

HERZICK

**FISHERMEN AND LABOR MARKETS:
PARTICIPATION, EARNINGS, AND ALTERNATIVES
IN PACIFIC COAST FISHERIES**

by

James E. Wilen
Tzy-Ning Chen
Frances Homans

Department of Agricultural Economics
University of California, Davis

prepared for:
The National Marine Fisheries Service
Southwest Fisheries Center
Contract No. 50-ABNF-6-0016
August 1991

Opinions and conclusions are solely the responsibility of the authors and do not necessarily represent those of N.M.F.S.

I. INTRODUCTION

The task of fisheries management has become considerably more complicated since the passage of the Magnuson Act in 1977. Several important changes in process and procedure have evolved as a result of the legislation, also known as the Fisheries Conservation and Management Act of 1977. First, the basic objectives of management have been expanded from relatively simple physical objectives (such as maximizing sustained yield) to more complex and difficult to measure goals such as optimizing social yield. Second, to operationalize these new goals, a whole new layer of social science concepts has been added to the process of policy analysis of management options. Finally, with the establishment of regional management councils, the entire management process has become more public, with increased opportunity for scrutiny and comment by all parties affected by regulatory changes.

Under these new circumstances, economic analysis of policy options has become central to the process of fisheries management and implementation. For the most part, this has required borrowing concepts whose use and limitations have already been established in other policy arenas. For example, the basic principles of cost-benefit analysis developed in the early "water project" days have been essentially adopted in the task of measuring efficiency benefits of various policies in fisheries. At the same time, the unique nature of fisheries has generated some new conceptual and empirical problems for analysts to solve.

One of these issues is how to measure the value of inputs in a common property setting. This is a subset of one of the most important general problems in practical cost-benefit analysis; namely, how to incorporate the correct prices for inputs and

outputs in any evaluation. Much of the last two decades' work in the field has been devoted to calculating proxies for unmarketed outputs, for example. Less work has been done on the input price side, probably because most inputs in public projects seem to have easily measureable market prices.

The need to measure the value of inputs in fisheries arises in many settings. For example, one of the key debates over the past fifty years has been over how to reduce or eliminate the tendency for excessive input use under common property and open access to fisheries. Solutions suggested have ranged from none at all, to limited entry/buyback schemes, to recent individual transferable quota programs (ITQ's). The implementation of any policy that has any substantial impact on the typical status quo generally would be expected to cause dislocation of both capital and labor inputs, causing some retirements, some transfers to other industries or fisheries, and reallocation of remaining inputs. Whether such policies are beneficial in the aggregate depends in part on the alternative opportunities for affected inputs. If the opportunity to fish is removed for some, overall costs will be lowest to those individuals who can readily find alternative employment in comparable opportunities. Similarly, many fisheries are managed with the use of seasonal restrictions to control effort. In some cases seasonal constraints are binding and any relaxing or tightening of season lengths will have impacts on fishermen's labor allocation within fishing and between fishing and non-fishing activities. In both of these examples, responsible policy analysis requires some estimates of the costs associated with displaced fishing labor and capital.

As it turns out, very little is known about fishermen's labor markets, labor market behavior, or alternative opportunities. To our knowledge there are only a handful of studies that address fishing labor issues at all and these are limited in scope and

generally descriptive.¹ A review of the literature suggests, in fact, a distinct preoccupation with the capital side of the problem to the nearly complete neglect of labor. To the extent that labor issues have been addressed in fisheries economics, they arise in discussions of policy tradeoffs where unemployment is high, such as in underdeveloped countries.² In these situations, the case for rent maximizing policies often conflicts directly and obviously with the goal of maintaining employment. Beyond these studies, there are several other sociological and anthropological studies that examine various institutional aspects of fishing labor such as kinship relationships, ethnicity, remuneration systems, etc.³

In many articles where labor is discussed in any way, there is a persistent implicit or explicit view that fishermen operate in limited labor markets where alternatives to fishing are scarce. Reasons suggested for this alleged circumstance are both labor demand reasons (eg. isolated communities with narrow employment bases) and supply reasons (eg. specialized or limited skills). This view of the fisherman as an individual with few opportunities outside of fishing is widely held and potentially important to policy. To our knowledge, however, this view is speculative or

¹Cf. McCay, B.J., J.B. Gatewood, and C.F. Creed. "Labor and the Labor Process in a Limited Entry Fishery", *Marine Resource Economics*, Vol. 6, No. 4, 1989, pp 311-330.

²Cf. Panayotou, T. and D. Panayotou, "Occupational and Geographical Mobility In and Out of Thai Fisheries", *FAO Fisheries Technical Papers*, No. 271, 1986.

³For example, a comparison between a "kinship" based labor market (Gloucester) and a more fluid market (New Bedford) is made in Doeringer, P.B., P.I.Moss, and D.G.Terkla, *The New England Fishing Economy: Jobs, Income, and Kinship*, Amherst: Univ. of Massachusetts Press, 1986. Studies of Canadian Maritime fisheries are collected in Anderson, R., (ed.), *North Atlantic Maritime Cultures: Anthropological Essays on Changing Adaptations*, The Hague, Mouton, 1978. Other studies of Eastern Canadian fisheries focusing on fishing employment include: Apostle, R., L.Kasdan, and A.Hanson, "Work Satisfaction and Community Attachment Among Fishermen in Southwest Nova Scotia", *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 42, 1985, pp. 256-267.

anecdotal and basically untested empirically.

II. STUDY OBJECTIVES

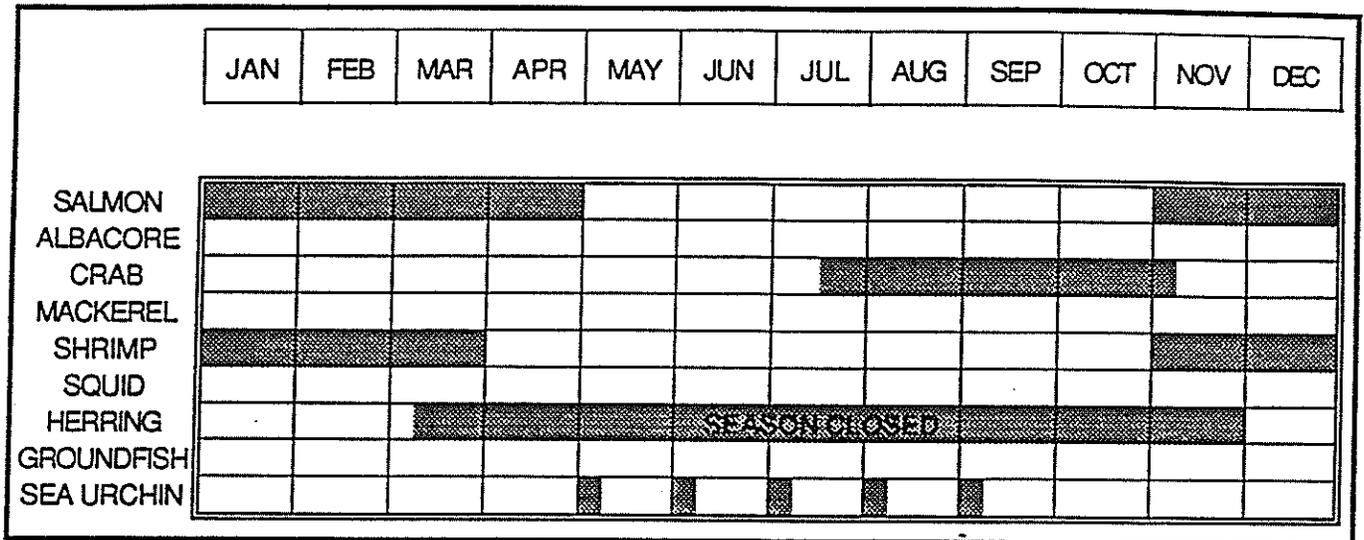
This report summarizes an investigation of labor participation and choices by fishermen involved in commercial fishing in California. The project arose out of both practical and basic questions about fishermen, their labor markets, and their opportunities outside of fishing. As discussed above, little concrete knowledge exists about fishing as an occupation and as an alternative or complement to other non-fishing jobs. Thus a primary objective of the study has been to describe the fundamental nature of fishing as an employment alternative on the Pacific Coast. A secondary objective has been to attempt to measure alternative wages of fishermen who participate in Pacific Coast commercial fisheries.

III. FISHERY DESCRIPTION

Fisheries off the Pacific Coast present fishermen with many and varied opportunities for employment. Some species are pelagic and available in fishable concentrations only for short periods of time (eg. albacore and herring) whereas others are available in roughly the same abundance year round (eg. groundfish). Other species may or may not have distinct seasonal patterns of abundance, but access is limited by seasonal restrictions. For example, salmon, crab, shrimp and sea urchin are all managed with specific season length restrictions. As Figure 1 shows, seasons in some restricted fisheries overlap with those in other restricted as well as unrestricted fisheries. Conditioned by this variation in opportunity is a mixed multi-purpose fleet with considerable flexibility. Gear types vary from pots to trawl gear, and from gillnets to troll gear and the investment required to fish can range from a few thousand dollars to several hundred thousand

dollars.⁴

FIGURE 1
1988 COMMERCIAL FISHING SEASONS--CALIFORNIA



This setting generates a large array of different labor participation options for fishermen at any point in time over the season. For example, the summer-season salmon fishery may be conducted by both part-time fishermen, some of whom have off-summer jobs or are retired, as well as by full-time fishermen as part of a seasonal complex of several fisheries. Similarly, albacore may

⁴There are few studies of Pacific Coast fisheries that provide hard data characterizations of its structure, mainly because micro-level data are scarce. Survey data are summarized in King, Dennis and V. Flagg, "The Economic Structure of California's Fisheries, 1982", *California Sea Grant College Program Working Paper No P-T-32*, 1982. Additional data from Coastwide Data Files were used in: Wilen, James and Phil Meyer, "Limited Entry Programs for the Pacific Coast Fisheries", report presented at the Workshop on Limited Entry, Portland, Oregon, 1982; Huppert, D., C. Thomson, and B. Edwards, "Annual Summary Files from the 1972 thru 1976 Coastwide Summary Data Base: Contents and Summary Statistics", N.M.F.S. *Administrative Report LJ-82-29*, Southwest Fisheries Center, Dec. 1982; Fletcher, J. and W. Johnston, "An Economic Analysis of Eureka Crabber-Troller Vessels", *Giannini Foundation Information Series*, University of California, 1984.

be present close to shore or several hundred miles out depending on currents and temperature gradients. Thus in any given year, albacore may be fished mainly by the highliner fleet or by an even larger fleet of small, part-time summer vessels. Crab are available for much of the year but about ninety percent are taken during the first two months, by a mix of participants that depends on how severe weather conditions are and on relative prices. Groundfish are also available year round (although some species are limited) and fished mainly by full-time, high investment, crew/vessel combinations. Some of these fish groundfish exclusively whereas others fish groundfish as part of a complex that may include salmon, crab, albacore, and shrimp.

Fisheries characteristics (the labor demand side) are not the sole determinants of fishermen labor force participation. Fishermen also differ in their "human capital", both that specific to fishing (such as years of experience) and capital useful to non-fishing activities. Thus the supply of fishing labor may depend on the range of alternative skills and the strength of the market for those. For example, if individuals have experience as carpenters or loggers, the supply of fishing labor may be affected by the housing and building cycle. Finally, in many cases, fishing labor choices are part of a joint household labor participation decision. Thus a given individual's decisions may be impacted by spousal labor opportunities and other factors such as number of children at home, health, other family income, etc. All of this points to a complex choice process that is difficult to characterize in a few summary statistics.

IV. DATA COLLECTION PROCEDURES

Most statistical or econometric studies of behavior fit models by using observations of actual behavior. These are then utilized to predict behavior under a range of perturbations of the economic environment within which individuals are assumed to make choices. For example, data on food expenditures might be gathered and used

to fit a model of household food demand that depends on relative food prices, income, and household characteristics. The model could then be used to predict how expenditures on a particular food group would change if prices changed. One limitation of such analysis is that the range of predictions that one can make with confidence is limited by the range of actual experience observed, eg. the analyst cannot predict accurately how individuals would respond to a tripling of prices if the normal variation is only ten or twenty percent.

In this study we attempted to design a data gathering procedure that would yield information about a broader range of potential behavior than typically analyzed. This involved a two-pronged approach in which we gathered information on actual choices made at a "snapshot" in time and then supplemented this with information about hypothetical choices that might be made under various other scenarios.

Data in this study were gathered by utilizing a comprehensive mail survey following the design procedure outline by Dillman⁵. The Dillman procedure has been developed to increase response rate and involves a specific set of design and procedural steps that have been repeatedly tested in social science settings. The survey was sent to a random sample drawn from the mailing lists of fishermen licensed to commercially fish off California in 1988. California requires that all participants (crew members and skippers) in commercial fisheries have a license to fish. In the survey year there were 21,686 fishermen licensed to participate in fisheries landing fish in California.

The survey (see Appendix A) contained four sections, the focus of which were as follows:

- **FISHING & NON-FISHING TIME AND INCOME**

⁵Dillman, D.A., *Mail and Telephone Surveys: the Total Design Method*, Wiley, New York, 1978.

This section was designed to gather information on how fishermen actually allocated their time between the available fisheries and non-fishing activities in 1988. A calendar-based worksheet was provided to all potential respondents which blocked out closed seasons. This allowed easy transfer to a table listing several fisheries with spaces for total time spent fishing as well as the contribution of that fishery to before-tax income. We keyed on salmon, crab, albacore, shrimp, herring, sea urchin, mackerel, squid, groundfish and an "other" category. Also included was a space for fishing-related time such as boat repair.

A second question in this section was designed to gather information on non-fishing allocation of time for both the fisherman and his spouse. A table was provided which asked for an estimate of total weeks spent and contribution to before-tax income of any income earning non-fishing labor participation by both parties, together with another question on other family income such as rent, interest, etc.

- **HOUSEHOLD SOCIOECONOMIC CHARACTERISTICS**

This section asked a series of questions about the fisherman, his spouse, and children in the household. Included were questions about household size and composition (number and ages of children), location (zipcode), and questions about experience in both fishing and non-fishing occupations for both the fisherman and spouse. Finally, some additional questions asked about both years of formal education and health of both the fisherman and spouse.

- **FISHING AND NON-FISHING OPTIONS**

An important part of the study was to get a better idea of the employment options that fishermen perceive themselves to have. To examine these issues we designed some questions

around some hypothetical scenarios involving closures of fisheries. A problem initially faced was that fishermen typically participated in several fisheries. In order to increase the reliability of answers, we needed to focus the scenario on one fishery most familiar to them without knowing in advance which fisheries each person participated in. To do this we had each respondent identify the fishery that typically contributed most to their family income and referred to this as their (individual) "major" fishery. Then, questions were keyed to this major fishery by having respondents imagine a closure of their major fishery.

Three scenarios were set up, differing in the severity of the hypothesized problem. We asked individuals to imagine that an event like the Alaska oil spill occurred on the Pacific Coast that required a closure of their major fishery, assuming that other fisheries were unaffected. The least serious scenario was described as one that caused a two week closure, the intermediate scenario one with a closure of half the normal season for one year, and a third scenario involving a half-season closure for five years.

For each of these scenarios, respondents were asked whether they would switch to another fishery, switch to a non-fishing job, or switch to some other unpaid activity during the duration of the closure. For those who indicated that they would switch to a non-fishing occupation, we asked what their best guess was of what the job would be, how much their earnings would be, how long it would take to start the alternative job, and how far away from their current residence they would find this job. We also asked what specific fisheries and estimated earnings would be for those who responded that they would simply switch fisheries.

- **VESSEL CHARACTERISTICS/SEASON CLOSURE IMPACTS**

The last section gathered information on the vessel used

in 1988 (length, tonnage, horsepower, year built, approximate value) together with information on the crew size. Also asked was a question which identified the respondent's crew status (skipper/owner, skipper, crew, other).

Another set of questions in this section was designed to determine whether the respondent was constrained in his major fishery by season length restrictions. Since different individuals might find the same season length constraint either binding or non-binding, we asked whether the respondent fished up to the season end or not. For those who did not, we asked further questions regarding what they switched to, including other fisheries, non-fishing jobs, or non-paid activities together with the earnings where relevant.

The survey containing the above questions was printed and prepared for multiple mailings as outlined by Dillman. The mailing list provided by the California Department of Fish and Game was utilized to draw a random sample of 3747 license holders in the 1988 commercial season. A subsample of 100 names was utilized in a pre-test to gauge response rate and potential ambiguities in the survey. The first mailing of the full sample took place on November 20, 1989. One problem that became immediately obvious was that a large number of individuals on the mailing list had moved with no forwarding addresses. About 650 were returned and were unforwardable, leaving us with about 3100 that reached a potentially valid respondent. There is some reason to believe that the result is an overrepresentation of skippers and skipper/owners and underrepresentation of crewmembers in the total sample.

At the end of the first week following mailing, 168 surveys were returned. A postcard reminder was mailed after one week to all on the original mailing list. The additional response between the end of the first week and up to the third week was an additional 459 respondents. Finally, three weeks after the first mailing, an additional mailing was sent to the remaining potential

respondents, enclosing a modified cover letter and an additional survey. This brought in an additional 271 surveys, bring the total response up to 898 out of 3095 valid addresses. The overall response rate was thus twenty-nine percent, a respectable return given the length, difficulty, and personal nature of the survey.

Of the 898 returned, a significant number indicated that they no longer actively fished but that they maintained their licenses anyway. Others were involved in commercial sports fisheries on party boats. For most of these, surveys were returned blank. Finally, as is usually the case, some of the returned surveys were only partially filled out with missing information in many of the questions. The most significant omissions were in the questions asking information about time spent and income earned in various fishing and non-fishing activities. There are various ways to save some of the information from incomplete surveys. In what we report here, we work only with a "clean" data set, i.e. with surveys that are virtually complete including particularly those with complete answers to the income questions.

V. DATA SUMMARY STATISTICS.

We report in this section summary statistics for a sample of approximately 600 surveys that were largely complete from among those returned. It is difficult to judge how close the sample is to being random but there are several potential biases. First, since this represents a snapshot of 1988 information only, there is the possibility that relative abundance and prices influence the summary "picture" drawn by looking at mean responses. In particular, the sample is heavily dominated by fishermen involved in salmon fisheries, either exclusively or as part of a group of fisheries. 1988 was a year in which salmon prices were the highest in recent history and hence one would expect a higher relative participation rate and perhaps also a higher absolute participation

level. Second, the sample indicates an average crew size of over two persons, including skipper, on vessels utilized by the sample respondents. The returned sample is overrepresented with skipper/owners and skippers by this measure since crewmembers only comprise 20% of the returned surveys. Finally, there may be other forms of sample selection bias related to income level, education and experience levels, etc. or even to factors related to valid addresses on the sample drawn from the master list. With these caveats in mind we report below some of the survey findings.

There are numerous ways to sort and display even simple summary statistics from the data. A subdivision which first comes to mind is to group data in some way that reflects the fisheries respondents are participating in. Unfortunately, even this subsampling strategy is difficult to define precisely because of the diversity of the participation types. In Table 1 we show a matrix of responses from about 600 survey respondents reporting some income in the various fisheries. It is obvious from the table that fishermen participate in many combinations of fisheries. Each cell reports the number of fishermen reporting income from that particular pair of fisheries. Cells are not mutually exclusive so that (reading across the first row) although 88 fishermen received income from both salmon and groundfish and 94 received income from both salmon and crab, there will be "double-counting" in that some in the salmon/groundfish group will also be in the salmon/crab group. By reading down the columns, one can add to get the total numbers earning income in any given fishery; for example, 171 respondents earned some income fishing groundfish and 116 earned income in the crab fishery. This table provides evidence of the point made earlier, that these Pacific Coast fisheries offer a wide range of choice of combinations of activities and that fishermen do not always target a single species. Reading across the bottom row, 267 out of the 595 earned income exclusively from a single species.

TABLE 1
FISHERY PARTICIPATION BY SAMPLE RESPONDENTS

	SALMON	GROUND FISH	CRAB	ALBACORE	HERRING	SWORDFISH	SEA URCHIN	SQUID	SHRIMP	HALIBUT	TUNA	MACKEREL	OTHER
SALMON	357	88	94	33	34	6	12	5	4	4	1	3	29
GROUND FISH		83	8	5	4	3	0	3	6	0	0	2	23
CRAB		14	1	2	0	0	2	0	2	0	0	0	4
ALBACORE		13	0	4	2	2	2	0	0	2	1	0	0
HERRING		8	0	0	1	0	0	0	0	1	0	0	0
SWORDFISH		16	0	0	1	0	0	0	1	0	0	0	0
SEA URCHIN		47	0	0	0	0	0	0	0	0	0	0	4
SQUID		6	0	0	1	4	3						
SHRIMP		5	0	0	0	0	0	1	4	3			
HALIBUT		4	0	0	0	0	0	1	0	0	0	0	1
TUNA		4	0	0	0	0	0	0	0	0	0	0	1
MACKEREL		2	2	2	0	0	0	0	2	2	0	0	0
OTHER		1	1	1	1	1	1	1	1	1	1	1	1
TOTAL	357	171	116	52	48	29	64	16	18	9	6	13	93
SINGLE SPECIES ONLY	146	41	4	5	6	15	43	0	4	3	0	0	0

A. FISHING & NON-FISHING TIME AND INCOME

Although the majority of fishermen fish in several fisheries, individuals typically target fisheries that are consistently most important to their total fishing income. One of the first questions asked concerned the fishery that typically contributes most to family income. This is what we designated as each individual's *major* fishery and 52% of the sample identified salmon as their major fishery, followed by groundfish (10.1%), sea urchin (9.8%), crab (4.7%), albacore, shrimp, and herring (each about 2%), and smaller percentages in the remaining options. Similar responses were given to a question about which fishery they devoted the most time to in a typical year. Table 2 reports time allocation and before-tax income earned in the major fisheries and secondary fisheries in 1988 as indicated by sample respondents.

Several interesting points emerge from the data in Table 2. First, with the exception of herring, mean earnings per week are reasonably close across fisheries, somewhat as we would expect if there is mobility and easy entry. Second, there are differences in the variability of earnings across fisheries, with more uniformity in salmon, sea urchin, herring, and mackerel fisheries and higher variability in the groundfish and squid fisheries. This may reflect inherent fishery variability or factors related to crew status or vessel characteristics of respondents. Finally, several of these fisheries are clearly parts of complexes, fished by part-time fishermen, or restricted. For example, mean times spent in the salmon, albacore, and herring fisheries are relatively low compared with groundfish, sea urchin, or mackerel fisheries.

Of equal interest as fishery-specific earnings and time allocations are data on totals over all fishing and non-fishing alternatives. With respect to the total time allocation to commercial fishing and the corresponding total fishing income, the mean over the sample indicates 1988 fishing earnings of \$28,490 per year from an average time commitment of 23.45 weeks. About 30% of

TABLE 2
EARNINGS AND TIME ALLOCATION BY MAJOR FISHERY

	MAJOR FISHERY						OTHER FISHERIES					
	INCOME			TIME			INCOME			TIME		
	MEAN	ST DEVIATION	ST DEV	MEAN	ST DEV		MEAN	ST DEVIATION	ST DEV	MEAN	ST DEV	
SALMON	\$17,209.71	\$18,732.00	6.82	13.58			\$6,710.95	\$15,420.79	6.35	6.35	9.92	
CRAB	\$22,485.71	\$21,567.89	8.96	16.60			\$11,879.46	\$15,178.63	11.19	11.19	9.93	
ALBACORE	\$12,615.38	\$13,927.12	7.35	10.38			\$15,615.38	\$22,477.91	10.38	10.38	12.46	
SHRIMP	\$21,720.00	\$21,718.03	13.04	21.33			\$12,760.00	\$16,679.94	8.6	8.6	10.16	
HERRING	\$19,061.54	\$19,706.58	3.87	8.13			\$8,230.77	\$9,319.82	10.15	10.15	11.15	
SEA URCHIN	\$37,796.43	\$26,364.73	14.06	28.78			\$4,269.64	\$11,996.47	3.9	3.9	8.92	
MACKEREL	\$26,657.14	\$18,592.01	8.91	29.00			\$19,357.14	\$14,646.03	19.71	19.71	9.88	
SQUID	\$19,666.67	\$26,312.23	10.07	16.67			\$833.33	\$1,040.83	7.67	7.67	6.35	
GROUNDFISH	\$26,548.00	\$42,233.05	16.03	23.47			\$7,589.33	\$19,518.73	4.27	4.27	7.53	
OTHER	\$23,352.81	\$26,482.21	14.12	21.80			\$4,452.70	\$12,749.57	3.14	3.14	6.37	

the respondents indicated that they also spent an average of 7.42 weeks on fishing related tasks such as boat repair. Tables 3 and 4 show relative frequencies for both total fishing earnings and total fishing time.

Mean earnings are skewed towards zero and differ as would be expected by crew status. Respondents who are crew members earned \$14,067 over a 19.19 week period on average, for an average weekly wage of \$730. Skippers who are hired earned an average of \$32,807 over a 29.03 week period for average weekly wages of \$1131. Skipper/owners earned \$33,225 for a 23.85 week period on average, yielding approximately \$1393 per week. The "other" category includes partners or other non-crew respondents.

Figures 2 and 3 plot the earnings and time allocations, respectively, as relative frequency distributions. As can be seen, 36% of the sample earned under \$10,000 in 1988 and two-thirds of the total sample respondents earned less than \$30,000. Considering crew members only, 55% earned less than \$10,000 and two-thirds earned less than \$15,000. For the group of skipper/owners, thirty percent earned less than \$10,000 and two-thirds earned less than \$35,000. With respect to time allocation to fishing, crew members are obviously a fluid group less dependent on fishing full time. One third of the crew members fish less than ten weeks while over 70% fish less than 24 weeks out of the year. Skippers who are hired average 29 weeks and over forty percent of them average over 40 weeks. For skipper/owners, thirty percent devote over 30 weeks to fishing.

Another way to group earnings and time allocation data is in terms of household income and time. Of particular interest in this study is the role of fishing vis-a-vis non-fishing and spouses' income in the household earnings profile. The data collected suggest that non-fishing income is significant to the household

TABLE 3
TOTAL FISHING INCOME BY CREW STATUS

NUMBER IN SAMPLE INCOME: DOLLARS	TOTAL SAMPLE	SKIPPER/ OWNERS	SKIPPERS	CREW	OTHER
	595	382	46	115	42
ZERO	3.36%	1.04%	0.00%	4.39%	23.81%
1-5000	3.19%	18.02%	15.22%	30.70%	14.29%
5001-10,000	30.08%	11.23%	10.87%	20.18%	14.29%
10,001-15,000	10.42%	10.18%	8.70%	12.28%	7.14%
15001-20,000	7.73%	8.09%	6.52%	6.14%	4.76%
20,001-25,000	8.40%	7.83%	13.04%	8.77%	7.14%
25,001-30,000	5.38%	5.74%	2.17%	6.14%	4.76%
30,001-35,000	4.37%	4.44%	6.52%	4.39%	2.38%
35,001-40,000	4.20%	4.18%	13.04%	1.75%	2.38%
40,001-45,000	2.52%	3.39%	0.00%	1.75%	0.00%
45,001-50,000	4.37%	4.44%	6.52%	2.63%	4.76%
50,001-55,000	2.18%	2.87%	4.35%	0.00%	0.00%
55,001-60,000	3.03%	4.44%	0.00%	0.88%	0.00%
60,001-65,000	0.67%	0.78%	0.00%	0.88%	0.00%
65,001-70,000	1.34%	1.31%	4.35%	0.00%	4.76%
70,001-80,000	1.85%	2.87%	0.00%	0.00%	0.00%
80,001-90,000	2.02%	2.87%	0.00%	0.00%	2.38%
90,001-100,000	1.68%	1.57%	4.35%	0.00%	4.76%
OVER 100,000	3.36%	4.44%	2.17%	0.00%	4.76%
WITH ZEROES:					
MEAN	\$28,489.99	\$33,225.04	\$32,807.07	\$14,066.99	\$24,601.19
STANDARD DEVIATION	\$34,321.38	\$37,863.50	\$31,724.64	\$14,108.07	\$34,090.29
WITHOUT ZEROES:	20 ZEROES	4 ZEROES		5 ZEROES	11 ZEROES
MEAN	\$29,480.94	\$33,576.62		\$14,706.40	\$32,289.06
STANDARD DEVIATION	\$34,492.55	\$37,908.04		\$14,095.32	\$35,788.16

TABLE 4
TOTAL FISHING TIME BY CREW STATUS

	TOTAL SAMPLE	SKIPPER/ OWNERS	SKIPPER	CREW	OTHER
NUMBER IN SAMPLE	595	382	46	115	42
TIME:WEEKS					
ZERO	2.02%	1.31%	0.00%	0.87%	11.90%
LESS THAN 5	7.73%	5.24%	6.52%	17.39%	9.52%
5 TO 9	10.76%	9.95%	8.70%	14.78%	9.52%
10 TO 14	11.93%	12.57%	8.70%	12.17%	7.14%
15 TO 19	11.26%	12.30%	4.35%	11.30%	7.14%
20 TO 24	15.29%	16.49%	6.52%	14.78%	14.29%
25 TO 29	8.91%	10.73%	2.17%	4.35%	11.90%
30 TO 34	5.88%	5.76%	8.70%	4.35%	2.38%
35 TO 39	4.87%	4.19%	10.87%	5.22%	4.76%
40 TO 44	8.40%	9.42%	10.87%	6.09%	4.76%
45 TO 49	5.21%	5.76%	6.52%	4.35%	2.38%
50 PLUS	7.73%	5.76%	23.91%	4.35%	14.29%
WITH ZEROES					
MEAN	23.45	23.85	29.03	19.19	22.23
ST DEVIATION	14.99	14.1	16.65	14.59	17.83
WITHOUT ZEROES	12 ZEROES	5 ZEROES		1 ZERO	5 ZEROES
MEAN	23.93	24.17		19.35	25.23
ST DEVIATION	14.76	13.92		14.54	16.86

FIGURE 2

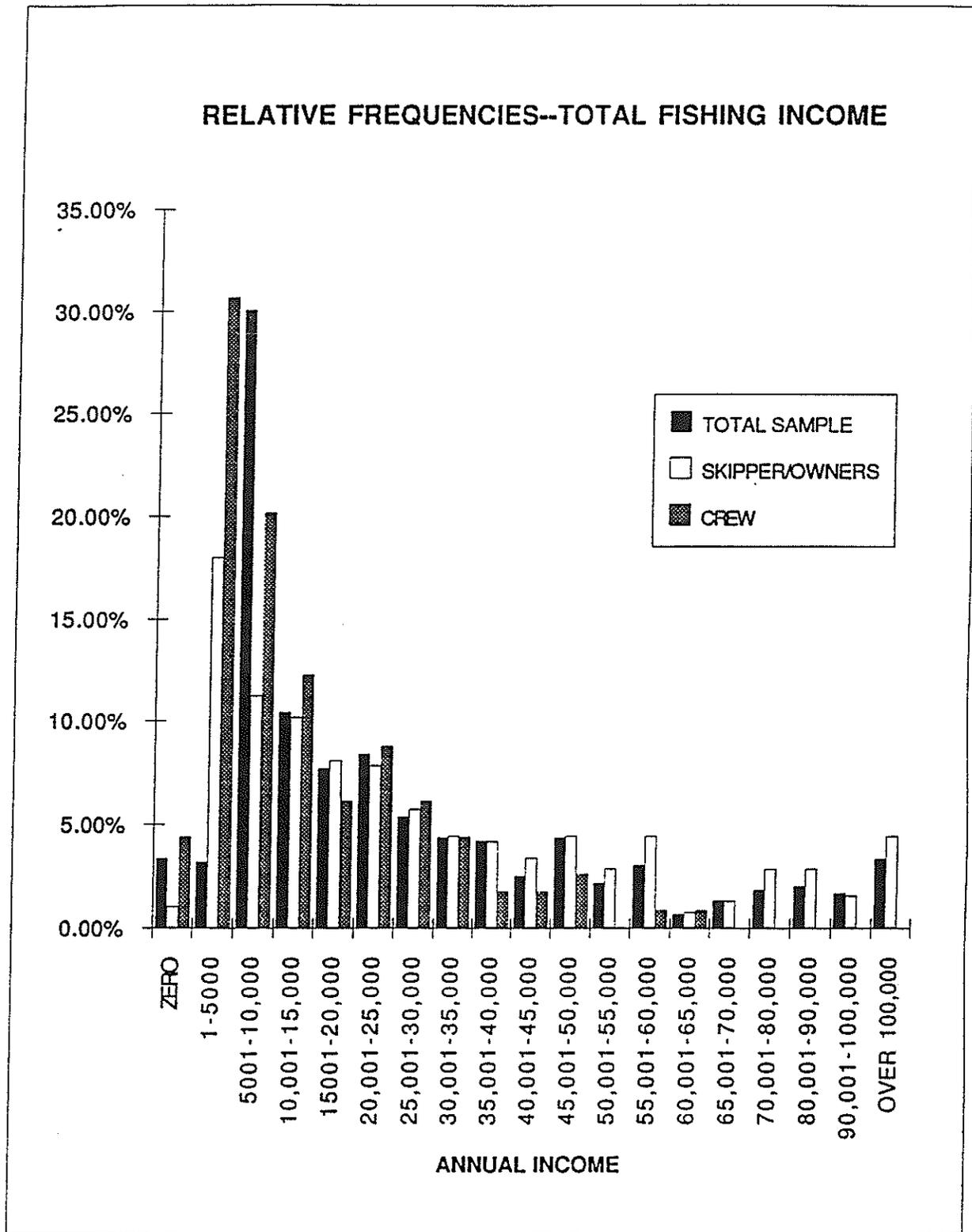
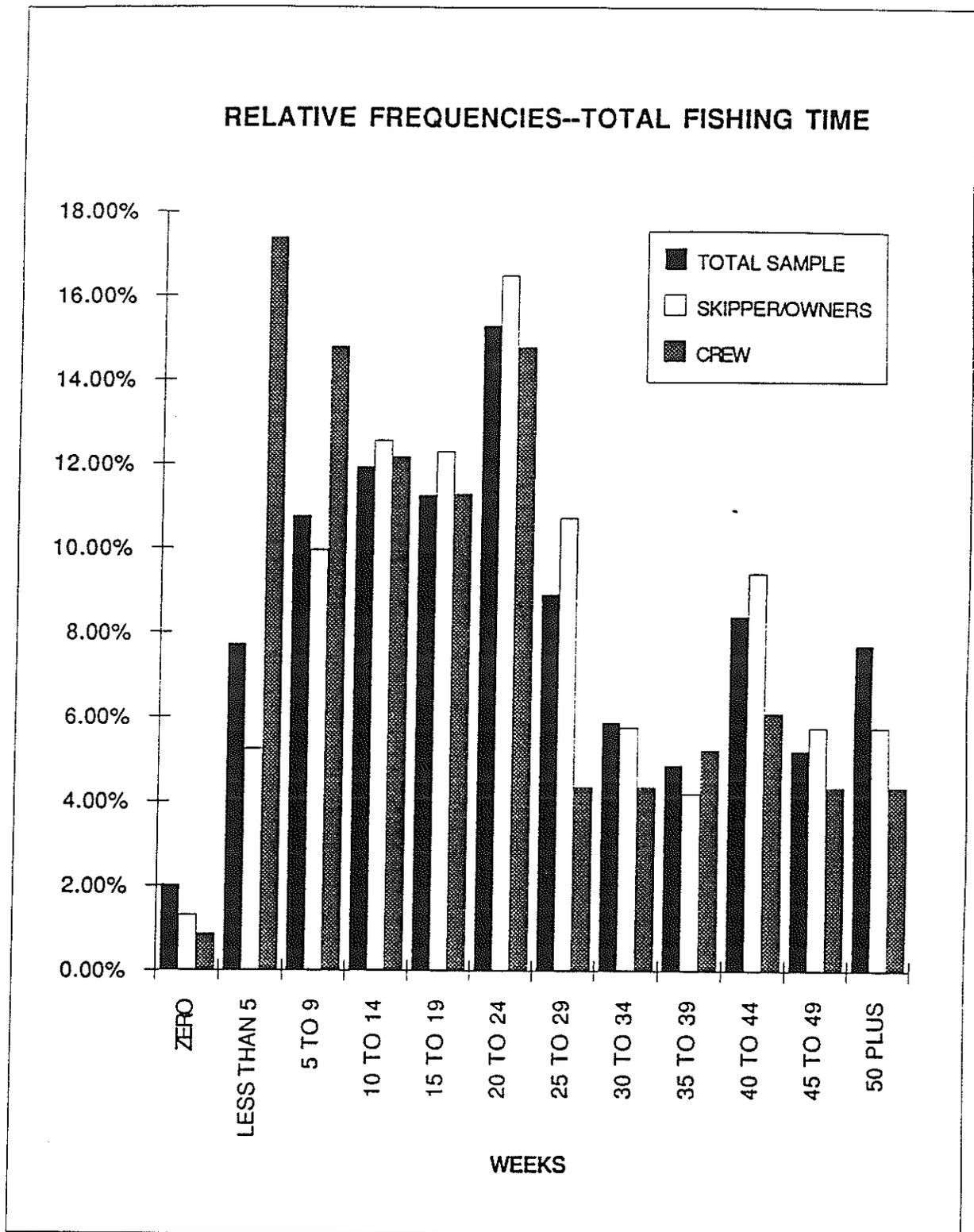


FIGURE 3

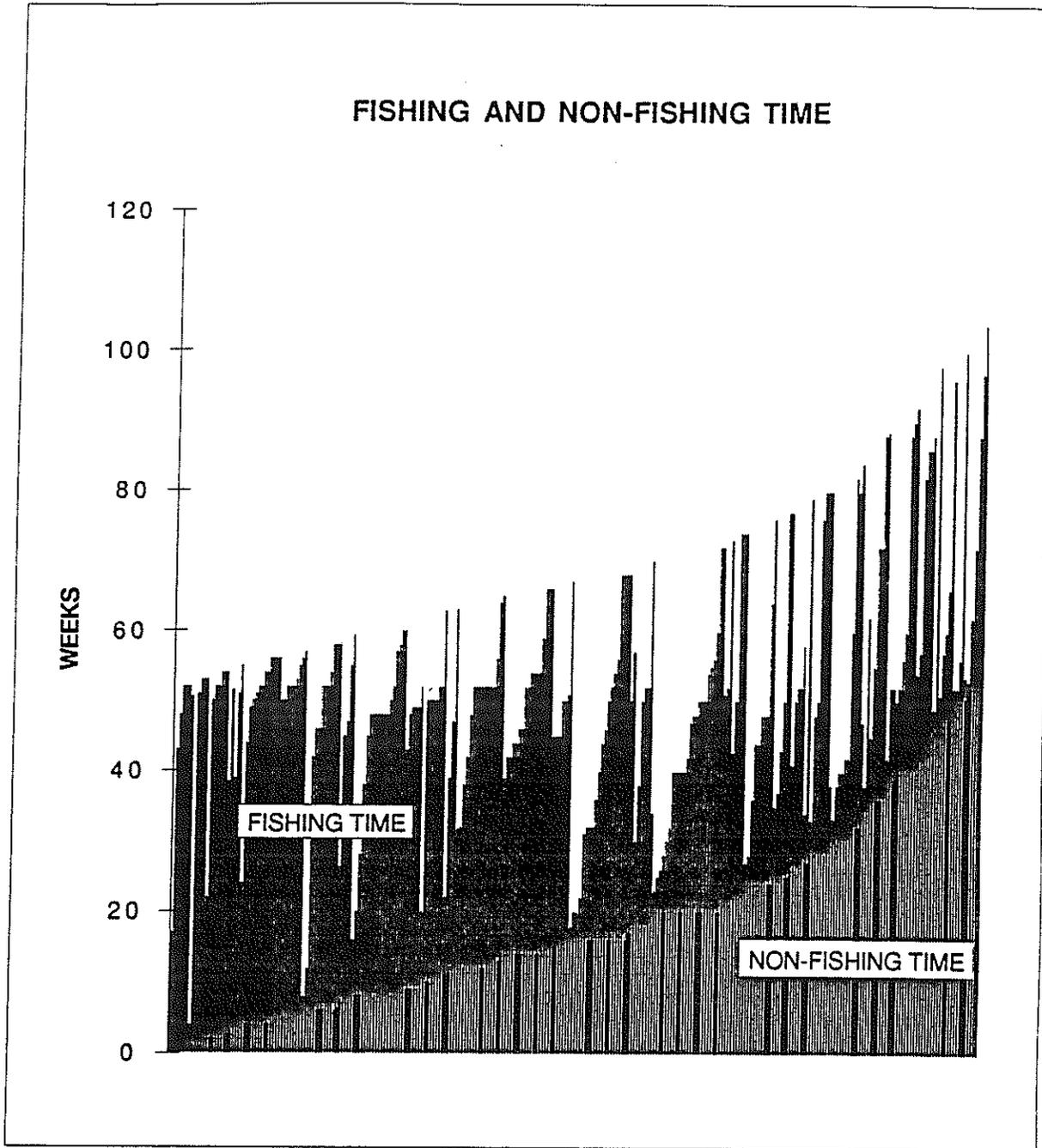


budget for a number of respondents. 50.8% of the respondents reported some non-fishing income exclusive of spousal income and other family income. Of those who indicated some non-fishing income, the mean amount was \$22,167 per year, from a time allocation averaging 33.29 weeks. Figure 4 sorts all observations with some reported non-fishing time by total non-fishing time and adds in fishing time to get total work time. This shows something of what we would expect; namely a tendency to substitute one type of work for the other. Those with low allocations to non-fishing time generally have higher allocations to fishing time and vice versa. Note that there are some observations claiming more than 52 weeks allocation of time; most of these claim to be working weekends and other non-normal work weeks.

An additional question was asked about other sources of family income such as interest, dividends, rents, etc. Positive answers were reported by 27.23% of the respondents and of those the mean response was \$13,772. Averaging over the whole sample, including those who had no other non-wage income, the sample mean is \$3,750.

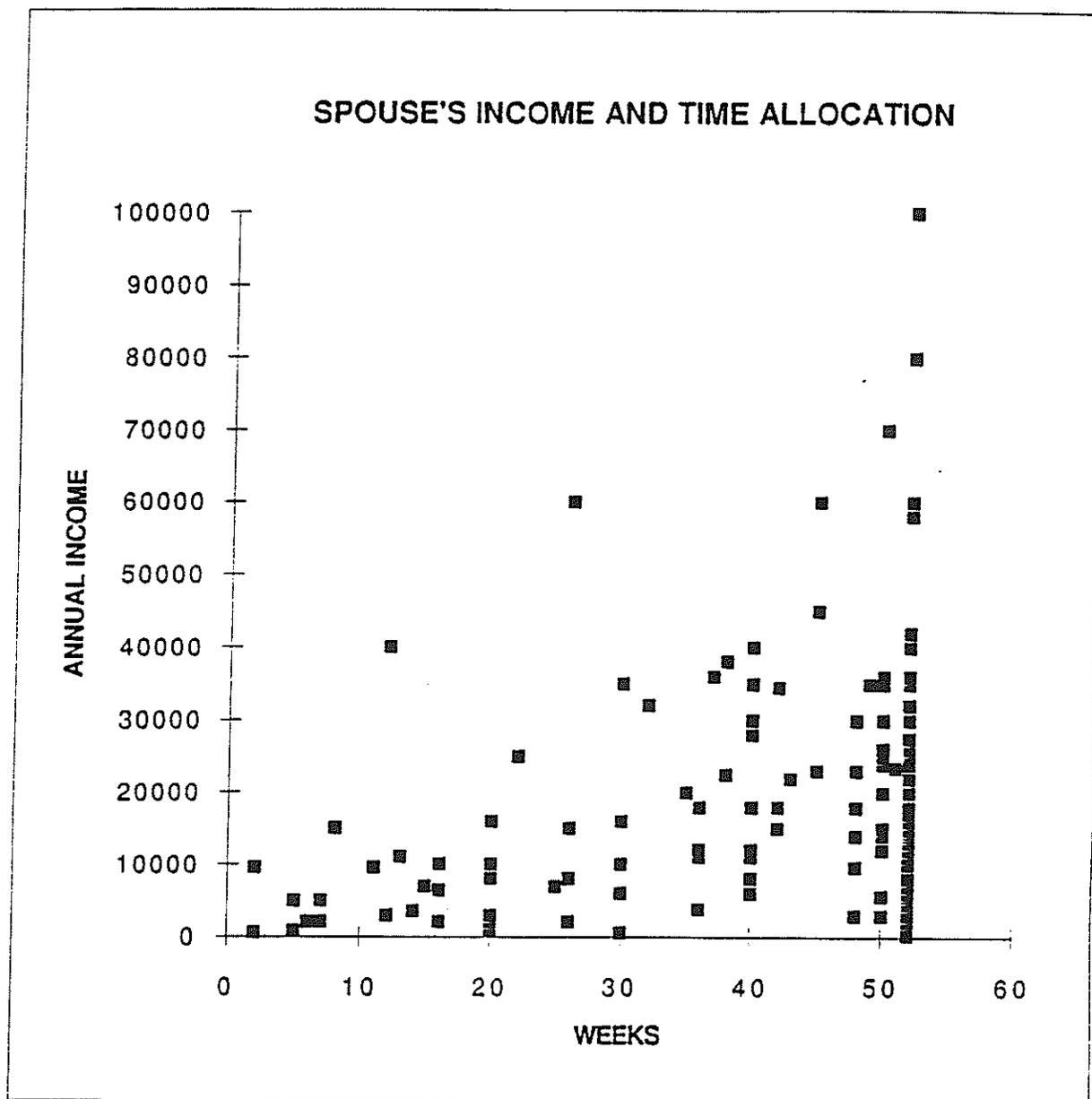
With respect to spouses' income, 39.57% of the spouses we sampled reported some direct labor income. 78% of the sample fishermen respondents lived with a spouse (or partner) and of the 465 with spouses, 198 reported positive income averaging \$19,996 per year, earned over an average work period of 43 weeks. Figure 5 shows total income versus time worked for those with positive income. The pattern here is as would be expected, with a positive relationship between income and time worked. The mean weekly wage for those reporting income was \$466.

FIGURE 4



MEAN FISHING TIME: 33.29
STANDARD DEVIATION: 16
MEAN NON-FISHING TIME: 18.27
STANDARD DEVIATION: 13.23
N=278

FIGURE 5



B. HOUSEHOLD SOCIOECONOMIC CHARACTERISTICS

Table 5 reports sample mean for various responses to questions about household composition and socioeconomic information. The average fishing household is comprised of a fisherman/spouse, each about 44 years of age and both with some post-high school education. Each has about 16 years of non-fishing job experience and the fisherman has about 13 years of fishing experience. 35% of those sampled have children at home and of those with children the average is 2.6 children.

Table 6 summarizes the total income and time allocations (some of which were discussed above) for the whole sample by household. Summing over the whole sample, the average household income is about \$50,000 from all sources. About half comes from fishing and the rest from non-fishing work by both the fisherman and spouse. These averages mask the fact that both non-fishing and spousal income are concentrated at levels associated with near full-time work. For example, although the sample average for spousal income is \$6,677 over 13.36 weeks, only 43.2% of the households' spouses have outside work income. If we only consider these, the average spousal income is \$19,996, earned over a 43 week period per year. Similarly, among those earning some non-fishing income, the mean earnings are \$22,167 over a 33 workweek year, but the non-fishing income averaged over the whole sample is \$11,102.

C. FISHING AND NON-FISHING EMPLOYMENT OPTIONS

An important part of the survey was devoted to determining the employment alternatives to fishing as perceived by fishermen. As discussed above, questions were posed about hypothetical closure scenarios and fishermen were asked what alternatives they would pursue in response to closure of their major fisheries. Short term, intermediate term, and long term scenarios were posited.

TABLE 5
HOUSEHOLD SOCIOECONOMIC CHARACTERISTICS

	TOTAL SAMPLE		SKIPPER/ OWNERS		SKIPPERS		CREW	
	MEAN	ST DEV	MEAN	ST DEV	MEAN	ST DEV	MEAN	ST DEV
FISHERMEN'S CHARACTERISTICS								
AGE	44.72	13.50	47.63	13.26	39.51	11.66	37.65	12.88
YEARS OF EDUCATION	13.53	2.73	13.52	2.53	12.68	3.15	13.85	3.24
YEARS OF FISHING EXPERIENCE	13.16	10.07	14.85	10.47	13.36	9.62	8.32	7.65
YEARS OF NON-FISHING EXPERIENCE	15.63	13.34	16.85	13.95	10.30	11.08	13.40	12.00
HEALTH: SCALE FROM 1 TO 5	4.15	0.97	4.11	0.96	4.02	1.04	4.39	0.80
PERCENTAGE WITH SPOUSE	78.20%		84.00%		67.00%		65.00%	
SPOUSE'S CHARACTERISTICS								
AGE	43.76	14.06	45.01	14.10	36.63	10.76	40.52	14.00
YEARS OF EDUCATION	13.29	2.90	13.34	2.89	13.27	2.43	13.36	3.11
EMPLOYMENT EXPERIENCE	16.05	12.78	16.97	12.53	7.75	8.39	15.14	13.78
HEALTH: SCALE FROM 1 TO 5	4.12	0.87	4.13	0.88	3.97	0.91	4.19	0.82
PERCENTAGE WITH CHILDREN	36.30%		35.30%		47.80%		34.80%	
PERCENTAGE WITH CHILDREN:								
UNDER 3	11.10%		9.70%		21.70%		12.20%	
BETWEEN 4 AND 6	9.10%		9.20%		15.20%		7.00%	
BETWEEN 7 AND 12	12.80%		12.80%		19.60%		13.00%	
BETWEEN 13 AND 18	15.30%		16.80%		13.00%		12.20%	

TABLE 6
TOTAL HOUSEHOLD INCOME AND TIME ALLOCATION

	TOTAL SAMPLE		POSITIVE RESPONSES ONLY		
	MEAN	ST DEV	MEAN	ST DEV	% OF SAMPLE
FISHING INCOME	\$28,489.99	\$34,321.38			
FISHING TIME	23.45	14.99			
FISHING RELATED TIME	2.20	5.09	7.42	6.99	
NON-FISHING INCOME	\$11,102.08	\$17,995.95	\$22,166.91	20040.19	50.08%
NON-FISHING TIME	15.90	19.99	33.29	16.02	
SPOUSAL INCOME	\$6,676.52	\$13,771.38	\$19,996.32	\$15,115.10	30.92%
SPOUSAL TIME	13.36	21.36	42.88	13.96	
OTHER INCOME	\$3,749.74	\$11,917.72	\$13,772.19	\$19,624.75	27.23%
TOTAL INCOME	\$50,018.33	\$39,843.51			
TOTAL TIME	39.34	19.47			

Table 7 shows responses to the question regarding what broad employment option would be pursued in response to the closure scenarios.

TABLE 7
CHOICE OF ALTERNATIVE OCCUPATION BY SCENARIO

PERCENT			
CLOSURE DURATION:	2 WEEKS	1 YEAR	5 YEARS
SWITCH TO:			
OTHER FISHERY	25.70%	30.30%	34.60%
NON-FISHING JOB	30.60%	46.40%	52.70%
UNPAID ACTIVITIES	43.70%	23.30%	12.70%
TOTAL NUMBER OF RESPONSES	588	591	584

For the short term incident (two week closure), the majority of respondents stated that they would take a positive action, either by switching to another fishery (25.5%) or by switching to a non-fishing job (30.6%). A significant number (43.7%) would simply engage in unpaid activities such as working on their boat, etc. As the severity of the closure scenario increases to a half-season for one year, a larger number would seek a non-fishing job. The percentage stating that they would take a non-fishing job increases from 30.6% to 46.4% if the event is presumed to last a half-season. In the most severe scenario (half-season closures for five years), more fishermen would opt for non-fishing employment and/or other fisheries. Only 12.7% would choose to engage in unpaid activities for the closure periods.

We also asked questions about the potential *adjustment costs* associated with making a transition out of fishing. Table 8 shows how far away from their current residence and how much time they estimate the transition would take if they respondents were to

switch to a non-fishing job. As the severity of the scenario increases, both the estimated distance and the estimated transition

TABLE 8
TRANSITION TIME/DISTANCE FROM RESIDENCE

CLOSURE DURATION:	1 YEAR	5 YEARS
ALTERNATIVE JOB LOCATION:		
CURRENT TOWN	42.90%	31.60%
1-20 MILES AWAY	27.60%	19.90%
21-50 MILES AWAY	14.90%	16.80%
51-100 MILES AWAY	6.30%	10.90%
OVER 100 MILES AWAY	8.20%	21.60%
MOVE RESIDENCE	9.90%	18.30%
TRANSITION TIME:		
LESS THAN 2 WEEKS	46.10%	39.80%
2 WEEKS-1 MONTH	28.20%	25.60%
1-2 MONTHS	13.90%	17.00%
OVER 2 MONTHS	11.70%	17.40%

time increase, reflecting willingness to pursue more permanent employment readjustments to the proposed scenarios. For example, 42.9% would attempt to find a job in their current town and 46.1% expect that such a job could be found in less than two weeks in the event of a half-season closure for only one season. If such a closure were to persist for the long term (five years), only 31.6% expect suitable replacement employment locally and the number expecting it more than 100 miles away increases to 21.6%.

Table 9 summarizes responses to the question asking respondents to estimate employment and earnings alternatives to their current major fisheries. As discussed above, more respondents would switch out of fishing as the severity of the

TABLE 9
TOTAL FISHING INCOME BY CREW STATUS

	TOTAL SAMPLE	SKIPPER/ OWNERS	SKIPPER	CREW
ONE-YEAR CLOSURE SCENARIO				
SWITCH TO:				
OTHER FISHERY	\$30,285.38	\$29,528.55	\$32,490.91	\$17,818.67
NON-FISHING JOB	\$27,369.80	\$30,008.16	\$25,416.00	\$22,703.02
UNPAID ACTIVITIES	\$0.00	\$0.00	\$0.00	\$0.00
	30.29%	32.11%	26.09%	27.43%
	46.36%	42.11%	54.35%	53.10%
	23.35%	25.79%	19.57%	19.47%
FIVE-YEAR CLOSURE SCENARIO				
SWITCH TO:				
OTHER FISHERY	\$33,758.54	\$33,939.86	\$39,560.00	\$22,916.36
NON-FISHING JOB	\$25,802.90	\$27,178.73	\$42,317.86	\$22,427.50
UNPAID ACTIVITIES	\$0.00	\$0.00	\$0.00	\$0.00
	34.59%	40.80%	33.33%	19.64%
	52.74%	45.33%	62.22%	66.96%
	12.67%	13.87%	4.44%	13.39%
1988 FISHING INCOME	\$28,489.99	\$33,225.04	\$32,807.07	\$14,066.99
1988 NON-FISHING INCOME	\$12,582.36	\$12,504.77	\$10,365.34	\$13,011.88

closure of their major fishery increases. Of interest also, and consistent with intuition, are the differences in mobility between those paid as "labor" (skippers for hire and crewmembers) and those who also have an investment in the boat. A half-season closure for one year would cause over 53% of both crew and skippers for hire to seek non-fishing employment versus 46% for skipper/owners. These exit percentages jump to over 62% and 52% respectively, for a five year half-season closure scenario.

With respect to perceived alternative income earnings, most fishermen believe that they have viable earnings opportunities to current prospects in their major fisheries. Of those answering that they would simply switch fisheries in the event of a closure, the expected earnings are, for the most part, comparable to earnings claimed for 1988. For example, skipper/owners, whose mean 1988 fishing earnings were about \$33,225, believe that they could switch out of their preferred fishery and into an alternative fishery for a year and still earn about \$30,000 in fishing income. A long term adjustment could be made with a negligible difference in earnings. Of those skipper/owners who responded that they would switch out of fishing and into a non-fishing job, the mean expected earnings over the short term are also about \$30,000.

As discussed earlier, an important but unresolved question about fishermen and their labor alternatives is exactly how flexible their opportunities are. Answers to several of our questions suggest that fishermen perceive that they have ready alternatives to fishing, much as one would expect. As part of our exploration of various closure scenarios, we asked open-ended questions about what specific occupation they would pursue if they chose not to continue fishing. In Table 10 below, we categorize responses to the long-term closure scenario, i.e. these are the specific occupations listed by respondents as most likely options to them in the event that they left fishing as a result of a long term closure.

A total of 308 out of 584 respondents answered that they would

TABLE 10
NON-FISHING EMPLOYMENT OPPORTUNITIES

PROFESSIONAL	SERVICE	SKILLED LABOR	LABOR
ACCOUNTANT AEROSPACE ANALYST CONSULTANT (2) ENGINEER (6) TEACHER (9) DENTIST	AUTO SALESMAN APARTMENT MANAGER BARBER BARTENDER BOOKKEEPER (8) FISH SALES FOOD SALES HEALTH (2) JEWELER LAW ENFORCEMENT (2) LIFE INSURANCE MARICULTURE POST OFFICE PRINTER REAL ESTATE (6) RETAIL SALESMAN (11) SECURITY STORAGE MUSEUM TECHNICIAN (9) THEATER CHILD CARE FINANCE	CARPENTER (7) BOAT REPAIR (12) CONSTRUCTION (42) ELECTRICIAN (4) DRY WALL LANDSCAPE (4) FARMER (3) WELDER (7) LOGGER (3) MACHINIST PLUMBER (5) WAITER (4) MECHANIC (14) MILLWORKER (2) PAINTER (5) ROOFER (2) SERVICE STATION TRUCKING (7) ASSEMBLY WOODWORKER (2)	LABORER (10)

switch out of fishing and into the occupations listed in the table following a long-term closure. There is a wide variety of alternative skills indicated, ranging from highly trained professional occupations to manual labor and skilled labor occupations. About one quarter of the responses are for service or professional occupations but by far the largest group of alternative jobs is in the skilled labor category such as carpenters, mechanics, welders, etc. The most frequently mentioned single option is construction with nearly fourteen percent of the responses. When one groups all construction and building-related jobs (carpenter, electrician, plumber, roofer, painter) it is clearly the most important alternative to fishing, with an overall group response of over twenty percent. The second most important option group is fishing/marine related; namely, boat repair, welding, and mechanic work. About ten percent of respondents perceive these occupations to be their best alternatives to fishing.

The above findings are consistent with the findings of McCay et. al. who asked similar questions to East Coast clam fishermen.⁶ In her study, McCay found that over fifty percent of the fishermen interviewed had work experience in the laborer and craft occupations and about twenty percent had experience in service and manager occupations. The findings from her study and our new data are potentially important for several reasons. First, a significant fraction of those interviewed would look to alternative employment in building, logging, and fishing. All of these are seasonal jobs and building and logging are also affected by business and building cycles. Thus the certainty of alternative employment is not necessarily guaranteed and would be dependent on timing and factors other than simply skills of the individuals. Second, many of the employment opportunities listed are in the skilled trades where experience rather than formal educational training is important. Thus the likelihood of employability may be

⁶See McCay, B. et.al., *op. cit.*

dependent on maintaining skills and keeping connected with potential employers.

D. FISHING AND LABOR OPPORTUNITY COSTS

As discussed in the introduction, an important component of cost-benefit analysis of fisheries policies is the assumption about the alternative value of fishermen's labor. If fishermen are easily employable in alternative occupations with little loss in income and small transition costs, then policies which displace fishermen will not "cost" society much. On the other hand, if fishermen have few or inferior opportunities, and/or adjustment costs are high, then displacement policies will be socially costly.

One of the first attempts to deal with the issue of employment alternatives in cost-benefit analysis came out of federal water resource development project analysis. In water project analysis the issue has been how to evaluate the true social cost of labor diverted into construction and maintenance of large scale regional water developments. In most cases a simple approach based on regional unemployment rates has been used. In regions where labor is fully employed, the social cost of labor is assumed to be essentially the full wage. This reflects the idea that the going wage reflects the value of alternative production being foregone by drawing labor to resource development projects. In regions where labor is partially unemployed there is a probability of drawing a worker from the unemployed labor pool where the social opportunity cost of diversion is essentially assumed zero. Unemployment rates have thus been used to "weight" wage rates so that in regions with high unemployment, the local wage rate is "discounted" by a factor associated with the employment rate.

The issue that arises in fisheries policy analysis is similar; namely, what is the correct measure of fishermen's alternative employment opportunities? A persistent view is that displacing fishermen could have high social costs because the bulk of them would simply become unemployed. This is the low "opportunity cost"

view, i.e. that the social cost of labor in fishing is low because fishermen come from isolated rural communities with few employment options. Alternatively, it is possible that fishermen are not substantially different from other laborers in non-fishing occupations and that the social cost of fishing labor is relatively high and reflecting viable alternative employment options with wages similar to those earned in fishing. This question is one which we attempted to address in several ways in this survey.

As a first cut at this question, we first turn to the summary income data reported in Table 6. This gives sample means for income and weeks worked in both fishing and non-fishing occupations by respondents reporting some fishing income in 1988. From the table it can be seen that the sample mean weekly fishing "wage" is $\$28490/23.45$ or $\$1,215$. The mean weekly non-fishing wage is $\$698$ over the entire sample, and $\$666$ over those respondents reporting positive non-fishing time only. These mean non-fishing wages might be used as a first approximation to the opportunity cost question. They are likely to be biased but whether they are biased upwards or downwards depends on how similar the subsample of fishermen currently with non-fishing jobs is to the remaining sample of fishing-only individuals. For example, suppose that experience is an important determinant of non-fishing wages. Then we might expect that part-time fishermen would have more non-fishing job experience than full-time fishermen. Actual reported wages for this group might thus overstate the true opportunity cost wage over the sample including those who derive income from fishing only. In addition, since a considerable number of fishermen engage in multiple fisheries, a closure of one fishing option would be responded to be switching to another fishery rather than to a non-fishing occupation.

To address these types of potential bias we now turn to the wage responses to questions involving hypothetical closures of individuals' major fisheries. These were essentially included in the survey in order to examine how individuals currently involved only in fishing employment perceive their employment alternatives.

For each of the scenarios, options included alternative fisheries, non-fishing occupations, and unpaid activities. Table 7 summarizes these choices by scenario severity and employment option. Table 11 summarizes respondents' perceived opportunity wages by crew status for the long term (five year) closure scenario. The sample mean weekly opportunity wage is about \$600 for those electing to seek paid employment and about \$520 if we include those who would not seek or find alternative income-generating employment. The mean opportunity wage for skipper/owners with positive responses (all responses including zeros) is \$627 (\$538) and for crew members \$470 (\$405). The fraction indicating that they would not engage in paid employment in the event of a long term closure is about 14% for the entire sample, as well as for each of the skipper/owner and crew groups.

Figure 6 plots the opportunity wage responses as relative frequencies for each of the crew status groups. Of interest are the differences in numbers that would take unpaid activities in the event of a closure; about 14% for crew and skipper/owners vs. about 4% for hired skippers. Excluding these unemployed, about half of the skipper/owners expect that they would earn less than \$600 in their best alternative to their major fishery. Again excluding zeros, about two thirds of the crew members expect that alternative earnings would be under \$600 per week.

A remaining way to examine opportunity wages is to examine responses by employment choice, i.e. to categorize opportunities according to whether respondents would shift out of fishing or not. Table 12 reports mean opportunity wages by crew status and according to employment response to the long term closure scenario. Of interest here is the comparison between crew for hire (both crew and skippers) and those with investments in capital (skipper/owners and "other"). Expected alternative wages for the former group are not substantially different between the non-fishing and fishing alternatives. For the skipper/owners/other group, however, expected earnings in fishing are considerably lower than perceived non-fishing alternatives. This is somewhat unexpected although it

TABLE 11
WEEKLY OPPORTUNITY WAGE BY CREW STATUS

	TOTAL SAMPLE	SKIPPER/ OWNERS	SKIPPERS	CREW	OTHER
NUMBER IN SAMPLE	563	359	46	109	40
DOLLARS					
ZERO	12.97%	14.21%	4.35%	13.76%	7.50%
1-100	2.49%	2.51%	0.00%	3.67%	2.50%
101-200	6.75%	6.41%	6.52%	9.17%	5.00%
201-300	12.79%	13.37%	8.70%	11.93%	15.00%
301-400	9.77%	9.75%	8.70%	10.09%	10.00%
401-500	12.43%	10.58%	15.22%	15.60%	17.50%
501-600	12.43%	9.47%	28.26%	17.43%	7.50%
601-700	7.46%	8.91%	2.17%	6.42%	5.00%
701-800	4.62%	3.62%	15.22%	2.75%	5.00%
801-900	6.04%	6.41%	6.52%	1.83%	15.00%
901-1000	2.13%	2.23%	2.17%	1.83%	2.50%
1001-1100	3.73%	4.46%	0.00%	2.75%	0.00%
1101-1250	2.66%	3.06%	2.17%	1.83%	2.50%
1251-1500	0.53%	0.56%	0.00%	0.92%	0.00%
1501-2000	1.42%	1.95%	0.00%	0.00%	2.50%
2001-3000	0.71%	1.11%	0.00%	0.00%	0.00%
3001-4000	0.53%	0.84%	0.00%	0.00%	0.00%
OVER 4000	0.53%	0.56%	0.00%	0.00%	2.50%
WITH ZEROES:					
MEAN	\$521.30	\$537.70	\$515.39	\$405.07	\$703.08
STANDARD DEVIATION	\$593.92	\$572.68	\$248.68	\$295.59	\$1,284.82
WITHOUT ZEROES:	73 ZEROES	51 ZEROES	2 ZEROES	15 ZEROES	3 ZEROES
MEAN	\$598.96	\$626.73	\$538.82	\$469.71	\$760.08
STANDARD DEVIATION	\$598.99	\$571.37	\$227.60	\$266.03	\$1,320.52

FIGURE 6

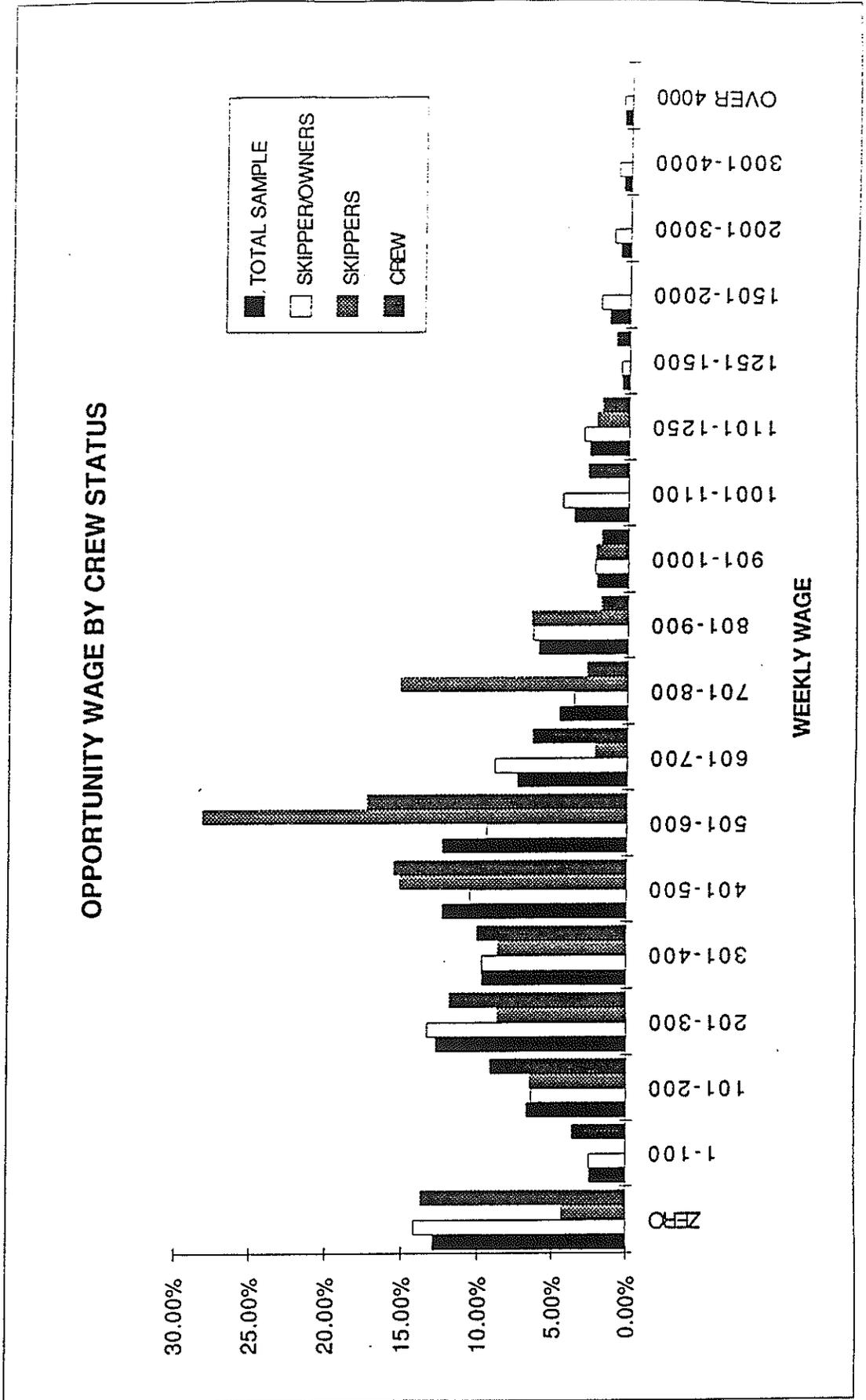


TABLE 12
WEEKLY OPPORTUNITY WAGE BY EMPLOYMENT TYPE

	MEAN	STANDARD DEVIATION
SWITCH TO NON-FISHING JOB		
TOTAL	\$703.36	\$830.66
SKIPPER/OWNERS	\$707.13	\$690.04
SKIPPERS	\$547.93	\$242.29
CREW	\$477.50	\$312.23
OTHER	\$1,378.70	\$2,456.43
SWITCH TO ANOTHER FISHERY		
TOTAL	\$534.09	\$368.78
SKIPPER/OWNERS	\$559.81	\$430.25
SKIPPERS	\$534.57	\$228.00
CREW	\$467.33	\$252.68
OTHER	\$553.24	\$347.68

may reflect relative flexibility; those who have outside opportunities may simply have higher valued skills in the general labor market.

VI. SUMMARY

The market for fishing labor on the Pacific Coast is diverse and complicated, reflecting both the wide variety of opportunities (the demand side) and a mix of fishing and non-fishing skills (the supply side). There is considerable ability to move between fisheries whose relative profitabilities vary from year to year, as well as between fishing and non-fishing occupations whose labor demands also fluctuate. The findings of our survey reflect this complicated mix of options and are difficult to summarize in a few simple statistics. In what follows, we highlight some important characteristics of the sample of respondents.

■ **Fisheries Participation**

In the sample year, fisheries participation mirrored the wide mix of fishing opportunities. Less than half the sample pursued a single species. Salmon clearly dominates the complex with 60% of those reporting fishing income deriving some from salmon. Whether this is "normal" is unclear since 1988 was such a profitable salmon year. Other fisheries with high participation are groundfish, crab, sea urchin and albacore.

■ **Income**

Mean fishing earnings for 1988 were about \$28,500 over about a 23 week period, for an average weekly "wage" of about \$1250. Earnings for skippers averaged about \$33,000 whereas for crew members the average was about \$14,000. Weekly earnings averaged about \$1400 for skipper/owners, \$1130 for skippers who were hired, and \$730 for crew members.⁷

■ **Fishing Household Characteristics**

The typical fishing household consists of the fisherman and wife, each approximately 44 years of age, with considerable fishing and non-fishing labor experience. Non-fishing income is earned by about half of the sample fishermen and the mean wage is about \$675 per week. Of those with non-fishing income, the total weeks worked averages 33 weeks. Approximately 78% of the respondents have spouses and of those households, about 40% of the

⁷These are all before tax earnings. It should be noted that skipper/owners are self-employed and hence pay an additional 7% Social Security Tax, in addition to insurance and other benefits commonly covered by employers. Also, the difference in earnings between skipper/owners and skippers bears some relationship to a competitive payment for the services of the vessel capital. Taking the difference (\$1400-\$1130=\$270) and multiplying by the average fishing participation of 23 weeks yields a yearly payment to vessel capital of about \$6,500.

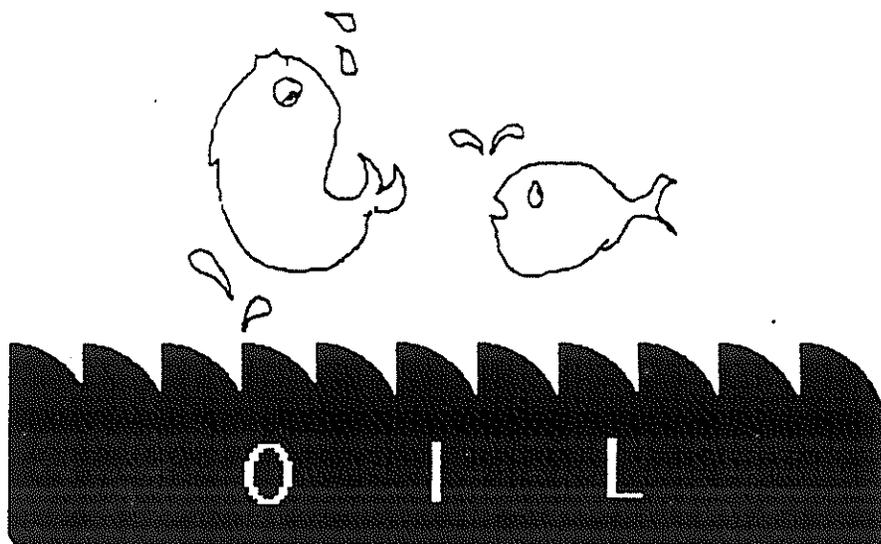
spouses earn income. Of the income-earning spouses, most work essentially full time (43 weeks) and the mean weekly wage is \$465. Mean household income (averaging over all responses) was approximately \$50,000 from all sources in 1988.

■ **Alternatives to Fishing**

The scenarios posed to the sample of fishermen give some idea of what options respondents believe they have to their current major fisheries. The two week, one year, and five year scenarios bracket likely responses to changes in access. About half the sample appears to be very fluid and essentially able to instantly adjust. These would switch from their major fishery even for a two week closure, although the other half would simply engage in unpaid activities. At the opposite end of the spectrum, a half-season closure of fishermen's major fishery for a five year period would induce a substantial number to readjust, although about 14% would not find income earning alternatives. Over half the respondents would switch to a non-fishing job during the period of the closure. Of the job types expected, there is some variety but a considerable concentration skilled labor jobs, including construction, carpentry, welding, mechanic work, etc. Estimated alternative weekly wages over all options envisioned are about \$600, with skipper/owners anticipating earnings of \$625 and crew members expecting about \$470 per week.

APPENDIX A

ENVIRONMENTAL DISASTERS AND COMMERCIAL FISHING



An effort to assess potential impact of disasters on fishermen and their families across Washington, Oregon and California.

Please return this survey to:

Dr. James E. Wilen
Dept. of Agricultural Economics
Univ. of California, Davis
Davis, CA 95616

Please be sure that you answer **ALL** questions in the survey since **WE CAN NOT USE ANY QUESTIONNAIRE THAT HAS INCOMPLETE ANSWERS**. Be assured that all answers will be anonymous and used only to develop industry averages and profiles. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire so your response cannot be traced back to you.

I. ENVIRONMENTAL DISASTERS
AND COMMERCIAL FISHING

In this section we would like to ask you some questions which call for you to **IMAGINE** how you might adapt to fishing disruptions caused by major disasters such as the recent oil spill in Alaska or PCB contamination in New Bedford. First, we would like you to tell us:

Q-1 Which individual fishery do you normally spend the **MOST TIME** participating in? (circle number)

1. SALMON
2. CRAB
3. ALBACORE
4. SHRIMP
5. HERRING
6. SEA URCHIN
7. MACKEREL
8. SQUID
9. GROUND FISH
10. OTHER (please specify) _____

Q-2 Which individual fishery typically contributes the most to your **FAMILY INCOME?** (circle number)

1. SALMON
2. CRAB
3. ALBACORE
4. SHRIMP
5. HERRING
6. SEA URCHIN
7. MACKEREL
8. SQUID
9. GROUND FISH
10. OTHER (please specify) _____

NOTE: In the questions which follow, we will refer to the fishery that contributes the most to your family income (box checked in Q-2) as your **MAJOR FISHERY**.

First, we would like you to think about some situations where only your **MAJOR FISHERY** is impacted by an event such as an oil spill or a fish virus contamination. When answering these questions, you should suppose that all other fisheries are relatively unaffected and remain as currently regulated. For example, if salmon is your major fishery, you should imagine a closure of the salmon fishery while all other fisheries (crab, albacore, groundfish, etc.) retain their current seasons.

Q-3 Suppose, because of a small-scale oil spill, that in 1988 your major fishery was closed **TWO WEEKS EARLIER** as an emergency measure. How would you have adjusted to this during that period? (circle number)

1. SWITCHED TO ANOTHER FISHERY DURING THIS PERIOD.

Which one(s)? _____

2. SWITCHED TO A PAID NON-FISHING JOB.



- (a) Which job do you think you would have switched to? _____
- (b) About how many days would have passed between season closure and starting job? _____ DAYS
- (c) How much do you think you could have earned in this job? \$ _____
PER WEEK / MONTH / YEAR
(circle one)

3. TAKEN TIME OFF, WORKED ON BOAT, OR DONE OTHER UNPAID WORK.

Q-4 Imagine that a large-scale event like the Alaska oil spill occurs on the Pacific Coast. Assume that your MAJOR FISHERY is the most severely impacted and that managers must TEMPORARILY (for a ONE YEAR period) close that fishery for the SECOND HALF of the normal season. For example:

- salmon season closes on 7/31 instead of 10/31.
- or crab season closes on 3/15 instead of 7/15.
- or herring season closes on 1/15 instead of 3/10.
- or groundfish closes on 6/30 instead of open all year around.

Assume also that ALL OTHER FISHERIES are relatively uncontaminated and remain as presently regulated. What is your best guess about how you would respond to these changes during the CLOSED HALF SEASON?

1. SWITCH TO ANOTHER FISHERY.

Which one(s)? _____

Please skip
to Q-9 on
page 4.

2. SWITCH TO A PAID NON-FISHING
JOB.

Please
continue
with Q-5.

3. TAKE TIME OFF, WORK ON BOAT,
OR DO OTHER UNPAID WORK.

Please skip
to Q-10 on
page 4.

Q-5 What is your BEST GUESS about the specific occupation you would switch to during the closed season?

OCCUPATION: _____

Q-6 Using your best guess, how long do you think it would take you to switch to this specific job? (circle number)

- 1. LESS THAN 2 WEEKS
- 2. 2 WEEKS - 1 MONTH
- 3. 1 - 2 MONTHS
- 4. OVER TWO MONTHS
- 5. OTHER (please specify) _____

Q-7 What is your best guess about WHERE you might find this specific occupation? (circle number)

1. IN MY CURRENT TOWN/CITY OF RESIDENCE
2. 1-20 MILES FROM MY CURRENT RESIDENCE
3. 21-50 MILES FROM MY CURRENT RESIDENCE
4. 50-100 MILES FROM MY CURRENT RESIDENCE
5. OVER 100 MILES FROM MY CURRENT RESIDENCE
6. OTHER (please specify) _____

Q-8 Would you have to move from your current town/city of residence? (circle number)

1. NO
2. YES

Q-9 What is your BEST GUESS about how much your before-tax earnings might be in this alternative fishery or non-fishing job? Note: a rough estimate is sufficient here.

ESTIMATED
EARNINGS: \$ _____ PER WEEK / MONTH / YEAR
(circle one)

Q-10 Now assume that the impact on your major fishery is long term rather than just temporary. Specifically suppose that an oil spill reduces abundance in your MAJOR FISHERY so that managers must reduce the season length to half its current length over a five year period. What is your best guess about how you would adjust to this long term season reduction in your major fishery, assuming that all other fisheries are unaffected?

1. SWITCH TO ANOTHER FISHERY.

Which one(s)? _____

→ Please skip to Q-12 on page 5.

2. SWITCH TO A PAID NON-FISHING JOB.

→ Please continue with Q-11.

3. TAKE TIME OFF, WORK ON BOAT, OR DO OTHER UNPAID WORK.

→ Please skip to Section II on page 6.

Q-11 What is your **BEST GUESS** about the specific occupation you would switch to during the closed season?

OCCUPATION: _____

Q-12 Using your best guess, how long do you think it would take you to switch to this alternative fishery or non-fishing job? (circle number)

1. LESS THAN 2 WEEKS
2. 2 WEEKS - 1 MONTH
3. 1 - 2 MONTHS
4. OVER TWO MONTHS
5. OTHER (please specify) _____

Q-13 What is your best guess about **WHERE** you might find this alternative fishery or non-fishing job? (circle number)

1. IN MY CURRENT TOWN/CITY OF RESIDENCE
2. 1-20 MILES FROM MY CURRENT RESIDENCE
3. 21-50 MILES FROM MY CURRENT RESIDENCE
4. 50-100 MILES FROM MY CURRENT RESIDENCE
5. OVER 100 MILES FROM MY CURRENT RESIDENCE
6. OTHER (please specify) _____

Q-14 Would you have to move from your current town/city of residence? (circle number)

1. NO
2. YES

Q-15 What is your **BEST GUESS** about how much your before-tax earnings might be in this alternative fishery or non-fishing job? Note: a rough estimate is sufficient here.

ESTIMATED
EARNINGS: \$ _____ PER WEEK / MONTH / YEAR
(circle one)

**II. TIME COMMITMENT AND INCOME CONTRIBUTION
OF YOUR COMMERCIAL FISHING AND
NON-FISHING ACTIVITIES**

We would like to assess how much damage would result if a disaster like the Alaska oil spill occurred along the Pacific Coast. To do this we need some idea about how important commercial fishing is to you and your family, both in terms of **TIME** commitment and contribution to total family **INCOME**. In this section we need to ask some questions about your 1988 family income from all sources. Please be assured that your responses will be completely anonymous and cannot be traced back to you in any way. For your convenience we have inserted a **CALENDAR** here for you to use as a **worksheet** in answering Q-16 and Q-17 if you wish.

Q-16 Please estimate, to the best extent possible, how much **TIME** you spent in various fisheries in 1988 together with the **INCOME** each activity generated. We realize that it may be difficult to remember or be absolutely accurate, so please simply **ESTIMATE** as best as you can. Please round to nearest thousand dollars, and put zero in for activities that do not apply.

COMMERCIAL FISHING		
Your Primary Activity Was Fishing for:	Total Number of Weeks You Spent	Contribution to Before-Tax Family Income (In Dollars)
Salmon		
Crab		
Albacore		
Shrimp		
Herring		
Sea Urchin		
Mackerel		
Squid		
Groundfish		
Other Fisheries		
Fishing-Related (boat repair, etc.)		

Q-17 To complete our assessment of potential oil spill impacts, we also need information on other non-fishing sources of family income. Please fill in the following table for your non-fishing jobs, your other non-employment income, and (if married) your spouse's or adult household partner's activities. Again, please be assured that this information is completely anonymous. (If your spouse or adult household partner does not have an income-earning job, please write down "0" in the corresponding boxes.)

Non-Fishing			
Activity		Total Weeks	Before-Tax Income
Income-Earning	You		
	Spouse		
Other Family Income (interest, rent, etc.)			

III. ABOUT YOUR FISHING VESSEL AND FISHING ACTIVITIES

Q-18 Please tell us about the vessel you fished on in 1988: (If you used more than one vessel, answer for the vessel which you used to fish for your MAJOR FISHERY.)

_____ LENGTH
 _____ TONNAGE
 _____ ENGINE HORSE POWER
 _____ YEAR BUILT

\$ _____ APPROXIMATE CURRENT MARKET VALUE

Q-19 On average, how many crew members (INCLUDING SKIPPER, family members, paid and unpaid crewmembers) worked on the vessel described above in 1988?

_____ CREWMEMBERS ((INCLUDING SKIPPER, family members, paid and unpaid crewmembers)

Q-20 During the 1988 commercial fishing season, which of the following applied to YOU AND THE ABOVE DESCRIBED VESSEL? (circle number)

1. I WORKED AS A SKIPPER ON A VESSEL I OWN.
 2. I WORKED AS A SKIPPER ON A VESSEL OWNED BY SOMEONE ELSE.
 3. I WORKED AS A CREW MEMBER ON A VESSEL OWNED BY SOMEONE ELSE.
 4. OTHER (please specify)
- _____

If your major fishery in 1988 was

SALMON
or CRAB
or SHRIMP
or HERRING

} → **Please continue with Q-21.**

Otherwise, → **Please skip to Q-22 on page 10.**

Q-21 Consider only the **LAST OPEN AREA** in which you fished for your **MAJOR FISHERY** in 1988. Did you continue fishing in that fishery right up until **SEASON CLOSURE** in that area? (circle number)

1. NO



What did you do during the rest of the **OPEN** season? (circle number)

1. SWITCHED TO ANOTHER FISHERY

Which one(s)? _____

2. SWITCHED TO A PAID NON-FISHING JOB, FOR EARNINGS OF \$ _____

PER WEEK / MONTH / YEAR
(circle one)

3. TOOK TIME OFF, OR WORKED ON BOAT, OR DID SOME UNPAID WORK

2. YES



Would you have continued fishing if the season in 1988 had been **EXTENDED** two weeks longer? (circle number)

1. YES

2. NO



Please skip to Section IV, Q-23 on page 10.

Q-22 Consider only the LAST AREA in which you fished for your MAJOR FISHERY in 1988. Did you continue fishing in that fishery right up until THE END OF 1988 in that area? (circle number)

1. NO



What did you do during the rest of the year?
(circle number)

1. SWITCHED TO ANOTHER FISHERY

Which one(s)? _____

2. SWITCHED TO A PAID NON-FISHING
JOB, FOR EARNINGS OF \$ _____
PER WEEK / MONTH / YEAR
(circle one)

3. TOOK TIME OFF, OR WORKED ON BOAT,
OR DID SOME UNPAID WORK

2. YES

IV. ABOUT YOU AND YOUR FAMILY

Q-23 What is the zip code of your primary residence?

_____ ZIP CODE

Q-24 How many people including yourself live at the above residence?

_____ PEOPLE

Q-25 How many children under 18 living in your household are in each age group?

_____ 0 - 3 YEARS OLD
_____ 4 - 6 YEARS OLD
_____ 7 - 12 YEARS OLD
_____ 13 - 18 YEARS OLD

Q-26 How many years since age 18 have you done at least some commercial fishing?

_____ YEARS

Q-27 Do you have a spouse or adult household partner over age 18 who lived in your household in 1988? (circle number)

- 1. NO
- 2. YES

Q-28 Please tell us about yourself and your spouse (or adult household partner):

	YOU	SPOUSE/PARTNER (Skip this column if not applicable.)
Age	_____	_____
Years of NON-FISHING employment since age 18	_____	_____
Years of formal education completed (for example: completed high school = 12)	_____	_____

Q-29 How would you rate your and your spouse's (or adult household partner's) health conditions in 1988? (circle number)

	POOR				EXCELLENT
YOU	1	2	3	4	5
	POOR				EXCELLENT
SPOUSE/PARTNER	1	2	3	4	5

Your contribution to this study is very greatly appreciated. If you would like a summary of results, please print your name and address on the back of the return envelope (NOT on this questionnaire.) We will see that you receive it.

OMB#0648-0189

