117	306	49	67	10	5	0	745	176
(03) Bass	463	218	598	261	633	401	55	16	1749	896
(04) Croaker	41	0	69	11	38	1	14	1	162	13
(05) Cow Cod	19	2	150	6	207	33	25	1	401	42
(06) Rock Cod	163	102	562	438	755	622	178	92	1658	1254
(07) Ling Cod	140	23	175	29	536	113	150	25	1001	190
(08) Bonito	446	190	450	189	144	49	9	2	1049	430
(09) Halibut	168	11	450	47	283	18	43	3	944	79
(10) Mackerel (S&J)	321	252	347	239	174	165	22	8	864	664
(11) Mackerel (P&B)	210	88	260	88	151	64	17	8	638	248

(Continued)

TABLE 6 CONTINUED

*1.&2. Catch (Continued)	Region 1 San Diego & Orange County		Region 2 Santa Monica Bay		Region 3 Oxnard Santa Barbara		Region 4 San Francisco		Whole Sample Total	
	Expected/Actual		Expected/Actual		Expected/Actual		Expected/Actual		Exp./Actual	
(12) Salmon	10	4	41	1	41	0	876	472	968	477
(13) Sculpin	164	38	194	36	67	12	3	1	428	87
(14) While Sea Bass	131	17	157	10	126	12	18	0	432	39
(15) Yellow Tail	374	111	176	26	91	3	58	12	699	152
(16) Other	51	59	46	80	48	111	26	23	171	273
(17) None	0	47	0	86	0	71	0	247	0	451

Exp. is abbreviation for expected catch.
*1. Number of peiople that expected to catch
2. Number of people who caught

3. Priority Rating Fish	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
(01) Croaker	1	0	1	9	1	1	1	0	0	1	1	0	12	2	2
(02) Cow Cod	0	0	2	2	11	23	16	25	36	1	3	4	19	39	65
(03) Rock Cod	26	23	20	195	75	70	263	158	108	45	142	90	529	398	288
(04) Ling Cod	3	13	12	10	46	25	96	120	64	25	50	51	134	229	152
(05) Halibut	24	30	45	150	113	92	101	122	66	5	25	37	280	290	240
(06) Bonito	23	45	50	37	59	51	16	36	29	0	2	1	76	142	131
(07) Barracuda	56	66	48	60	74	69	8	28	35	0	1	4	124	169	156
(08) Bass	89	92	70	204	181	111	292	138	77	40	144	63	625	555	321
(09) White Sea Bass	12	36	26	28	35	35	13	33	29	4	24	6	57	128	96
(10) Yellow Tail	238	105	48	110	98	71	43	62	42	7	17	37	398	282	198
(11) Albacore	86	68	28	52	61	34	42	42	23	19	52	14	199	223	99
(12) Salmon	6	3	5	14	12	5	21	14	14	635	61	20	676	90	44
(13) Sculpin	6	11	6	7	11	13	3	4	6	1	0	1	17	26	26
(14) Mackerel (S or J)	4	5	5	4	12	9	4	6	4	2	0	2	14	23	20
(15) Mackerel (Blue)	1	7	5	0	3	3	1	1	4	1	0	0	3	11	12
(16) Other	17	17	24	22	42	31	29	33	34	14	50	39	82	142	128
(17) Don't Know	33	73	129	33	70	191	89	128	241	38	225	188	193	496	749
(18) No Answer	148	179	249	234	267	337	216	304	442	202	243	483	800	993	1511

TABLE 6 CONTINUED

	Region 1 San Diego & Orange County	Region 2 Santa Monica Bay	Region 3 Oxnard Santa Barbara	Region 4 San Francisco	Whole Sample Total
4. Congestion					
(1) Too Crowded For Fishing	82	198	206	98	584
(2) Crowded But O.K. To Fish	296	531	493	344	1664
(3) Not Crowded	378	426	538	580	1922
(4) No answer	17	16	17	18	68
5. Likelihood That Passengers Will Return					
(1) Yes	594	909	992	785	3280
(2) No	33	25	48	52	158
(3) No Answer	146	237	214	203	800
6. If Yes, How Many Trips Will He Make Per Year?					
(1) 1 - 5 trips per year	245	297	534	503	1579
(2) 6 - 10 trips per year	81	128	160	166	535
(3) 11 - 25 trips per year	118	209	174	90	591
(4) 26 - 40 trips per year	48	59	32	3	142
(5) 41 - 60 trips per year	52	120	57	12	241
(6) More than 60	40	84	28	7	159
(7) No Answer	189	274	269	259	991
7. If No to 5, Why Not					
(1) No Fish	7	6	5	11	29
(2) Too Expensive	3	1	2	12	18
(3) Too Crowded	2	6	3	0	11
(4) Don't Live By Ocean	11	3	8	10	32
(5) Reduced Limit	0	0	0	4	4
(6) Other	10	9	30	15	64
(7) No Answer	740	1146	1206	988	4080

4.0 ESTIMATING DEMAND FOR PARTY BOAT FISHING

4.1 Introduction

Valuation of open party boat fishing may be approached from two standpoints: the travel-transfer cost approach and the willingness-to-pay approach. In this review of recent literature, we focus on the recent developments in the travel-transfer cost approach. We follow, in general, the review presented in Dwyer, Kelly & Bowes (1977) and also Dwyer & Bowes (1978). The concepts of importance as described in these sections are: benefit-cost analysis and consumer surplus, the simple travel cost model, and regional extensions of the travel cost model.

4.2 Benefit-Cost Analysis

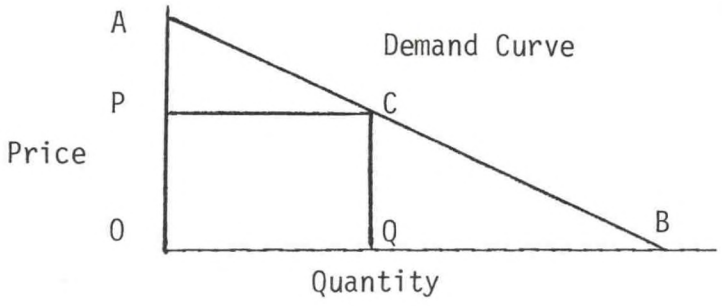
The primary policy issues generating this study relate to managing the commercial and recreational fishing within the study area. Of importance is an estimate of the effect of a change in fish species population on the benefits attributable to recreational fishing. A cost-benefit approach is suitable for this problem. Choice among feasible policy alternatives, following the cost-benefit approach, should be such as to maximize positive net benefits. Fulfillment of this benefit-cost criteria should insure that it is possible for those who benefit to fully compensate the losers such that no one person is made worse off and at least some persons can be made better off, regardless of whether compensation is actually made.

Positive benefits arising from increases in the quality of recreational open party boat fishing are to be measured in terms of the willingness of fishermen to pay for each increment in quality provided. Willingness-to-pay includes entry and use fees actually paid and also an estimate of the maximum amount in excess of these charges that users could be induced to pay. Willingness to pay in

excess of actual charges are referred to as "net willingness-to-pay." This is an appropriate measure of additional benefits by those individuals who gain use from the recreational facility. It must be understood that it is necessary to evaluate a net change in willingness-to-pay as a result of a net increase in the quality of the sport fishing experience.

An approximation of willingness of fishermen to pay for recreational opportunities can be developed from a demand curve which indicates the quantity of use that buyers would be willing to purchase at each price. Demand curves generally have downward slope because increasing amounts of the good are demanded at lower prices. Willingness-to-pay may be described as the sum of two components: the actual market expenditure plus any excess amount which consumers might be induced to pay. The quantity demanded, it should be noted, is a function of price of the good, prices of substitutes and complementary goods, individual income and tastes. The quantity of fishing trips demanded might depend on party boat fare, income, expected catch (a quality variable), associated gear costs, as well as variable costs associated with the recreational experience and other quality variables such as congestion and weather conditions.

Benefits are usually approximated by an area under the actual demand curve.



If OQ units were consumed at price P, the benefits would be measured as the area ACQO. This includes the actual expenditure PCQO plus an

approximation ACP of what consumers were willing-to-pay. The area ACP is referred to as consumers' surplus since it approximates net benefits to consumers or the willingness of consumers to pay in excess of their actual payment. This approximation is satisfactory if extracting the full willingness-to-pay for each unit would not raise expenditures sufficiently to cause any shift in the demand curve.

4.3 The Simple Travel-Cost Method

The travel-cost method is based on a model for predicting the use of a site or area. The model can be described by an expression such as

$$V_{ij} = f(C_{ij}, P_i, S_{ij}, A_j)$$

where V_{ij} = number of site visits or trips from a population source or center i to a recreation site j.

C_{ij} = trip cost, the cost of travel between the origin i and the site j, plus entry fees at site j.

P_i = the population of origin i.

A_j = the attractiveness of site j.

Parameters of the model are estimated from information about users at existing sites. The model can also be used to estimate a demand curve for the site. The travel cost method estimates a demand function by using travel costs as a surrogate for price. The area under this demand curve provides an estimate of user benefits.

The travel-cost model is developed by using actual observations on use and user characteristics from various origins i to a site j.

The wide range of costs facing individuals at different distances from a site provides information about the influence of costs on participation. This information can be used to generate a demand curve giving estimates of participation at various entry fees. Direct measures of site demand require data relating site use to actual fees. If actual fees show little variation, only indirect estimation of the demand curve is possible.

The procedure for developing a demand curve from the estimated travel-cost model is as follows. First the model is applied to all origins i using actual data for trip cost, C_{ij}, and other variables. With fees initially considered zero, C_{ij}, is the travel cost. The predicted use from all origins is then summed to obtain an estimate of total use at zero price. It is then assumed that participants will react to an increase in fees just as they do to an increase in travel cost. Therefore the travel cost for each origin is augmented by fixed increments (say $1.00) and the model is used to estimate use at the new hypothetical level. Successive estimates of use at each level of fees are obtained. These estimates are then used to plot a site demand curve. Total net willingness-to-pay is estimated by the area under this demand curve. An estimate of gross willingness-to-pay may then be obtained by adding total site entry and use fees to net willingness-to-pay.

A consistent bias in demand curves derived as above results because of the failure to capture the effects of travel time. Lower visit rates from more distant locations are due not only to the greater monetary costs of making the longer trip but also the greater time that is involved. Consequently, if travel time is omitted as a variable, estimates of use at higher dollar costs will be underestimated. Thus, to ignore time leads to an underestimation of benefits.

The assumption is made that all relevant and statistically significant variables which affect trip making behavior are probably specified in the travel cost model. As a prediction model, the travel cost method is improved markedly by including variables reflecting the availability and relative quality of substitute sites. Other variables may be expected to influence demand including travel time, income levels of users, past experience with activities available at the site, age and family structure and size of the town in which the potential visitor lives.

4.4 More General Travel-Transfer Cost Models: Regional Models

The more general travel cost method makes use of a model that can be expressed functionally as:

$$V_{ij} = f(C_{ij}, T_{ij}, P_j, O_i, D_i, Q_j, C_{ik}, T_{ik}, Q_k)$$

where V_{ij} = number of trips from an origin i to a location j

C_{ij} = travel cost between origin i and location j

T_{ij} = travel time from origin i to location j

P_j = entry fee for use of area j

D_i = characteristics of individuals at origin i

Q_j = Quality or characteristics of location j

C_{ik} = vector of trip costs from origin i to substitute locations $k \neq j$

T_{ik} = vector of trip times from origin i to substitute locations $k \neq j$

Q_k = vector of quality characteristics at substitute areas k ($k \neq j$)

This is the most general form of the model. There have been no examples of explicit models which satisfactorily include all the suggested determinants. Two somewhat different models have been

developed to take into account the effect of time on substitute sites. These are examples of regional models and they represent the state of the art of the travel-transfer cost approach.

(1) A linear system of per-capita demand equations, Burt & Brewer (1974). The study was aimed at evaluating the recreation benefits of a proposed reservoir project to be developed in Missouri. Five Corps of Engineers improvements are located in the vicinity and four others were under construction at the time of the study. Thus, the availability of substitutes was an important factor in determining the value of the proposed reservoir.

A system of five interrelated demand functions of the form indicated below was estimated. Each equation is linear in travel costs and income and explains per capita demand for trips.

$$V_{i1} = a_1 + \sum_{k=1}^{5} b_{1k} C_{ik} + c_1 Y_i$$

$$\vdots$$

$$V_{i5} = a_5 + \sum_{k=1}^{5} b_{5k} C_{ik} + c_5 Y_i$$

where V_{ik} = visits by individuals i to the nearest site of type k

C_{ik} = trip cost to reach the nearest site of type k

Y_i = family income of individual i

The demand survey sample was derived from direct interviews of over 2000 households. The purpose of the survey was to identify actual outdoor recreation behavior during 1966. Information used in constructing the model was (a) the number of days spent at specific sites including travel time (b) expenditures specific to the trip including auto cost (c) mileage driven on each trip (d) family income.

4.5 The Study Model

Even though development of a simultaneous equations regional model is within the state of the art, the increased data and estimation requirements place such a development outside the scope of this study. Instead, this study estimates demand functions for each region (group of landings) within the study area. Both Log-linear and Log-Log forms of the function have been estimated for each region and for the study area as a whole. The forms estimated are (subscripts have been dropped):

1. $\text{Ln } Q = B_0 + B_1 \text{ TC} + B_2 \text{ ID} + B_3 \text{ Y} + B_4 \text{ EC} + \varepsilon$

2. $\text{Ln } Q = B_0 + B_1 \text{ Ln TC} + B_2 \text{ Ln ID} + B_3 \text{ Ln Y} + B_4 \text{ Ln EC} + \varepsilon$

where Q = Number of trips per 100,000 population
TC = Total Cost (travel cost + fare, bunk & Tackle rental)
ID = Investment in durables
Y = Income
EC = Expected catch
ε = Random error term

4.6 Constructing the Empirical Model

In order to estimate demand functions with the travel-transfer cost model, it is necessary to construct a set of distance zones around the recreation site. The problem presented for this study is that fishermen participate in the activity at multiple sites along the coast. The data set collected for this study is composed of responses from 368 Commercial Passenger Fishing Vessel trips from 33 separate landings. While it might be possible to estimate demand functions for each landing, this would make interpretation difficult and would significantly reduce the data base for each demand estimate. Therefore this study grouped landings into 10 groups and four regions. Demand for CPFV fishing was then estimated in each region. The procedure used to estimate the model involved four steps:

1. Group landings into four geographic regions
2. Construct distance zones for each region
3. Estimate model in each region
4. Estimate model for whole area

The procedures used to combine the data necessitated some assumptions about the nature of the fishing activity. It is possible to combine the data in different ways, thus making different assumptions about the fishing activity. This task is left for future studies with the data.

4.6.1 Geographic Grouping: To facilitate the analysis, the landings were grouped into four geographic regions (1) Mexican border to Newport Beach (2) Seal Beach to Paradise Cove (3) Port Hueneme to Morro Bay and (4) Half Moon Bay to Sausalito. These groups were chosen to approximate the market area of each landing grouping. The groupings are not unique and the raw data (delivered in February 1980) may be regrouped and analyzed in any manner NMFS chooses.

4.6.2 Distance Zones And Estimation Procedure: The travel cost model estimates demand by first grouping all fishermen into distance zones. Table 9 shows the two distance zone structures used to estimate the model.

Because Commercial Passenger Fishing Vessel fishing activity takes place at many landings on the California coast, it was necessary to construct distance tables originating from each of 10 landing groups. Figure 2 displays the regional location and point of CPFV trip origin for each distance table. Each distance zone contains a list of zip codes that was compared against the zip codes of fishermen taking a CPFV trip at a given landing. Thus, each fisherman was assigned a travel distance equal to the mid point of the distance zone containing his or her zip code.

While ten landing groups (and distance tables) were used, demand for CPFV fishing was estimated for each region rather than each landing group. This was done for two reasons. First, the study objective was to estimate regional demand. Second, by combining landing groups, more stable estimates of demographic, economic and motivational data on CPFV fishermen was obtained.

Combining landing groups into regions to estimate demand involves, at the first level, the assumption that, with the exception of travel distance, all fishing trips in the region are identical. While this assumption appears to be extremely strong, it was much less restrictive than it appears because that data set was stratified in a manner that made trips from landings in each region relatively similar. As is discussed in Section 2.0 of this report (see tables 3 and 4) three strata were used in each region: Season, target fish and day of week. Thus, the assumption necessary is that all fishing trips in a region that occur, for example, on a summer weekday and are targeted for surface fish are identical.

TABLE 9
Alternative Distance Zone Structures

	Structure 1	Structure 2
Zone 1	0-6 miles	0-15 miles
Zone 2	6-15 miles	15-25 miles
Zone 3	15-25 miles	25-35 miles
Zone 4	25-35 miles	35-50 miles
Zone 5	35-50 miles	50-100 miles
Zone 6	50-100 miles	100-700 miles
Zone 7	100-150 miles	over 700 miles
Zone 8	150-200 miles	
Zone 9	200-300 miles	
Zone 10	300-400 miles	
Zone 11	400-500 miles	
Zone 12	500-600 miles	
Zone 13	600-700 miles	
Zone 14	over 700 miles	

Figure 2

	Region 4
Table 1	San Francisco - centered tip of Peninsula
Table 2	Berkeley/Emeryville
Table 3	Half Moon Bay
	Region 3
Table 4	Avila Beach
Table 5	Santa Barbara
Table 6	Ventura
	Region 2
Table 7	Redondo
Table 8	Santa Monica
Table 9	Seal Beach
	Region 1
Table 10	San Diego -centered Point Loma

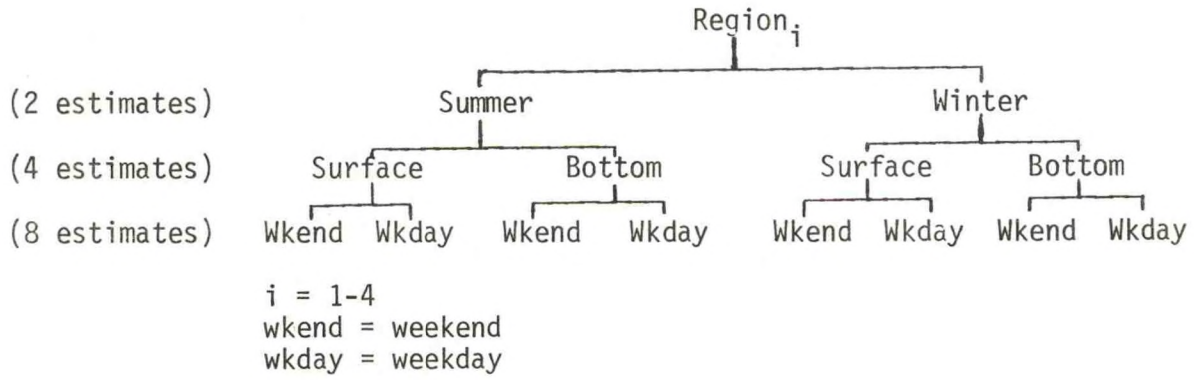
The second step necessary to estimate the travel cost model involves calculating mean values in each cell for all data used in the model. This is necessary because the travel cost model does not use individual response data. Instead it uses mean data in each distance zone as the input data. The output from aggregating the cell data is included as Appendix 4. This Table shows the mean for each of the model variables in each of the 224 cells of the 14 distance zone structure.

Once the distance data was attached to each case, the data aggregated and means calculated, the data was ready for use in estimating the travel cost model. The stratified data structure

meant that at the first level, eight demand functions were estimated in each region. The structure of the demand estimates is shown in Figure 3.

Figure 3

Structure Of Demand Estimates For Each Region



Six additional demand functions were also estimated for each region. First, the "day of week" stratum was dropped and demand was estimated for summer-surface, summer-bottom, winter-surface and winter bottom in each region. Next, the "season" stratum was dropped and the model was reestimated for surface and bottom fishing in each region.

Finally, the regional structure was dropped and the model was estimated at each level of stratification for the entire data set.

In addition to the structure above, each equation was estimated in both semi-log and logarithmic forms and each was estimated using per capita income and then household income. This meant that some 280 equations were estimated for each distance zone structure for a total of 460 estimates. The results of the estimates are discussed below.

5.0 TRAVEL COST ESTIMATES

5.1 Introduction

This chapter reports the results of the travel cost estimates for each region. Because of the large number of alternative models estimated, the first step in the evaluation process is to develop a series of screens to quickly and efficiently identify the equations to be used in the analysis. Next, a set of statistical tests for structural homogeneity are used to determine the significance of seasonality, type of fish sought and day of week fished. Finally, statistical tests are used to determine the significance of the variables in the selected model for each region.

5.2 Screening The Estimates

Four hundred and eighty equations were estimated from the travel cost data. While all the estimates are conceptually valid, this study applied a series of screens to the estimates in order to identify the equations that were most relevant.

Some of the regressions failed because there were insufficient data cells to estimate the model. These estimates were, obviously, deleted from the analysis. The remaining estimates were subjected to a screen that tested the hypothesis:

H_0 $B = 0$

H_1 $B \neq 0$

where: B is the vector of coefficient estimates

This test simply asks whether any one of the estimated coefficients is statistically significantly different from zero. The test statistic used was the standard "F" statistic produced for each

estimate. A critical value at the .9 level of significance was used in each test. All estimates that failed this test were deleted from the analysis.

The third screen applied to the estimates asked whether at least two of the individual coefficient estimates were significantly different from zero at the .90 level. This screen deleted a number of estimates where the only significant coefficient estimated was the coefficient for travel cost (TCOST). These three screens reduced the number of estimates to approximately ninety.

While examining the estimates for the initial screens, it was observed that in almost all instances when an estimate passed the screens containing the household income variable (Y), the matching estimate containing per capita income (PCIN) also passed. The reverse, however, was not true. This presented the possibility of using a fourth screen. If this screen proved reasonable, the number of estimates could be further reduced.

In order to test the validity of this observation, a test of structural homogeneity was used. Specifically, the models were tested for mean homogeneity using the hypothesis

$$H_0 \; B = B_*$$

Against the alternative

$$H_1 \; B \neq B_*$$

where: B = the vector of estimated coefficients

B_* = the mean

It can be shown that the necessary test statistic is (Dhrymes, 1978):

$$\frac{e^1e_1 - e^1e_2}{e^1e_2} \times \frac{T - s(n+1)}{(s-1)(n+1)}$$

where: e^1e_1 = sum of squared residuals for model 1

e^1e_2 = sum of squared residuals for model 2

$T = \sum_{i=1}^{s} T_i$

T_i = number of observations for the ith model

s = number of models tested

n = number of coefficients estimated in each model.

This test statistic is distributed $F_{r,\ T-s(n+1)}$

where: $r = (s-1)(n-1)$

Estimates for each region were tested using this statistic. In the majority of cases, no significant (.9 level) differences were found between the models. Therefore, with the exception of specific equations described below, estimates using household income (Y) were excluded from the analysis.

5.3 Model Structure

The model estimated in this study measures the impact on demand for Commercial Passenger Fishing Vessel fishing of four variables: Travel/transfer cost, investment in fishing gear, income and the quantity of fish the fisherman expects to catch. Economic theory suggests that each of these variables should impact demand for the activity in specific ways. Travel/transfer cost is a proxy for price. It includes the ticket price of the trip, the cost of traveling to the fishing site, food and beverages during the trip and on site expenditures for gear such as hooks or sinkers as well as the cost of any rented gear. Theory suggests that the other three variables should be directly related to demand for CPFV fishing. That is, other things being equal, as investment in fishing gear, expected catch and income increase, the quantity of CPFV fishing demand should increase. Therefore, on the basis of *a priori* economic theory, the estimated model should result in the following structure:

$$\text{Ln } Q = a - b_1 TCST + B_2 \text{ INV} + B_3 \text{ PCIN} + B_4 \text{ EXP}$$

where:
- Q = fishing trip per 100,000 population
- TCST = Travel/transfer cost
- INV = Investment in fishing gear
- PCIN = Per capita Income
- EXP = Expected catch by type of fish
- a = estimated constant
- B_1 to B_4 = estimated parameters

As is described in Chapter 4 of this report, three characteristics of the CPFV trip are also expected to influence demand for CPFV fishing. These three characteristics are target species, season fished and weekend/weekday trips. These factors entered the model through judicious grouping of the data for two reasons. First, season fished and target species are highly correlated. Inclusion of these variables in the regression equation results in a high level of colinearity and therefore highly unstable estimates. Second, because these variables represent different trip characteristics, they were used as product differentiators in the data. Thus, a summer surface trip is presumed to be a different experience from a winter bottom trip.

5.4 Description Of Results By Region

5.4.1 General Observations: The test for structural homogeneity described above was used to determine whether any or all of the data delimiter (seasonality, target species and day of week) resulted in statistically different estimates of the model. Two of the delimiters, seasonality and target species, resulted in statistically different estimates. The day of week delimiter proved to be insignificant in each of the four regions. While, for example, the actual estimated coefficients for summer, surface, weekday trips are different from the estimated coefficients

for summer, surface, weekday trips, the test for structural homogeneity indicates that the differences are not statistically significant. Therefore, the study tentatively concludes that there is no significant differences between demand for CPFV on weekends and weekdays.

When the model is estimated using only target species, the majority of the estimates cannot pass the screening procedures. The vast majority fail the first test of significance with no coefficient significantly different from zero. In those that do pass the screens, the coefficient for expected catch is seldom significant. In addition, the signs on most coefficients are inappropriate. Adding the delimiters for season dramatically improves the results. Significant estimates are obtained in all regions and the majority of the signs conform to received theory.

On the other hand, tests of the estimates using data grouping based upon season and target species shows that the estimates are statistically different from estimates with data group based upon season, target species and day of week. This inconsistency among estimates based upon different data groups suggests that some significant degree of colinearity still exists in the data. On the basis of economic theory, it is suspected that the income and investment variables are probably somewhat colinear. Examination of some of the correlation matrices indicates that in at least some instances the two variables are highly correlated. In addition, the standard errors on some of the estimated coefficients for income and investment are relatively large. This is another indication of colinearity.

An additional technical problem exists when using the data to estimate the travel cost model. The travel cost model uses mean values in each distance zone, or data group within a distance zone, to estimate aggregate demand. The procedure of calculating means introduces the certainty of heteroskedastic error terms (ε) into

the model. Thus the statistical tests are not strictly appropriate.

5.4.2 Regional Results: Estimation results for summer and winter surface and bottom fishing trips are presented in table 10. Note that most of the estimates presented did not pass the screens described above. However, for comparative purposes, representative estimates from each season/species group are shown for each region. The best estimates for Regions 1 and 3 are from the Log Log form of the model. The best estimates for Regions 2 and 4 are from the Log Linear form of the model. The model tended to show the best results when a clearly defined type of fishing was being measured. In Region 1, for example, the estimate for summer surface fishing reflects Yellowtail, Albacore and other surface fishing in the Coronados. In Region 4, the Winter surface estimate reflects the early portions of the Salmon season.

In all cases presented and some 95% of the estimated equations, the sign of the variable for travel/transfer cost (TCOST) is negative and highly significant. In many cases, the vast majority of the variation in the data can be explained by the TCOST variable.

The worst overall results were obtained in Region 2. This tends to conform with results obtained in most travel cost models as Region 2 is the metropolitan Los Angeles area. Some 70% of the fishermen in this region travel 25 miles or less. It may be possible to improve these estimates through judicious restructuring of the distance zone designations. However, it is not very probable that this will help as the variation in travel cost would be relatively insignificant.

When the regional breakdown of the data is deleted and the model is estimated for the entire study area, most of the estimates are either insignificant or consistently have the wrong signs on most of the variables. There is however, a notable exception. Table 11 shows

TABLE 10

Representative Estimates By Region *

REGION 1

Delimiter	Constant	LTCOST	LINV	LSURF	LBOTTOM	LY	R^2
Summer-Surface	29.16	-1.37 (.995)	.67 (.9)	2.51 (.995)		2.89 (.90)	.87
Winter-Surface	34.399	-1.86 (.95)	.23 (-)	1.49 (-)		-2.86 (-)	.74
Summer-Bottom	45.60	-3.1 (.95)	-.404 (-)		.627 (-)	-3.01 (-)	.83
Winter-Bottom	46.597	-1.39 (.95)	-.457 (-)		-7.91 (-)	-3.88 (.95)	.80

REGION 2

Delimiter	Constant	TCOST	INV	SURF	BOTTOM	PCIN	R^2
Summer-Surface	2.48	-.017 (.995)	.067 (-)	-.086 (-)		-.000007 (-)	.65
Winter-Surface	-.44	-.01 (.975)	-.098 (.90)	.308 (.95)		.00003 (-)	.78
Summer-Bottom	2.62	-.0195 (-)	-.0073 (-)		-.179 (-)	.0002 (-)	.81
Winter-Bottom	.33	-.019 (.975)	.092 (-)		.14 (-)	-.00001 (-)	.72

*Confidence level (by one-tailed t-test) for regression coefficients are in parentheses. If less than .90, no number is reported.

TABLE 10 CONTINUED

Representative Estimates By Region *

REGION 3

Delimiter	Constant	LTCOST	LINV	LSURF	LBOTTOM	LPCIN	R^2
Summer-Surface	-21.24	-2.01 (.9995)	-.089 (-)	.013 (-)		3.65 (.975)	.909
Winter-Surface	11.34	-2.55 (.995)	.269 (-)	-.698 (-)		.205 (-)	.897
Summer-Bottom	22.2	-2.01 (.995)	-.015 (-)		-.96 (-)	-1.11 (-)	.87
Winter-Bottom	7.46	-2.12 (.9995)	-.01 (-)		.717 (.95)	.23 (.95)	.92

REGION 4

Delimiter	Constant	TCOST	INV	SURF	BOTTOM	PCIN	R^2
Summer-Surface	5.999	-.022 (.9995)	-.037 (-)	-.48 (-)		-.00009 (-)	.84
Winter-Surface	-1.29	-.017 (.995)	.109 (.95)	.5 (.90)		.00029 (.90)	.89
Summer-Bottom	3.32	-.011 (.975)	.031 (-)		-.7 (.975)	.00053 (.975)	.969
Winter-Bottom	3.34	-.0189 (.99)	.028 (-)		.0189 (-)	.000019 (-)	.82

* Confidence level (by one-tailed t-test) for regression coefficients is in parentheses. If less than .90, no number is reported.

the two primary exceptions.

Table 11

Model Estimates With No Regional Breakdown

Delimiters	Constant	TCOST	INV	SURF	BOTTOM	PCIN	R^2
a. winter-surface	1.13 (.9995)	-.018 (-)	.0118 (.90)	.0635		.0002 (.95)	.715

Delimiters	Constant	LTCOST	LINV	LSURF	LBOTTOM	LPCIN	R^2
b. surface	7.56	-1.99 (.9995)	.156 (.90)	.105 (-)		.132 (.95)	.67

Estimate (a) from Table 11 shows the demand estimate for winter surface fishing for the entire study area. Estimate (b) shows the demand estimate surface fishing for the entire study area. Note that while the coefficient for expected catch of surface fish in estimate (b) is insignificant, further quantifying the data by specifying winter-surface fishing (estimate a) makes the coefficient significant at the .95 level.

The fact that the model appears to yield a good estimate of demand for winter surface fishing for the entire study area rather than on a regional basis may be extremely misleading. The majority of winter surface fishing occurs in region 4 (San Francisco area). The strength of the association among the variables in Region 4 may be overwhelming the inputs from the other regions. The fact that winter surface fishing is the only rational estimate from data covering the whole study area is at least very suspicious given the regional characteristics of this type of fishing.

The most significant finding from the study is that the quantity of fish that the fisherman expects to catch on the fishing trip most often enters the estimated demand function with the anticipated positive sign. The sign is positive and the coefficient is

significant in those cases where the product is tightly defined, such as winter surface fishing in San Francisco, summer surface fishing in San Diego and Ventura - Santa Barbara.

A positive significant coefficient on the expected catch variable means that the more fish of the specified type that the fisherman expects to catch on the fishing trip, the greater the quantity of fishing demanded and therefore the more trips the fisherman will take. At the level upon which this model is estimating demand, the number of trips taken therefore does not depend directly upon the number of fish actually caught. It depends, instead, upon the number the fisherman expects to catch. By inference, however, the number actually caught probably does indirectly affect demand for fishing because fishermen will learn from experience. Thus, if fishermen continually catch significantly fewer fish than they expect, this experience may cause them to revise their expectations downward and therefore the quantity of fishing demanded will decrease.

There are obviously additional factors that affect the change in expectations. Experienced fishermen, for example, understand that factors such as winter rainfall and water temperature will affect runs of surface fish. There are good years and bad years. If, however, a series of good years yields significantly lower catches than the experienced fisherman took in prior good years, the fisherman can be expected to lower his expected catch and decrease quantity of fishing demanded. Inexperienced fishermen, on the other hand, can be expected to attribute at least part of a lower than expected actual catch to their skill level. As their skills increase, however, these fishermen will begin to react as experienced fishermen. At the same time, if the inexperienced fisherman is on a CPFV with experienced fishermen who complain about the success rate, the inexperienced fisherman's expectations could easily be adversely affected.

The policy implications of this finding on the influence of expected catch on quantity demanded are very significant. Specifically, other things being equal, the health of the CPFV fishery industry is obviously and closely tied to the availability of target species. Policies allocating desirable species should recognize this during the allocation process.

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APPENDIX 1

Form approved. OMB No. 41-S-78049
Expires 7/31/79

Recreational Fishing Survey

On-Board Passenger Questionnaire

This survey is sponsored by the National Marine Fisheries Service. Information collected may be used to help develop conservation and management programs affecting future recreational fishing opportunities. The Privacy Act of 1974 (Public Law 93-579) requires that you be given certain information in connection with this survey. This questionnaire is voluntary and is authorized by law (16 U.S.C. 1801). While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate and timely.

Name _____ Date _____

City of Residence _____ State _____ Zip code _____

Is this your first partyboat trip? Yes _____ No _____

How many years have you considered yourself to be a partyboat fisherman? _____

Approximately how many partyboat trips did you take in the last 12 months? _____

How did you travel to the boat landing today?

(1) private auto _____
(2) rental car _____
(3) walked or bicycled _____
(4) public transportation _____
(5) other (please specify) _____

What was the approximate one-way distance you traveled to the boat landing today?
_____ miles

What was the approximate time you spent traveling to the boat landing today?
_____ hours and _____ minutes

From where did you travel today?
Home _____ Motel/hotel _____ Other _____

How many are in your immediate party today?

(1) I am alone _____
(2) With a friend _____
(3) With more than one friend (please specify number) _____

Do you consider this trip to be:

(1) Too crowded for good fishing? _____
(2) Crowded, but alright for good fishing? _____
(3) Not crowded _____

- PLEASE FILL OUT THE REVERSE SIDE -

Please indicate whether you expect to catch some of the following types of fish, and indicate the number of each type that you expect to catch.

	Yes or No		How many?
(01)	_____	Albacore	_____
(02)	_____	Barracuda	_____
(03)	_____	Bass (Calico, Kelp or Sand)	_____
(04)	_____	Croaker	_____
(05)	_____	Cow cod	_____
(06)	_____	Rock cod	_____
(07)	_____	Ling cod	_____
(08)	_____	Bonito	_____
(09)	_____	Halibut	_____
(10)	_____	Mackerel (Spanish, Green or Jack)	_____
(11)	_____	Mackerel (Pacific or Blue)	_____
(12)	_____	Salmon	_____
(13)	_____	Sculpin	_____
(14)	_____	White sea bass	_____
(15)	_____	Yellowtail	_____
(16)	_____	Other (please specify _____	_____

Please indicate your estimated expenses for this partyboat trip.

(1)	Partyboat fare and bunk cost, if any	$ _____
(2)	Tackle rental	$ _____
(3)	Purchase of tackle at landing (hooks, lines, sinkers, lures, etc.)	$ _____
(4)	Recent purchase of gear in preparation for this trip	$ _____
(5)	Fish cleaning or tips for the deckhands	$ _____
(6)	Galley (food/beverage)	$ _____
(7)	Hotel or motel	$ _____

Approximately how much money have you spent on Salt Water angling gear (rods, reels, etc.) in the last 12 months? $ _____

What is your current employment status?

(1) Employed full time _____
(2) Employed part time _____
(3) Seasonally unemployed _____
(4) Unemployed _____
(5) Retired _____
(6) Student _____
(7) Homemaker _____

We hope to contact you by telephone sometime during the next week in order to find out whether your partyboat trip was enjoyable and to get additional information about your catch and experiences. In order to help us complete the recreational fishing survey, please fill in your phone number below. (Please include your telephone area code.)

(_____) _____

What day of the week would you be most likely to be available at this number?

Sun. ____ Mon. ____ Tues. ____ Wed. ____ Thurs. ____ Fri. ____ Sat. ____

What time of the day would it be convenient for you to talk to us on the phone?

_____

THANK YOU FOR COMPLETING THIS SURVEY QUESTIONNAIRE.

Form approved. OMB No. 41-S-78049
Expires 7/31/79

Recreational Fishing Survey

On-Board Partyboat Skipper Questionnaire

This survey is sponsored by the National Marine Fisheries Service. Information collected may be used to help develop conservation and management programs affecting future recreational fishing opportunities. The Privacy Act of 1974 (Public Law 93-579) requires that you be given certain information in connection with this survey. This questionnaire is voluntary and is authorized by law (16 U.S.C. 1801). While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate and timely.

Vessel Name _____ Date _____

_____ Type of Trip (i.e., 1/2 day, 3/4 day, full, etc.)

_____ Number of passengers

_____ Number of passengers paid

_____ Boat passenger capacity

_____ Ticket price for today's trip

What type of bait did you use?

_____ squid

_____ live anchovy

_____ frozen anchovy

_____ salted anchovy

_____ other

Was there enough bait for the trip? (1) _____ yes (2) _____ no

How do you rate the quality (fresh, lively and of desirable size) of the bait used today?

Excellent _____ Normal _____ Poor _____

When you left the landing this morning, what kind of fish were you seeking?
(e.g., bottom fish, surface fish, etc.)

_____

Where did you fish? _____

_____

- PLEASE FILL OUT THE REVERSE SIDE -

In terms of amount of fish caught and passenger enjoyment, did you consider the fishing to be

_____ Well above average

_____ Above average

_____ Average

_____ Below average

_____ Well below average

Please estimate the catch of each species taken on today's trip:

Species Name	Number caught

Please evaluate the weather and sea conditions encountered on today's trip. (Circle appropriate description.)

Temperature: cold cool warm hot

Wind: none mild strong

Precipitation: raining misting dry

Sea surface: flat 1-2 foot swell 2-3 foot swell heavy swells

Overall, would you rate the conditions for today's trip to be:

Better than normal _____

About normal _____

Worse than normal _____

THANK YOU FOR COMPLETING THIS SURVEY QUESTIONNAIRE.

RECREATIONAL FISHING SURVEY

Telephone Interview Form

Hello. My name is _____. I'm calling about the survey you filled out on your last fishing trip. (Pause). Can you take a few minutes to answer some questions for me?

If not, when would be a better date and time to call back? _____

(1) Do you live in the area where you fished?
(1) yes_____(go to question 6)
(2) no_____(continue)

(2) Was this fishing trip the primary purpose of your visit to _____(insert city)?
(1) yes_____
(2) no_____

(3) What was the primary purpose of your visit?
(1) business
(2) vacation
(3) combination

(4) Would you have made the trip just for the fishing trip?
(1) yes_____
(2) no_____

(5) Would you have made the trip if there was no fishing available?
(1) yes_____
(2) no_____

(6) Did you stay overnight in the vicinity of the boat landing?
(1) yes_____(go to question 8)
(2) no_____(go to question 7)

(7) Where did you stay overnight?
(1) home_____(go to question 11)
(2) another area_____(continue)

(8) What were your overnight accommodations?
(1) hotel/motel_____
(2) with friends (go to question 10)_____
(3) with relatives (go to question 10)_____
(4) camped_____
(5) home_____

(9) Approximately how much did you spend for lodging during your stay?
$_____

(10) Approximately how much did you spend for food during your visit?
$_____

(11) What type or species of fish did you catch?

(01)	Croaker	(01)
(02)	Cow Cod	(02)
(03)	Rock Cod	(03)
(04)	Ling Cod	(04)
(05)	Halibut	(05)
(06)	Bonito	(06)
(07)	Barracuda	(07)
(08)	Bass(calico, kelp, sand)	(08)
(09)	White Sea Bass	(09)
(10)	Yellow Tail	(10)
(11)	Albacore	(11)
(12)	Salmon	(12)
(13)	Sculpin	(13)
(14)	Mackerel (Spanish, Green, Jack, unspecified)	(14)
(15)	Mackerel (Blue, Pacific)	(15)
(16)	Other	(16)
(17)	None (go to question 13)	

(12) Were these the species you wanted to catch?
(1) yes_____
(2) no_____

(13) Do you expect to go partyboat fishing in the future?
(1) yes_____
If yes, how often do you expect to go per year? _____per year
(2) no_____
If no, why?_____

(14) Given your expectations for catching fish and enjoying the boat trip, were you satisfied with the trip you just took?
(1) yes_____
(2) no_____

(15) Why were you _____ with the trip?
(Use satisfaction response above)

Dissatisfied		Satisfied	
Poor fishing	(01)	Companionship	(09)
Bad weather	(02)	Good crew or service	(10)
Trip too long	(03)	Good fishing	(11)
Too crowded	(04)	Good weather	(12)
Poor bait	(05)	Enjoy sea	(13)
rough sea conditions	(06)	Caught right species	(14)
Bad crew or service	(07)		
Didn't catch preferred species	(08)		

(Do not ask question #16 if they did not catch any fish)

(16) **Did the species or type of fish you caught influence your satisfaction level?**
- (1) strongly influenced
- (2) mildly influenced
- (3) no

(17) What species or type of fish do you prefer to catch during this season of the year? What is your second choice? third?

(01)_____Croaker
(02)_____Cow Cod
(03)_____Rock Cod
(04)_____Ling Cod
(05)_____Halibut
(06)_____Bonito
(07)_____Barracuda
(08)_____Bass (Calico, Kelp, Sand)
(09)_____White Sea Bass
(10)_____Yellowtail
(11)_____Albacore
(12)_____Salmon
(13)_____Sculpin
(14)_____Mackerel (Spanish, Green, Jack, unspecified)
(15)_____Mackerel (Blue, Pacific)
(16)_____Other
(17)_____Don't know

(18) Were you a guest on this trip?
- (1) yes_____(go to question 20)
- (2) no_____(continue)

(19) "People often express their appreciation for a purchase by saying, "It was a bargain." This means that a very good value was received for the price paid. Do you feel that the partyboat fishing trip you took was a bargain?"

(1) yes_____
If yes, "Would you still consider the trip a bargain if the fare was raised by:"

$1	yes	no
$2	yes	no
$3	yes	no
$4	yes	no
$5	yes	no
$10	yes	no
$15	yes	no
$20	yes	no

(2) no_____
If no, "Would you consider a partyboat trip, such as the one you recently took, to be a bargain at a lower price?"

(2) no_____(go to question 20)
(1) yes_____(continue)

"How much lower would the price have to be to make the trip a bargain?"

$1_____	$5_____
$2_____	$10_____
$3_____	$15_____
$4_____	$20_____
	more_____

(Question #17 tells favorite type or species)

(20) You mentioned that _____was your favorite species this season. If you could be assured of catching 1 more(5 for Rock Fish & Cod)_____, how much more than the ticket price would you be willing to pay for the fishing trip?

(For Rock Fish) (5) (1 more)		(10) (2 more)		(25) (5 more)	
0	(01)		(01)		(01)
Less than .50	(02)		(02)		(02)
.50 - 1.00	(03)		(03)		(03)
1.01 - 1.50	(04)		(04)		(04)
1.51 - 2.00	(05)		(05)		(05)
2.01 - 2.50	(06)		(06)		(06)
2.51 - 3.00	(07)		(07)		(07)
3.01 - 4.00	(08)		(08)		(08)
4.01 - 5.00	(09)		(09)		(09)
5.01 - 6.00	(10)		(10)		(10)
6.01 - 7.00	(11)		(11)		(11)
7.01 - 8.00	(12)		(12)		(12)
8.01 - 9.00	(13)		(13)		(13)
9.01 -10.00	(14)		(14)		(14)
10.01 -12.50	(15)		(15)		(15)
12.51 -15.00	(16)		(16)		(16)
15.01 -20.00	(17)		(17)		(17)
more than 20.00	(18)		(18)		(18)

(21) What is the approximate annual income in your household?

_____(01) Under $3,000
_____(02) $ 3,000 - 6,000
_____(03) $ 6,001 - 9,000
_____(04) $ 9,001 - 12,000
_____(05) $12,001 - 15,000
_____(06) $15,001 - 18,000
_____(07) $18,001 - 23,000
_____(08) $23,001 - 28,000
_____(09) $28,001 - 35,000
_____(10) $35,001 - 50,000
_____(11) Over $50,000
_____(99) No answer

(22) How many people live in your household? _____

Thank you.

APPENDIX 2

COMMERCIAL PASSENGER FISHING VESSELS NAME CODE

001	New Lo-An
002	Pacific Queen (San Diego)
003	Prowler
004	Daily Double
005	La Jollan
006	San Diego
007	Western Pride
008	Matt Walsh
009	Sun Fun
010	G.W.
011	City of Seal Beach
012	Queen of The Sea
013	Sport King
014	Redondo Special
015	City of Redondo
016	Ellie M
017	Estrella
018	Monte Carlo
019	Hornet
020	Jennie
021	Mascott VI
022	New Seaforth
023	Enterprise
024	Red Rader
025	Speed Twin
026	Betty O
027	Aquarius
028	Freedom
029	Indiana
030	Lenbrooke
031	Lovely Martha
032	Ketchikan
033	Ginnie C.
034	Rayann II
035	Long Finn
036	Salty Lady
037	Blue Horizon
038	Ma-Ra II
039	Fisherman III
040	Salmon Queen VI
041	Fiesta
042	Gypsy
043	Gardner #5
044	Pillar Point #3
045	Sea Trek
046	Cheyenne
047	Diablo
048	San Mateo
049	FV Flyer
050	Pursuit
051	New Dina Lee
052	Big Mama
053	Marauder
054	Sea Angler
055	Million Belle
056	Sea Spray
057	Searcher
058	Kiaora
059	Channel Isle
060	Sea Horse
061	El Dorado
062	Sea Fury
063	Gentleman
064	Holiday
065	Malihini
066	Sportfisher
067	Spitfire
068	Condor
069	Huck Finn
070	New Captain Pete
071	Chinook
072	Gertha L
073	New Sea Wolf
074	Pattie L
075	Easy Rider
076	New Florie S.
077	Del Mar
078	Pacific Dawn
079	Coral Sea
080	Daiwa
081	Duchess
082	Faith
083	Marges' Barge
084	Gardner I
085	Ranger "85"
086	Aurora
088	For You
089	Pacifica Queen (Sausalito)

Landing List

001	Imperial Beach
002	Fisherman's Landing
003	Point Loma Sport Fishing Association
004	H & M Sport Fishing
005	Seaforth Sport Fishing
006	Islantic
007	Dana Wharf
008	Davey's Locker
010	Arts Landing
011	Seal Beach
012	Belmont Landing
013	Queen's Wharf
014	Ports O'Call
015	Skipper's 22nd Street Landing
016	Redondo Sport Fishing
017	Marina Del Rey
018	Santa Monica
019	Malibu
020	Paradise Cove
021	Port Hueneme
022	Cisco Sport Fishing (Oxnard)
023	Ventura Sport Fishing
024	Sea Landing Santa Barbara
025	Avila Beach
026	Hittles, M.B.
027	Grahams
028	Breby Sport Fishing
029	Pillar Point (Half Moon Bay)
030	Fishermans Wharf (San Francisco)
031	Emmeryville (Hank Schrams)
032	Berkeley
033	Caruso's Sausalito
034	Blue Horizon Sport Fishing Sausalito

APPENDIX 3

Table 1. Distances and zone populations for each region.

Zone	Distance (miles)	Population			
		Region 1	Region 2	Region 3	Region 4
		1000's			
1	0-6	766.1	613.0	152.8	539.6
2	6-15	185.6	6515.7	369.1	2589.8
3	15-25	306.4	7567.5	220.3	880.2
4	25-35	193.2	5508.6	256.7	956.3
5	35-50	55.9	1575.1	387.6	1043.8
6	50-100	3251.5	4035.3	7546.7	1728.7
7	100-150	4297.6	840.3	2450.4	739.5
8	150-200	447.3	276.5	10941.6	739.7
9	200-300	594.9	835.6	7596.6	801.9
10	300-400	1669.9	4646.7	1345.9	5825.4
11	400-500	3779.4	794.3	1682.5	2088.2
12	500-600	296.7	499.0	2475.2	1632.9
13	600-700	1541.5	1078.7	2176.9	2658.2

APPENDIX 4

Table 1. Travel-cost data for Region 1, summer, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	46	0.84	21.17	10.80	16.17	2.18	27726	8537.08
2	73	2.94	22.91	9.15	16.39	1.07	23591	8503.39
3	76	5.60	27.86	7.35	16.93	1.35	26234	6613.14
4	9	8.40	33.99	8.83	6.71	2.16	32300	7292.54
5	9	11.90	28.61	40.66	21.10	0.45	19208	5870.95
6	22	21.00	27.36	6.89	10.22	1.27	23773	6838.86
7	6	35.00	42.33	1.33	11.47	0.83	28900	7714.48
8	15	49.00	24.10	7.66	29.13	5.73	32722	6738.89
9	13	70.00	22.75	0.47	13.99	1.61	25665	2420.22
10	13	98.00	52.20	15.83	11.40	1.31	23400	6007.04
11	1	126.00	13.00	0.0	0.0	0.0	13500	6750.00
12	1	154.00	23.00	0.0	15.00	2.0	31500	31500.0
13	0	182.0						
14	13	280.00	24.08	5.37	8.01	1.54	25630	8745.66

Table 2. Travel-cost data for Region 1, summer, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	1	.84	49.00	0	0	0	25500	8500.00
2	3	2.94	28.18	30.82	0	0	31865	14530.00
3	3	5.60	37.33	8.33	0	10.00	28500	4916.67
4	1	8.40	19.00	3.00	0	0	25500	6375.00
5	0	11.90						
6	0	21.00						
7	0	35.00						
8	2	49.00	17.75	0	0	0		
9	2	70.00	17.50	0	0	0	20500	2562.50
10	2	98.00	10.00	0	0	0	9000	1875.00
11	1	126.00	0	0	0	0		
12	0	154.00						
13	0	182.00						
14	9	280.00	28.87	.22	0	0	28500	6361.74

Table 3. Travel-cost data for Region 1, winter, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	41	.84	19.46	6.75	17.52	2.68	19385	8056.16
2	102	2.94	26.11	8.48	17.44	3.47	20820	5691.69
3	83	5.60	26.96	12.17	14.11	1.69	22303	7604.11
4	28	8.40	31.28	11.10	17.32	4.93	31300	7392.01
5	27	11.90	37.01	8.35	11.74	2.85	21958	6979.26
6	37	21.00	35.66	8.41	14.69	2.59	25488	7207.95
7	2	35.00	16.50	2.50	8.00	1.00	26500	8285.72
8	22	49.00	19.34	7.05	13.90	3.78	21156	7619.97
9	30	70.00	40.48	18.93	12.89	2.10	20771	6037.45
10	11	98.00	51.16	2.12	14.15	1.26	32568	10728.93
11	1	126.00	0	8.75	6.00	0		
12	1	154.00	57.00	0	14.00	0	20500	6833.33
13	1	182.00	210.00	220.00	20.00	11.00	62500	20833.33
14	11	280.00	40.87	12.75	6.45	.54	26250	7681.65

Table 4. Travel-cost data for Region 1, winter, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	3	.84	18.23	26.41	0	.66	16550	8707.67
2	11	2.94	17.01	14.99	0	0	21970	6238.89
3	5	5.60	13.90	.10	0	0	29167	7250.00
4	1	8.40	43.00	0	0	0	31500	3937.50
5	3	11.90	27.17	5.67	0	.67	28167	7273.81
6	7	21.00	7.02	.33	0	0	30500	6841.29
7	1	35.00	17.50	0	0	0	1500	750.00
8	2	49.00	32.00	1.50	0	0	7500	1250.00
9	1	70.00	38.00	3.00	0	0	20500	10250.00
10	4	98.00	45.25	.88	0	0	26550	7324.00
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	7	280.00	22.76	3.15	0	0	36220	5953.21

Table 5. Travel-cost data for Region 2, summer, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	91	.84	16.04	7.27	11.77	4.13	25154	6865.04
2	267	2.94	15.95	9.30	14.78	4.81	23909	7704.55
3	139	5.60	17.22	10.19	14.70	4.13	24852	6538.38
4	24	8.40	13.66	9.08	12.80	3.51	24750	8789.26
5	18	11.90	18.81	7.08	11.61	2.45	26429	6000.45
6	8	21.00	39.25	1.75	19.63	4.38	15500	2976.53
7	4	35.00	20.75	5.50	1.75	2.00	16500	3093.75
8	0	49.00						
9	1	70.00	20.00	0	5.00	15.00	20500	4100.00
10	2	98.00	16.00	1.50	11.00	10.50	13500	6750.00
11	0	126.00						
12	0	154.00						
13	1	182.00	0	0	0	0		
14	16	280.00	25.53	12.86	12.74	2.24	25800	5147.33

Table 6. Travel-cost data for Region 2, summer, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	19	.84	14.05	.93	0	9.78	25967	9931.24
2	53	2.94	17.61	3.69	0	8.63	26976	7952.38
3	43	5.60	17.91	10.91	0	8.79	20822	6322.14
4	6	8.40	20.84	1.00	0	10.00	22000	3316.67
5	2	11.90	26.50	39.50	0	15.00	18500	6687.50
6	4	21.00	11.25	0	0	10.75		
7	1	35.00	12.00	8.00	0	0		
8	0	49.00						
9	0	70.00						
10	0	98.00						
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	10	280.00	12.60	7.80	0	1.50	24005	4875.00

Table 7. Travel-cost data for Region 2, winter, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	48	.84	18.01	24.54	8.45	3.92	25613	7006.11
2	141	2.94	22.30	6.54	11.11	4.53	24235	7253.96
3	61	5.60	15.79	13.51	9.31	4.91	24121	5458.37
4	16	8.40	22.67	5.67	8.31	3.68	25964	6287.90
5	11	11.90	12.45	3.51	6.47	4.53	32000	8911.56
6	6	21.00	20.33	26.78	12.33	2.17	19750	3901.01
7	2	35.00	4.00	1.15	11.50	0		
8	0	49.00						
9	0	70.00						
10	3	98.00	24.74	2.34	11.33	3.35	18540	13968.75
11	1	126.00	35.00	15.00	10.00	42.00	10500	2625.00
12	0	154.00						
13	0	182.00						
14	6	280.00	21.82	16.39	5.19	7.51	20900	6303.06

Table 8. Travel-cost data for Region 2, winter, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	14	.84	15.35	2.78	0	17.28	19173	8562.40
2	77	2.94	19.64	7.02	0	11.50	26505	10026.25
3	43	5.60	18.04	7.51	.02	9.30	20346	5961.90
4	13	8.40	25.92	5.29	0	11.75	37102	11232.72
5	5	11.90	20.60	4.90	0	7.40	21750	5127.20
6	0	21.00						
7	0	35.00						
8	0	49.00						
9	0	70.00						
10	2	98.00	42.00	7.00	0	12.00	42500	7083.33
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	3	280.00	11.39	0	0	4.95	24000	7125.28

Table 9. Travel-cost data for Region 3, summer, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	102	.84	18.64	8.51	10.83	5.88	24713	6748.08
2	133	2.94	22.62	8.48	10.78	4.67	25301	8604.22
3	137	5.60	25.98	7.43	10.97	3.26	24119	7319.65
4	66	8.40	21.31	11.22	8.92	3.03	21590	5154.49
5	39	11.90	19.41	10.43	12.66	2.13	25220	6076.70
6	72	21.00	25.53	9.57	9.58	5.15	21902	5297.47
7	16	35.00	26.69	2.63	12.44	7.13	22809	5936.93
8	8	49.00	22.96	3.41	9.87	1.51	27100	6456.02
9	14	70.00	35.43	16.58	4.95	5.85	26777	6292.65
10	1	98.00	11.00	0	112.00	52.00		
11	5	126.00	26.00	2.40	15.40	2.20	26500	8216.66
12	3	154.00	44.67	2.33	12.33	30.33	36833	17000.00
13	2	182.00	39.75	3.00	8.00	19.20	36833	49.50
14	20	280.00	24.58	4.77	7.35	2.85	18662	4449.72

Table 10. Travel-cost data for Region 3, summer, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	23	.84	11.81	4.21	0	1.09	19068	2526.27
2	51	2.94	20.84	6.50	0	8.69	18120	5702.40
3	37	5.60	24.06	9.88	0	9.91	24435	7284.70
4	23	8.40	24.24	5.98	0	5.57	21367	6720.84
5	11	11.90	26.59	14.35	0	8.65	30750	7744.39
6	19	21.00	26.89	5.80	0	6.90	22640	5134.32
7	27	35.00	42.52	6.11	0	7.75	22873	5397.95
8	3	49.00	33.84	0	0	5.36	19500	6540.67
9	8	70.00	17.59	20.73	0	8.50	15750	3022.82
10	1	98.00	20.50	6.00	0	0		
11	0	126.00						
12	0	154.00						
13	1	182.00	41.00	15.00	0	11.00	31500	5250.00
14	11	280.00	28.64	12.26	0	12.17	37224	14640.71

Table 11. Travel-cost data for Region 3, winter, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	22	.84	15.99	4.08	5.35	6.52	23313	9367.21
2	35	2.94	20.15	12.37	7.73	10.22	22425	8360.66
3	11	5.60	21.69	17.46	13.80	5.68	16000	6735.98
4	17	8.40	26.14	6.15	4.74	4.26	22547	5951.64
5	9	11.90	21.18	8.42	3.77	5.67	24367	7542.58
6	13	21.00	20.17	7.48	9.31	14.77	22346	8759.29
7	27	35.00	32.87	6.92	2.85	6.07	19917	6160.85
8	3	49.00	17.33	3.67	1.00	3.00	10500	4125.00
9	5	70.00	41.80	6.60	10.60	28.80	24500	6519.90
10	1	98.00	17.00	0	0	0	42500	21250.00
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	8	280.00	25.32	3.00	5.26	7.62	25635	5480.64

Table 12. Travel-cost data for Region 3, winter, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	16	.84	18.17	2.63	0	5.83	18250	6995.17
2	45	2.94	25.78	15.70	0	8.51	25449	10446.07
3	51	5.60	24.77	12.07	0	10.49	23721	8132.43
4	24	8.40	22.41	6.08	0	8.60	27711	9781.79
5	19	11.90	22.20	8.94	0	11.62	19603	7821.91
6	33	21.00	26.49	14.82	0	13.60	23460	6598.02
7	24	35.00	25.46	2.00	0	9.54	20735	5409.20
8	14	49.00	24.79	2.00	0	4.29	27409	6589.96
9	25	70.00	26.70	3.04	0	10.24	22722	6620.78
10	0	98.00						
11	0	126.00						
12	3	154.00	38.00	2.50	0	2.00	14833	7958.33
13	1	182.00	84.00	22.00	0	10.00	25500	12750.00
14	8	280.00	26.66	1.34	0	.50	32503	15158.46

Table 13. Travel-cost data for Region 4, summer, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	3	.84	26.98	3.01	2.00	0	26085	8835.00
2	67	2.94	27.27	9.60	3.52	1.39	29625	8489.58
3	138	5.60	26.74	6.07	2.61	1.21	27307	6485.02
4	170	8.40	28.90	3.64	3.15	1.66	30976	8543.84
5	65	11.90	28.61	14.58	2.31	1.26	31209	7477.97
6	82	21.00	33.83	7.23	2.71	.49	27995	8380.47
7	17	35.00	50.48	4.22	1.88	0	36500	8173.20
8	18	49.00	32.11	9.97	2.44	1.39	24900	3889.23
9	6	70.00	51.50	4.00	1.50	0	27510	3799.92
10	7	98.00	47.41	11.41	2.13	1.04	27218	8763.01
11	2	126.00	31.00	0	4.00	4.50	41500	11375.00
12	1	154.00	58.00	10.00	2.00	0	7500	7500.00
13	0	182.00						
14	33	280.00	33.55	2.62	1.97	1.74	29565	5664.88

Table 14. Travel-cost data for Region 4, summer, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	0	.84						
2	10	2.94	20.45	13.10	0	6.40	49750	5384.95
3	15	5.60	23.14	4.10	0	2.60	28594	4641.66
4	13	8.40	20.89	5.00	0	4.22	30170	7422.25
5	14	11.90	21.57	11.18	0	6.50	27200	6276.17
6	10	21.00	21.40	2.15	0	3.00	28208	8072.50
7	2	35.00	50.00	0	0	0	20500	3416.67
8	0	49.00						
9	1	70.00	0	6.99	0	6.00		
10	1	98.00	22.00	5.00	0	13.00	31500	15750.00
11	0	126.00						
12	0	154.00						
13	2	182.00	13.50	4.00	0	9.00	62500	10416.66
14	2	280.00	16.00	4.00	0	0	10500	2625.00

Table 15. Travel-cost data for Region 4, winter, surface fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	6	.84	37.00	7.50	2.33	0	13500	3919.42
2	30	2.94	25.35	4.66	2.53	.37	35105	11394.57
3	35	5.60	27.86	8.70	2.23	.09	27963	12731.73
4	111	8.40	27.26	5.34	2.62	1.04	26377	9266.73
5	71	11.90	27.34	9.65	3.10	1.28	32048	7172.43
6	36	21.00	29.38	2.18	2.17	2.50	32796	8846.39
7	5	35.00	90.17	6.20	2.20	0	14500	4364.85
8	2	49.00	56.25	90.00	2.50	0	34000	9562.50
9	12	70.00	117.67	1.75	2.50	0	36167	11468.75
10	3	98.00	29.67	6.67	2.00	0	39500	15933.17
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	7	280.00	29.66	2.15	2.29	2.00	24300	8630.28

Table 16. Travel-cost data for Region 4, winter, bottom fishing.

Distance Zone	Number of Obs.	Cost		Gear Investment	Catch		Income	
		Travel	Non-Travel		Surface	Bottom	Household	Per Capita
		-----dollars-------		-dollars--			-------dollars--------	
1	0	.84						
2	3	2.94	23.33	1.00	0	15.67	33833	15416.67
3	5	5.60	20.20	9.80	0	10.60	14135	2691.67
4	10	8.40	19.80	4.00	0	7.30	21493	3884.14
5	10	11.90	21.30	7.79	0	4.40	22700	10645.83
6	4	21.00	31.00	8.25	0	10.00	22167	4487.42
7	0	35.00						
8	1	49.00	29.00	10.00	0	17.00		
9	2	70.00	21.00	3.50	0	0	52500	18437.50
10	0	98.00						
11	0	126.00						
12	0	154.00						
13	0	182.00						
14	2	280.00	25.75	1.00	0	10.00	62500	7812.50