SOUTHWEST FISHERIES CENTER

NATIONAL MARINE FISHERIES SERVICE HONOLULU LABORATORY P.O. BOX 3830 HONOLULU, HI 96812

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October 1984

ECONOMIC AND FINANCIAL ANALYSIS OF HAWAII'S LONGLINE AND HANDLINE FISHERIES

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Honolulu Hawaii 96813

Not for Publication

ADMINISTRATIVE REPORT H-84-17C

Southwest Fisheries Center Administrative Report H-84-17C

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PREFACE

This report was prepared under contract (81-ABC-00267) by A. Lono Lyman, Inc. for Hawaii Opinion, Inc. of Honolulu, Hawaii. The purpose of the project was to present an economic analysis of the Hawaii longline and handline fishing fleets based on survey data provided by Hawaii Opinion (Southwest Fisheries Center Administrative Report H-84-7C).

The data utilized in this analysis represent one point in time, the 1981 fishing year. The economic analysis was limited by three significant constraints: Reluctance on the part of commercial fishers to reveal sales revenue information, difficulties in identifying components of the longline and handline fleets, and a lack of historical time-series information on the economic performance of these fleets. The latter limitation is mediated by previous work done on the longline fleet (cf., Ashan, Ball, and Davidson, Costs and earnings of tuna vessels in Hawaii, University of Hawaii Sea Grant Report AR-72-01, 1972) and by a recent paper on Hawaii's Northwestern Hawaiian Islands bottom fish handline fishery (cf., Hau, Economic analysis of deep bottomfishing in the Northwestern Hawaiian Islands, University of Hawaii Sea Grant Report MR-84-01, 1984). Nonetheless, the data and the analysis contained in this report should be used with care.

Despite these limitations, the economic and financial analysis provides the most recent baseline from which to evaluate fisheries development and management decisions, and from which to extend the information required for more precise analysis. As a contract report, the statements, findings, conclusions, and recommendations cointained in this report are those of the contractors and do not necessarily represent the views of the National Marine Fisheries Service.

Samuel G. Pooley
Industry Economist

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I - INTRODUCTION

A. Lono Lyman, Inc. was engaged as a subcontractor by Hawaii Opinion to provide financial and economic analysis in conjunction with the cost-earnings study contracted for by the National Marine Fisheries Service (NMFS), OMB number 0648-0117. Hawaii Opinion was the prime contractor for the study responsible for the conduct of the study survey, preparing a computer tape of the survey results, and preparing the final report(s) for the study including incorporation of this narrative material with any material that Hawaii Opinion may add.

The primary responsibility of A. Lono Lyman, Inc. was to establish proto-types based on the cost-earnings data derived from the survey. A secondary area of responsibility was to provide a narrative summary that described the model and its output, to discuss the historical perspective of the longline and handline fisheries and the current status of the fisheries economic performance, and to discuss the potential impacts of a limited number of management and development policies.

REVISED SCOPE OF REPORT

Hawaii Opinion's proposal to conduct the work had anticipated that one general proto-type would be developed for each of four fisheries involved in the study. These fisheries were: the longline fishery, the palu ahi and the ika-sibi tuna handline fisheries, and the deep sea bottomfish fishery.

Limited response to the survey questions concerning revenues and the failure to explicitly query the palu ahi and the ika-sibi tuna handline fisheries made it necessary to modify both the cost-earnings and policy/management analysis. The need to make these revisions results from several problems beyond our control including the following:

(1) The data sets for both longline and handline fisheries were found to be of little analytical value because very limited revenue data was obtained. For the longline, only two of the interviews had any revenue data. In the case of the handlines, less than 50% of the observations have any sales data, presenting a serious degrees of freedom problem for testing most fishery economic models. **It should be noted that the degree of inconsistency and non-response for the handline vessels should not be unexpected. It is almost always difficult to collect economic information relating to part-time or non-commercial activities.**

(2) There was no question in the survey instrument that directly relates to distinguishing between the ika-sibi and Palu ahi fishing techniques used by tuna handline fishermen. It had been presumed that the distinction between the two types of tuna fishermen could be determined based on the species of the fish they caught. However, this proved not to be the case.

(3) Additionally, one can only use catch and/or sales data, to the extent it is provided by respondents, to infer which fishermen are primarily involved in the tuna handline fishery and which are primarily involved in the deep sea bottom fishery.

The factors cited above resulted in the need to concentrate on analysis of variable costs per day at sea. The cost-earnings analysis is limited to analysis of the volume weight of fish required to breakeven and to achieve a 25% return on investment. The analysis of fishery management and development policies, presented in Chapter V, focuses on policies related to maintaining sustainable yields, reducing costs, and increasing per unit sales prices.

REPORT ORGANIZATION

Chapter II of this report briefly discusses the historical perspective of the longline and handline fisheries and the current status of the fisheries' economic performance. Chapters III and IV provides a narrative summary of the financial and economic analysis for the longline and handline survey data, respectively. Chapter V presents a sensitivity analysis and discusses selected management and development policies.

II - HISTORICAL OVERVIEW

During the 1940's and through the 1960's, Hawaii's fishing industry experienced either losses or no growth in the volume weight of the catch landed. It was not until the early 1970's that a renewed interest in the State's fisheries began to emerge and not until the second half of the seventies that this interest resulted in actual gains in investment, employment, and productivity. The following sections discuss the various fisheries considered in this study.

LONGLINE FISHERY

The longline fishery, often referred to as the flagline fishery, experienced substantial decline in the number of vessels over the past 30 years. Despite this decline, it appears that the fleet is experiencing renewed growth, given that seven longliners have been added to the fleet since 1969. Additionally, the market remains strong for the longline yellowfin tuna catch, and the development of air-freighted exports of ahi to Japan has increased the demand for, and price of, the longliners' catch.

The longline fishery's main catch are yellowfin and bigeye tuna. The Hawaii Fisheries Development Plan estimates that the potential for yellowfin and bigeye is an additional 11 to 25 million pounds, and that shark and billfish is two to four million pounds. By comparison, in 1976 the estimated catch of these species by longline fishermen was less than one-half million pounds. This suggests that substantial resources remain for further development of the fishery.

Longline fishing occurs at depths of 150 to 300 feet depending on the season and the species. Most fishing takes place within 50 miles of the main Hawaiian Islands, although the larger vessels will occasionally take longer trips to distant grounds.

The longline fleet consists of two relatively distinct segments: single fishery, traditional sampan vessels, and multi fishery vessels which use longline gear in particular fishing activities. Although growth of the latter segment has reportedly been substantial in recent years, the Hawaii Opinion survey, used in this report, concentrated on the traditional sampan vessels.

PALU AHI AND IKA-SIBI FISHERIES

The palu ahi and ika-sibi fisheries are the primary types of tuna handline fisheries. The number of fishermen involved in both methods of fishing has increased substantially over the last ten years and further expansion could occur in the future. The tuna handline fishermen use relatively small vessels and typically have two or three crew members.

Until recently, relatively few if any fishermen practiced the ancient Hawaiian palu ahi method of handline fishing. By 1979 an estimated 100 full and part time fishermen used the method. The palu ahi technique involves the use of a stone sinker which takes a hook on a line and mashed chum (palu) to a depth of 100 to 150 feet. The stone and chum are then released causing a feeding frenzy among fish in the area and the possibility of a catch.

Similarly, as recently as 1971 there were only three or four vessels using the ika-sibi method. By 1979, there were an estimated 100 full time ika-sibi vessels with an estimated 80% based on the island of Hawaii. Very similar to palu ahi, ika-sibi fishermen use a line lowered to depths of about 100 feet. Ika-sibi, however, is done at night and the bait is either imported frozen squid or fresh squid caught by using a lighted jig or a gaff. The squid is attached to the hook and dropped to the desired depth.

The primary catch for the tuna handline fisheries is also yellowfin and bigeye tuna. In 1973, the ika-sibi fishery produced landings of 196,00 pounds and by 1975 the catch had increased to 341,000 pounds. By 1979, the combined palu ahi and ika-sibi catch exceeded one million pounds. The Hawaii Fisheries Development Plan estimates the potential for tuna handline fisheries at three to five million pounds of additional landings.

DEEP SEA BOTTOMFISH FISHERY

There is not much solid data regarding the number of vessels distinctly engaged in bottomfishing. As many as 1,000 vessels may be identified as handline vessels but many of them are primarily ika-sibi or palu ahi vessels. Like the tuna handline fishery, they are relatively small sized vessels and differ significantly from the larger bottomfish vessels studied by Hau (1983).

Despite the lack of historical data, it is generally regarded that the deep sea bottomfish fishery has grown in the last decade. One factor in the growth is the increased price paid for the bottomfish species. Another factor in the growth is the increased cost of fuel for trolling which has led to fishermen turning from trolling to bottomfishing.

The Hawaii Fisheries Development Plan reports that the waters surrounding the larger islands in the Hawaiian chain have been fished to a point that either approaches or exceeds the sustainable yield for bottomfish. The Northwestern Hawaiian Islands may allow for an expansion of this fishery, but this involves larger-sized vessels than those used in the main island fishery.

The fishing technique used by the deep sea bottom fish fishermen is very similar to that used by the tuna handline fishermen. Deep sea lines are used with hooks and chum bait. The fishing depths, however, are much greater, ranging from 180 to 900 feet. The primary catch of the deep sea fisheries is opakapaka, onaga, and uku.

III - LONGLINE FLEET ANALYSIS

OVERVIEW

The longline fleet survey conducted by Hawaii Opinion interviewed the captains and owners of Oahu based longliners. The sample for the longline survey was provided by NMFS staff. A total of thirty eight vessel names and owners, statewide, represented the universe for the survey. This included both "flagline", part-time, and small scale vessels using modified longline gear. Data collection was conducted from June 30 to July 30, 1982. A total of thirteen interviews were completed on Oahu. Additional attempts were made to recontact respondents between December 7 and 15, 1982, in those cases where editing revealed incomplete or missing information. Of the remaining twenty five vessels for which surveys were not completed, Hawaii Opinion could not contact twelve during the survey period, and the remaining thirteen were not based on Oahu during the survey period.

The longline survey had a a poor response rate to questions concerning asset value, financing, revenues, and expenses. Thus our analysis is limited by the reluctance on the part of respondents to provide information. In addition, given that interviews were completed with less than half of the the thirty eight vessels in the longline sample, sampling bias may be reflected in the data that was provided. Our perception is that the vessels sampled comprise the traditional sampan style of longline fishing, and not the newer multi-purpose vessels.

FLEET DESCRIPTION

Based on the surveys completed, Table III-A summarizes selected attributes of the longline fleet. As indicated, the longline fleet vessels have a mean length of 61 feet and mean net tonnage of 25.5 tons. The mean age of the vessels in mid-1982 was fifteen years, indicating that the typical boat was built in the mid-1950s. Of the thirteen interviews completed, respondents indicated that one vessel was built prior to 1940, and another five were built during the period 1940 to 1949.

TABLE III-A

Selected Attributes of the Longline Fleet

		Respondents Providing Data
Length of boat	61.2 feet	13
Net Tonnage	25.50 tons	12
Age of vessel	14.8 years	13
Year vessel built	1956	13

Source: Hawaii Opinion, H-83-11C.

OWNERSHIP AND VESSEL FINANCING

The predominant form of ownership for the longline respondents was that of a sole proprietorship. Of the thirteen longline respondents, eight, representing 62% of total, operated as sole proprietorships. The remaining five longline respondents were distributed amongst partnership, corporate and other forms of ownership.

TABLE III-B

Vessel Ownership for Longline Respondents

	Respondents Providing Data	Distribution Of Respondents
Sole Proprietorship	8	61.5%
Partnership	1	7.7
Corporation	2	15.4
Other	2	15.4

Source: Hawaii Opinion, H-83-11C.

The form of ownership generally affects the method of financing used for the vessels, inasmuch as sole proprietorships and partnerships generally rely on personal and investor financing, respectively. Table III-C indicates that of the thirteen respondents, 62% indicated that they had used personal funds to finance a portion of the vessel costs, and 85% had used funds from other investors. Funds derived from a bank loan were used for 46% of the vessels. Government guaranteed loans were used for only two vessels representing 15% of the total. According to Hawaii Opinion's summary, the distribution of funds used to finance the cost of a vessel indicates a mean of 47% of the funds being derived from personal resources and 45% from loans provided by banks. It is presumed that the remaining 8% is derived from other investors, government guaranteed loans, and/or other sources.

TABLE III-C

Method of Financing for Longline Respondents(1)

	Respondents Providing Data	Distribution Of Respondents
Personal Funds	8	61.5%
Other Investors	11	84.6%
Bank Loan	6	46.2%
Government Guaranteed Loan	2	15.4%
Other	1	7.7%

(1) Responses reflect multiple methods of financing.

Source: Hawaii Opinion, H-83-11C.

PURCHASE PRICE AND ESTIMATE OF CURRENT VALUE OF VESSEL

Table III-D presents a summary of the mean purchase value and estimated current value of longline vessels. The table also includes the computed standard error of the mean and the number of respondents. The standard error of the mean is used to estimate the population mean at a 50.0% confidence interval. The upper and lower limits of the interval represent an estimate of the upper and lower quartiles of a distribution of sample means drawn from the population of longline fishermen. There is a fifty percent (50%) likelihood that the unknown population mean will lie within the interval. There is a twenty five percent (25%) likelihood that the population mean is below the lower limit, and a similar likelihood that it is above the upper limit.

TABLE III-D

MEAN AND 50% CONFIDENCE INTERVAL
PURCHASE PRICE AND ESTIMATED CURRENT VALUE OF VESSEL
FOR ALL LONGLINE RESPONDENTS

	Mean	Std Error of Mean	Est. Mean at Lower Limit	50.0% Conf. Upper Limit	Responses
Purchase Price of Boat....................	$94,537	38,973	$67,256	$121,818	11
Current Value of Boat.....................	170,318	46,964	137,444	203,193	11

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

Table III-D indicates that the typical longline vessel required an initial capital investment of just under $100,000, and that respondents estimate that the current value of the vessels have appreciated. The mean purchase price of the long line vessels is $94,537 with the estimated mean at the lower and upper limits of the 50% confidence intervals $67,256 and $121,818, respectively. The mean estimated value of the long line vessels is $170,318 with the estimated mean at the lower and upper limits of the 50% confidence intervals $137,318 and $203,193, respectively. The rate of change between the mean purchase price and the mean estimated current value of the vessels is 4.00% annually. The 4% rate of change is less than the rate of inflation, and suggest that the "real" value of the vessels, after considering the impact of inflation, has actually been depreciating.

TRIP ANALYSIS

Table III-E indicates that during a typical month the longline respondents made 2.77 trips per month with an average duration of 6.19 days per trip. Multiplying the average number of trips per month by the average duration of the typical trip indicates that on the average 206 days annualy were spent at sea, representing 56% of the year. The estimated mean at the lower limit of the 50% confidence interval indicates an average of 2.59 trips per month lasting 5.89 days per trip, representing 183 days at sea per year or 50% of the year. The estimated mean at the upper limit indicates an average of 2.95 trips per month lasting 6.49 days per trip, representing 230 days at sea per year or 63% of the year.

TABLE III-E

TRIP ANALYSIS FOR ALL LONGLINE RESPONDENTS

	Mean	Standard Error of Mean	Est. Mean at 50.0% Conf. Lower Limit	Upper Limit	Responses
Number of Fishing Trips Average Month	2.77	.26	2.59	2.95	13
Duration of Fishing Trip (days)	6.19	.43	5.89	6.49	13
Days at Sea Per Year	205.78		183.22	229.61	

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

CAPITAL, FIXED AND VARIABLE EXPENSES

Table III-F presents summary statistics for capital, fixed and variable expenses indicated by longline respondents. The data indicate that total capital, fixed and variable cost of the respondents averaged $170,200. Capital and fixed expenses represented $24,450, or 14.4% of the total, and variable expenses represented $145,800, or 85.6% of the total. The estimated mean for total capital, fixed, and variable expenses at the 50.0% confidence interval indicated a lower limit of $139,500 and an upper limit of $200,900.

TABLE III-F

MEAN AND 50% CONFIDENCE INTERVAL
CAPITAL, FIXED AND VARIABLE EXPENSES
FOR ALL LONGLINE RESPONDENTS

	Mean	Standard Error of Mean	Est. Mean at Lower Limit	50.0%Conf. Upper Limit	Responses
Capital Expenses and Fixed Expenses:					
Boat Mortgage Paid in 1981	$16,456	844	$15,863	$17,049	10
Other Loans Paid in 1981	4,556	2,892	2,514	6,597	9
Licenses and Fees	2,241	1,482	1,187	3,294	8
Accounting and Bookkeeping	1,182	397	897	1,467	7
Sub Total	$24,434		$20,461	$28,408	
Variable Expenses					
Repairs					
Engine	$10,929	3,114	8,693	13,164	7
Hull	4,413	663	3,941	4,884	8
Electronic	919	316	694	1,144	8
Fish Equipment	4,671	1,218	3,797	5,546	7
Sub Total	$20,931		$17,125	$24,738	
Fuel and Oil	$11,561	3,114	$9,363	$13,760	9
Fishing Gear	8,871	663	8,395	9,348	7
Bait	12,798	316	12,575	13,020	10
Ice	4,692	1,218	3,836	5,548	10
Food	8,321	2,752	6,386	10,256	10
Auction and Unloading Fees	21,390	3,805	18,479	24,301	4
Sub Total	$67,633		$59,034	$76,232	
Share of Fish Paid to Crew and Captain(1)	$57,200	18,701	$42,894	$71,506	4
TOTAL VARIABLE EXPENSES	$145,764		$119,052	$172,476	
TOTAL CAPITAL, FIXED AND VARIABLE EXPENSES	$170,199		$139,513	$200,884	

(1) The share of fish paid to crew and captain is reported in the above table as a wage that does not vary relative to revenue.

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

VARIABLE EXPENSES PER DAY AT SEA

Table III-G presents the estimated variable expenses per day at sea based on the annual variable costs and the estimated days at sea. The mean variable expenses are estimated to be $708 per day at sea. The mean at the lower and upper limits of the 50% confidence intervals are estimated to be $650 and $751 per day at sea, respectively.

The analysis presented in Table III-G indicates that repairs account for 14% of the total variable costs reflecting both the relative age of the sampled vessels (15 years), and the fact that going to sea is rough on vessels. The average fuel and oil cost represents 8% of total variable costs. Gear costs represent 6% of total variable costs. Bait and ice represent a total of 12%, and auction and unloading fees represent 15% of total variable costs. The share of fish paid to crew and captain, representing 39% of variable cost, is reported in the table as a wage that does not vary relative to revenue.

TABLE III-G

VARIABLE EXPENSE ANALYSIS PER DAY AT SEA FOR ALL LONGLINE RESPONDENTS

	Mean	Est. Mean at 50.0% Conf. Lower Limit	Upper Limit
Repairs:			
Engine	$53.11	$47.44	$57.33
Hull	21.44	21.51	21.27
Electronic	4.46	3.79	4.98
Fish Equipment	22.70	20.72	24.15
Sub Total	$101.72	$93.46	$107.74
Fuel and Oil	$56.18	$51.10	$59.93
Fishing Gear	43.11	45.82	40.71
Bait	62.19	68.63	56.70
Ice	22.80	20.93	24.16
Food & Provisions	40.44	34.85	44.67
Auction and Unloading Fees	103.95	100.86	105.84
Sub Total	$328.68	$322.20	$332.01
Share of Fish Paid to Crew and Captain(1)	$277.97	$234.11	$311.43
TOTAL VARIABLE EXPENSES	$708.37	$649.77	$751.18

(1) The share of fish paid to crew and captain is reported in the above table as a wage that does not vary relative to revenue.

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

BREAKEVEN AND RETURN ON INVESTMENT ANALYSIS

Since only two of the longline respondents provided revenue data, the breakeven and return on investment analysis, summarized in this section, makes the a priori assumption that the volume of fish caught and the resulting revenues earned are primarily dependent on the time spent at sea. In making this assumption, it is acknowledged that the volume weight is also dependent on other variables, such as the amount of gear used, the intensity of fishing effort, and the skill of the captain. These variables are not considered in the analysis.

Breakeven Analysis

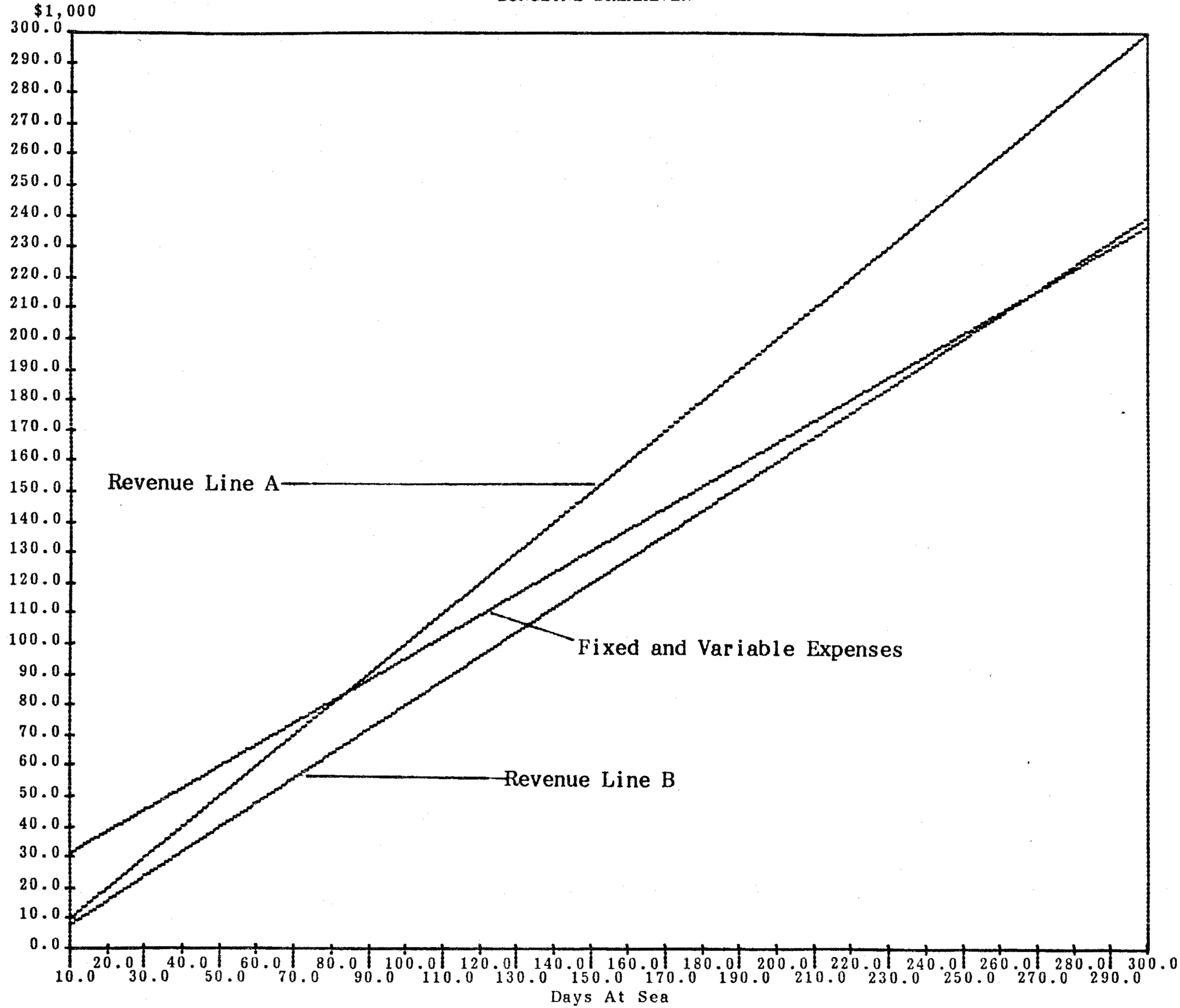
Breakeven analysis is based on relationships between costs and revenues and is useful in determining at which point revenues will cover total costs. Two sets of analysis were prepared. The first set is based on the linear relationship between expenses and revenues. The second set is based on the estimated volume weight of fishing activity necessary to cover total costs, assuming different periods of fishing activity ranging from one day to 300 days at sea.

Breakeven Analysis Depicting Revenues and Expenses

Illustration III-A is a graph showing the linear relationship between total expenses relative to the revenues that would be derived based on different assumptions regarding average daily catch rates and average price per pound. The graph illustrates the impact of a 25% change in either the average daily catch or the average price of fish per pound.

ILLUSTRATION III-A

LONGLINE BREAKEVEN



"Revenue Line A" assumes revenues of $800 per day at sea and "Revenue Line B" assumes revenues of $1,000 per day. The breakeven analysis depicted in Illustration III-A indicates that Revenue Line B would be profitable after approximately 85 days at sea, while Revenue Line A would not be profitable until after approximately 215 days at sea. The analysis illustrates the sensitivity of the effort required to break even relative to the factors determining average revenue per trip. The principal factors are the volume weight of fish caught per day and the average price per pound of fish sold.

Analysis Depicting Average Catch to Breakeven

Table III-H summarizes and Illustration III-B depicts a graphic plotting of the breakeven analysis for the mean value of all longline responses and the estimated means at the 50% confidence interval based on an assumed average price to the seller of $2.00 per pound. The analysis computes the average daily catch required to breakeven per day at sea for periods of 10 to 300 days annually. As would be expected, the fixed costs require a relatively high breakeven point for relatively short annual periods at sea. The breakeven point decreases at a declining rate as relative portion of the year spent at sea increases. Based on the mean value, after 100 days per year at sea, the breakeven point is 476 pounds per day at sea, after 200 days at sea it decreases to 415 pounds per day, and after 300 days it is 395 pounds per day.

TABLE III-H

POUNDS OF FISH REQUIRED TO BREAKEVEN AT $2.00 PER POUND
BASED ON AN ANALYSIS OF ALL LONGLINE RESPONDENTS

Days At Sea Per Year	----------Pounds Per Day At Sea--------		
		50% Confidence Interval	
	Mean Value $2.00/lb.	Lower Lmt $2.00/lb.	Upper Lmt. $2.00/lb.
10	1,576	1,348	1,796
20	965	836	1,086
30	761	666	849
40	660	581	731
50	599	529	660
60	558	495	612
70	529	471	579
80	507	453	553
90	490	439	533
100	476	427	518
110	465	418	505
120	456	410	494
130	448	404	485
140	441	398	477
150	436	393	470
160	431	389	464
170	426	385	459
180	422	382	455
190	418	379	450
200	415	376	447
210	412	374	443
220	410	371	440
230	407	369	437
240	405	368	435
250	403	366	432
260	401	364	430
270	399	363	428
280	398	361	426
290	396	360	425
300	395	359	423

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION III-B

BREAKEVEN ANALYSIS OF LONGLINE RESPONDENTS

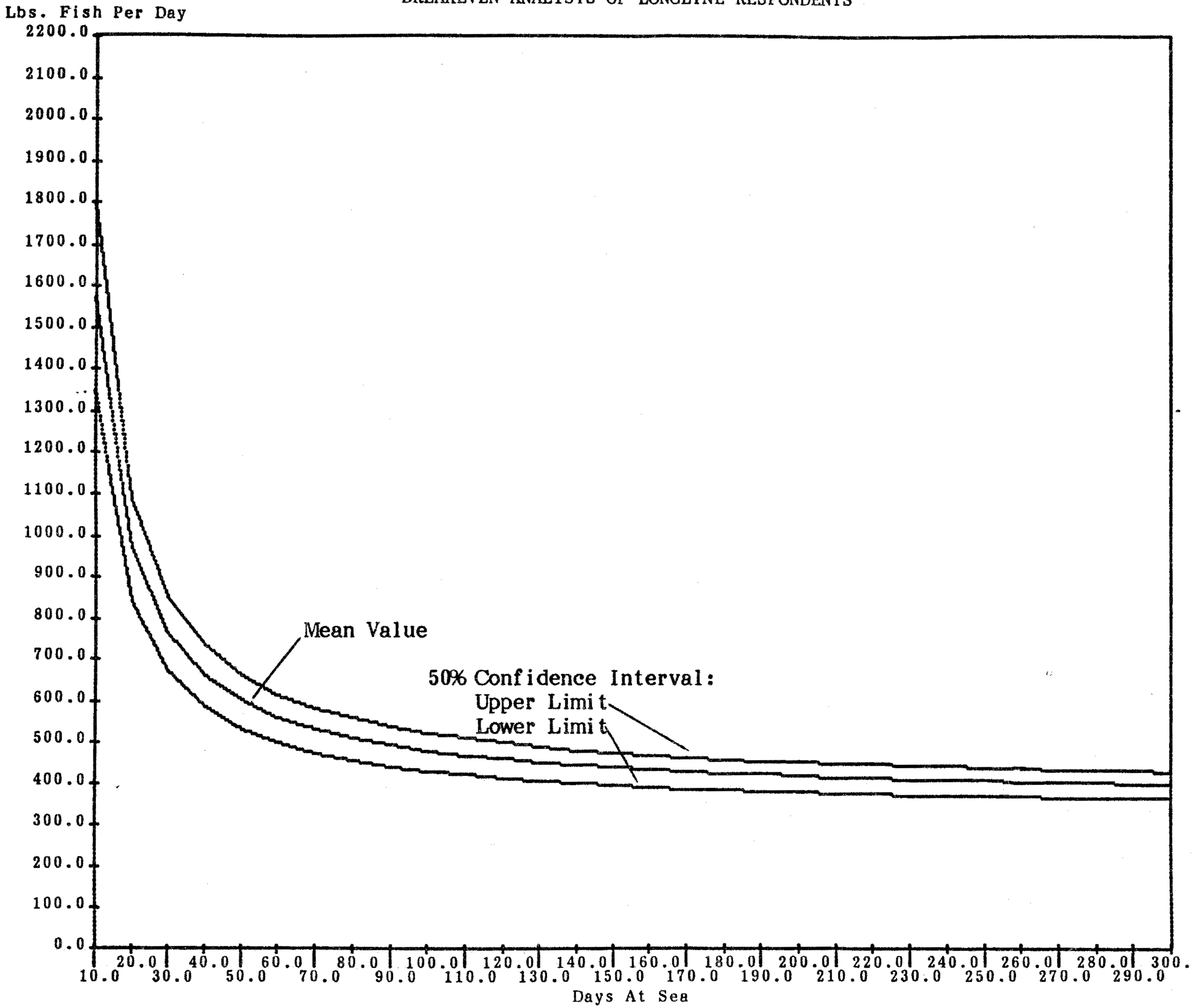


Table III-I summarizes and Illustration III-C depicts a graphic plotting of the breakeven analysis based on the mean of all longline responses and assumes average prices to the seller of $1.50, $2.00, and $2.50 per pound of fish. The analysis computes the average daily catch required to break even for periods ranging between 10 and 300 days at sea annually. As would be expected, the fixed costs require a relatively high breakeven point for relatively short annual periods at sea, and the breakeven point decreases at a declining rate as the days per year spent at sea increases. Also, as would be expected, there is an inverse relationship between average price per pound and the volume weight of catch required to break even. For example, a 25% decrease in price from $2.00 to $1.50 per pound results in a 33% increase in the breakeven point, while a 33% increase in price from $1.50 to $2.00 results in a 25% decrease in the breakeven point.

TABLE III-I

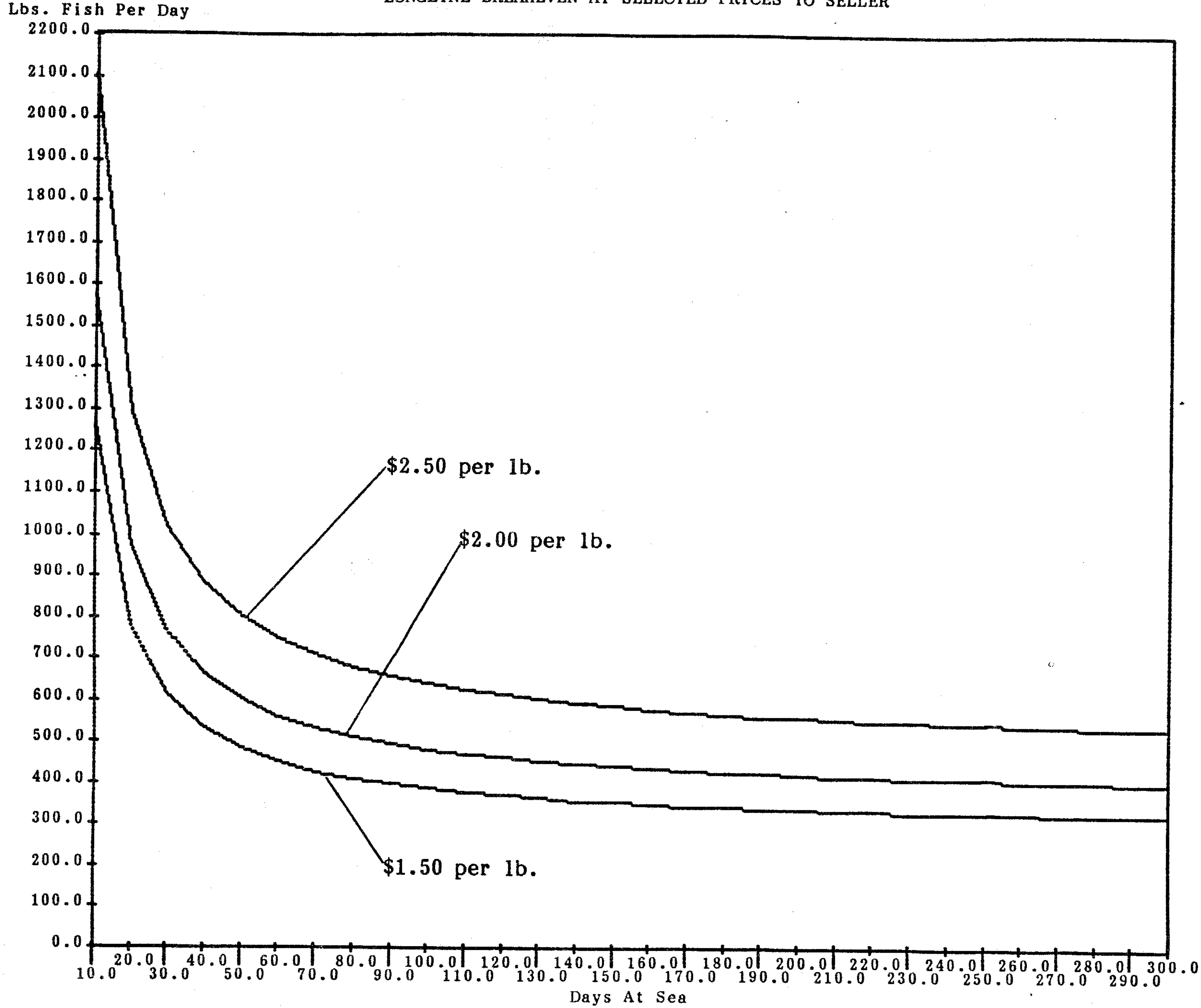
POUNDS OF FISH REQUIRED TO BREAKEVEN AT SELECTED PRICES
BASED ON THE MEAN FOR ALL LONGLINE RESPONDENTS

Days At Sea Per Year	Pounds Per Day At Sea $1.50/lb.	$2.00/lb.	$2.50/lb.
10	2,101	1,576	1,261
20	1,287	965	772
30	1,015	761	609
40	879	660	528
50	798	599	479
60	744	558	446
70	705	529	423
80	676	507	406
90	653	490	392
100	635	476	381
110	620	465	372
120	608	456	365
130	598	448	359
140	589	441	353
150	581	436	349
160	574	431	344
170	568	426	341
180	563	422	338
190	558	418	335
200	554	415	332
210	550	412	330
220	546	410	328
230	543	407	326
240	540	405	324
250	537	403	322
260	535	401	321
270	533	399	320
280	530	398	318
290	528	396	317
300	527	395	316

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION III-C

LONGLINE BREAKEVEN AT SELECTED PRICES TO SELLER



Return on Investment Analysis

The rate of return required by investors may be thought of as being comprised of three parts: the risk-free rate, a premium for business risk, and a premium for financial risk. The risk-free rate is the rate of return that could be earned on United States Treasury securities. The premium for business risk is attributable to the possible fluctuation of future operating income, and the premium for financial risk is attributable to the fluctuation of future earnings available to the proprietor, partners, or shareholders.

The analysis of return on initial investment is to estimate the volume weight of fishing activity necessary to cover an assumed 25% return on initial investment, and the total fixed, capital and variable costs assuming different periods of fishing activity ranging from one day to 300 days at sea. Two sets of analysis were prepared and are briefly discussed below.

Table III-J summarizes and Illustration III-D depicts a graphic plotting of the return on initial investment analysis for the mean value of all longline responses and the estimated means at the 50% confidence interval based on an assumed 25% rate of return on initial investment and average price to the seller of $2.00 per pound. The analysis computes the average catch per day at sea required to achieve a 25% return for periods of 10 to 300 days annually. As would be expected, the catch required to achieve a 25% return on initial investment decreases at a declining rate as the days per year spent at sea increases. Based on

TABLE III-J

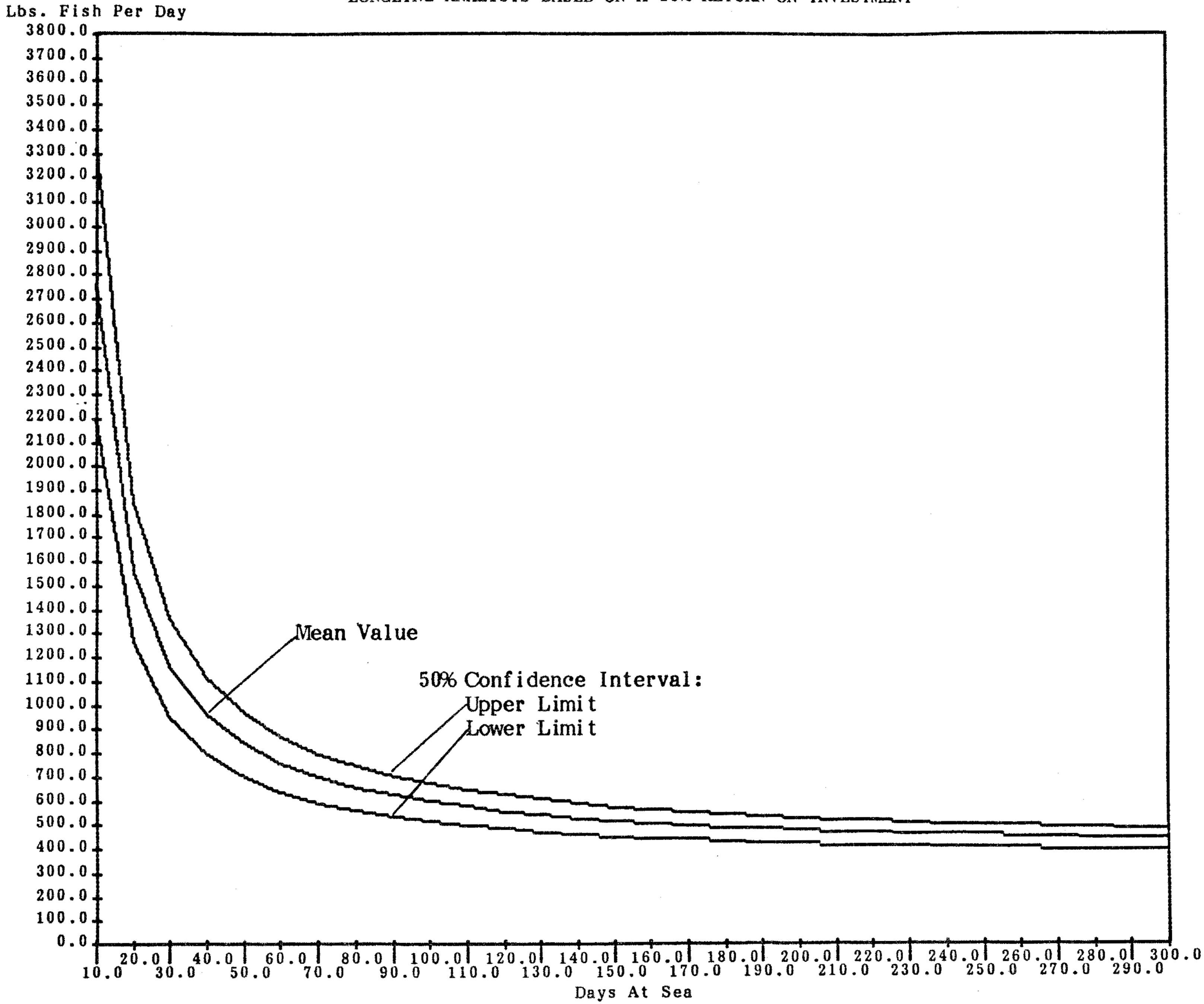
POUNDS OF FISH REQUIRED TO ACHIEVE A 25% RETURN ON INVESTMENT BASED ON AN ANALYSIS OF ALL LONGLINE RESPONDENTS

	-------Pounds Per Day At Sea--------		
		50% Confidence Interval	
Days At Sea Per Year	Mean Value at 25% ROI $2.00/lb.	Lower Lmt. at 25% ROI $2.00/lb.	Upper Lmt. at 25% ROI $2.00/lb.
10	2,757	2,189	3,318
20	1,556	1,257	1,847
30	1,155	946	1,357
40	955	791	1,111
50	835	698	964
60	755	636	866
70	697	591	796
80	655	558	743
90	621	532	703
100	594	511	670
110	573	494	643
120	554	480	621
130	539	468	602
140	526	458	586
150	514	449	572
160	504	441	560
170	496	435	549
180	488	428	539
190	481	423	530
200	474	418	523
210	469	414	516
220	463	410	509
230	459	406	504
240	454	403	498
250	450	399	493
260	447	397	489
270	443	394	485
280	440	391	481
290	437	389	477
300	434	387	474

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION III-D

LONGLINE ANALYSIS BASED ON A 25% RETURN ON INVESTMENT



the mean value, after 100 days per year at sea a 25% return on initial investment is achieved if the average daily volume weight of fish caught equals or exceeds 594 pounds per day at sea. After 200 days at sea the volume weight decreases to 474 pounds per day, and after 300 days it is 434 pounds per day.

Table III-K summarizes and Illustration III-E depicts a graphic plotting of the average daily catch required to achieve a 25% return on initial investment analysis based on the mean of all longline responses and assumes average prices to the seller of $1.50, $2.00, and $2.50 per pound of fish. As would be expected, the catch required decreases at a declining rate as the days per year spent at sea increases. Also, as would be expected, there is an inverse relationship between average price per pound and the volume weight of catch required to achieve a 25% return. A 25% decrease in price from $2.00 to $1.50 per pound results in a 33% increase in the volume weight required to achieve a 25% return, and a 33% increase in price from $1.50 to $2.00 results in a 25% decrease in the volume weight required.

TABLE III-K

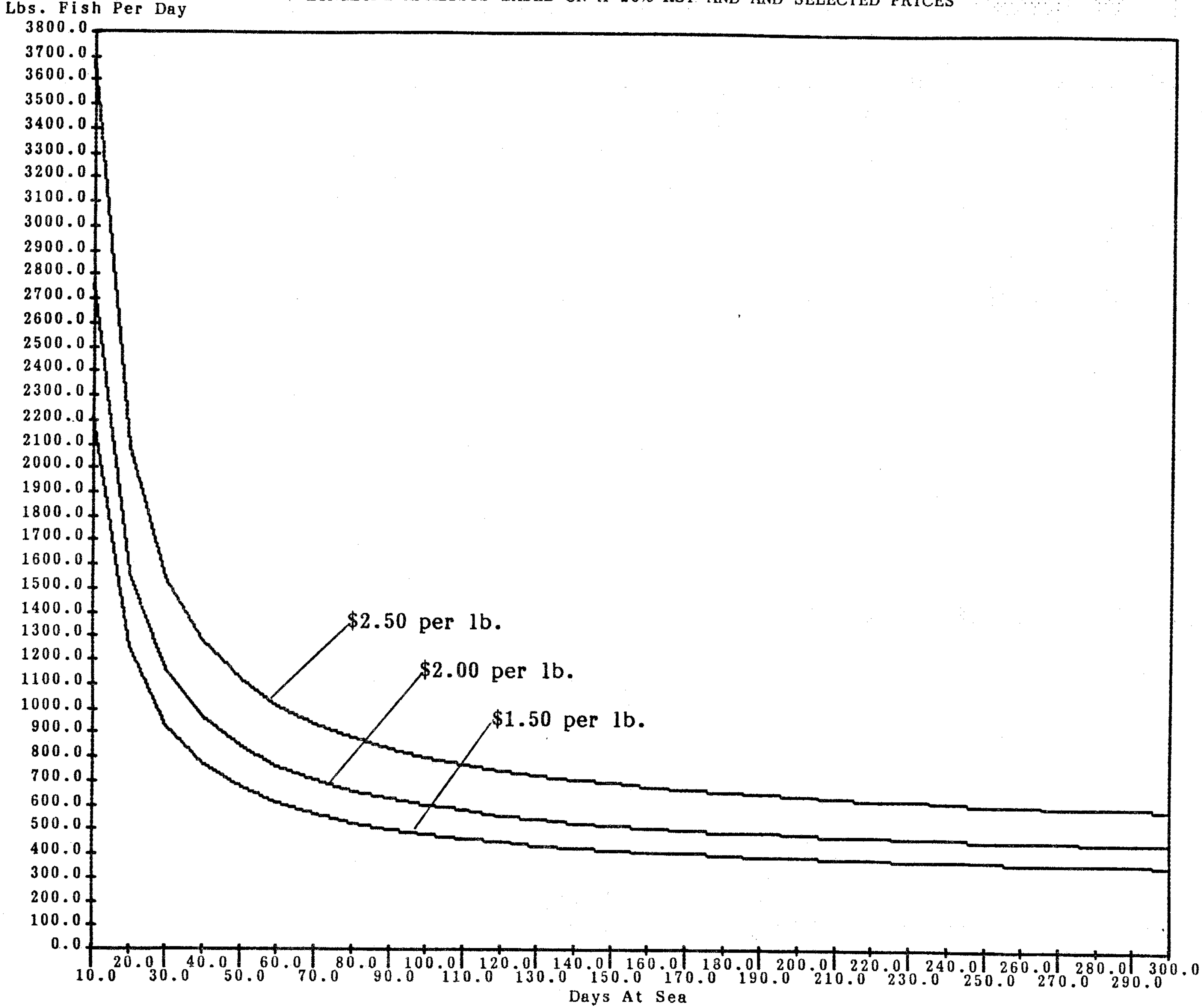
AVERAGE DAILY CATCH REQUIRED
TO ACHIEVE A 25% RETURN ON INVESTMENT AT SELECTED PRICES
BASED ON THE MEAN FOR ALL LONGLINE RESPONDENTS

Days At Sea Per Year	----------Pounds Per Day At Sea----------		
	$1.50/lb.	$2.00/lb.	$2.50/lb.
10	3,676	2,757	2,206
20	2,074	1,556	1,245
30	1,540	1,155	924
40	1,273	955	764
50	1,113	835	668
60	1,006	755	604
70	930	697	558
80	873	655	524
90	828	621	497
100	793	594	476
110	764	573	458
120	739	554	444
130	719	539	431
140	701	526	421
150	686	514	412
160	672	504	403
170	661	496	396
180	650	488	390
190	641	481	385
200	632	474	379
210	625	469	375
220	618	463	371
230	612	459	367
240	606	454	363
250	600	450	360
260	595	447	357
270	591	443	355
280	587	440	352
290	583	437	350
300	579	434	347

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION III-E

LONGLINE ANALYSIS BASED ON A 25% ROI AND AND SELECTED PRICES



Breakeven Relative to Return on Investment

The relationship between the volume weight required to achieve the breakeven point and the volume weight required to achieve a 25% return on investment is summarized in Table III-L and depicted in Illustration III-F. The analysis is based on an assumed 25% rate of return on initial investment and average price to the seller of $2.00 per pound. The difference between the volume weight required to breakeven and that which is required to achieve a 25% return on initial investment decreases at a declining rate as the days per year spent at sea increases. After 100 days per year at sea, an additional 118 pound per day would be required in order to increase the level of profitablity from the breakeven point to a level which achieves a 25% return on the initial capital investment. This decreases to 59 pounds per day at 200 days per year, and 39 pounds per day at 300 days per year.

TABLE III-L

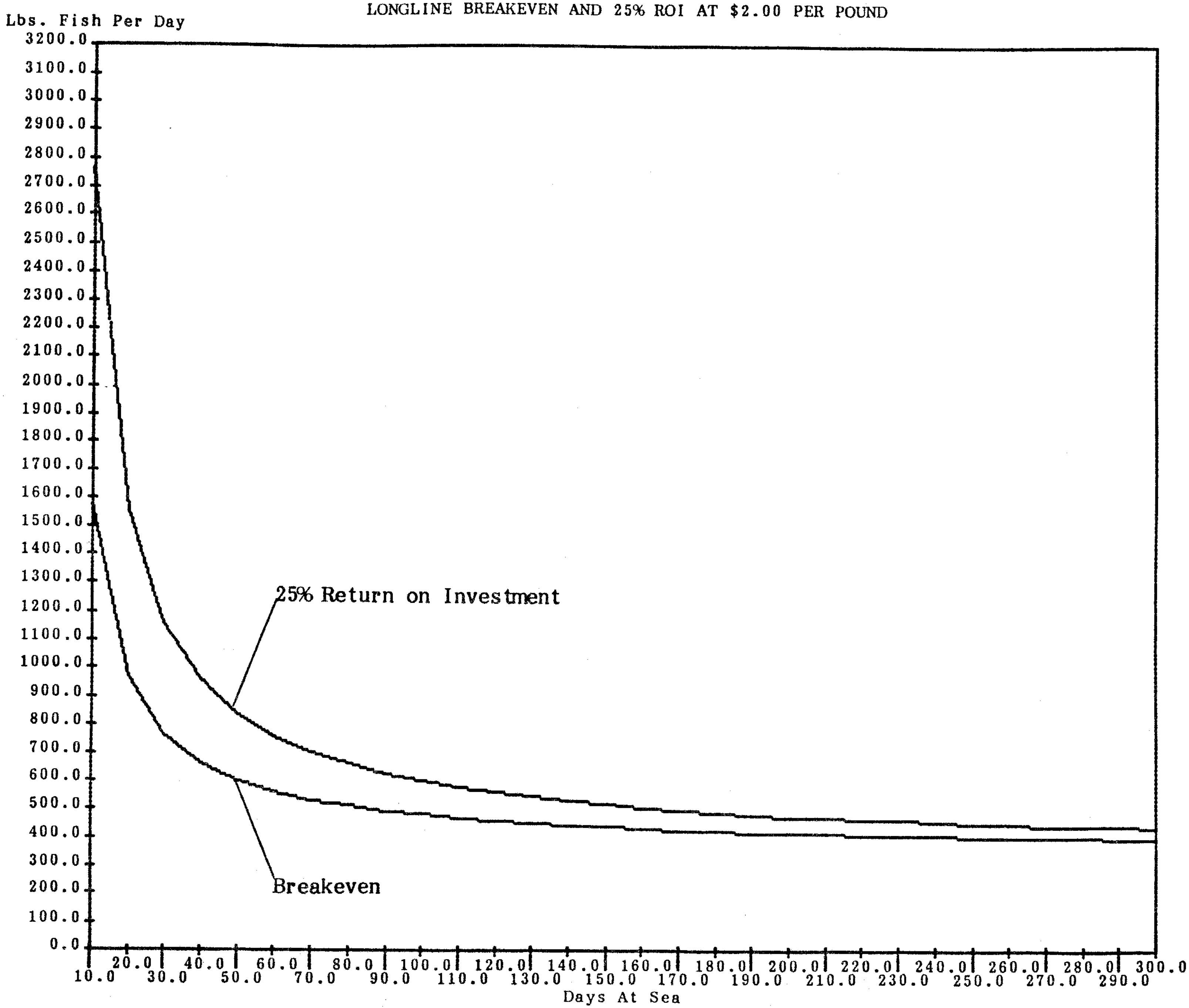
AVERAGE DAILY CATCH REQUIRED TO BREAKEVEN
AND TO ACHIEVE A 25% RETURN ON INVESTMENT AT $2.00 PER POUND
BASED ON THE MEAN FOR ALL LONGLINE RESPONDENTS

Days At Sea Per Year	--------Pounds Per Day At Sea-------- Volume Weight Required To: Breakeven	Achieve A 25% ROI	ROI Less Breakeven
10	1,576	2,757	1,181
20	965	1,556	591
30	761	1,155	394
40	660	955	295
50	599	835	236
60	558	755	197
70	529	697	169
80	507	655	148
90	490	621	131
100	476	594	118
110	465	573	107
120	456	554	98
130	448	539	91
140	441	526	84
150	436	514	79
160	431	504	74
170	426	496	69
180	422	488	66
190	418	481	62
200	415	474	59
210	412	469	56
220	410	463	54
230	407	459	51
240	405	454	49
250	403	450	47
260	401	447	45
270	399	443	44
280	398	440	42
290	396	437	41
300	395	434	39

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION III-F

LONGLINE BREAKEVEN AND 25% ROI AT $2.00 PER POUND



IV - HANDLINE FLEET ANALYSIS

OVERVIEW

The handline fleet survey conducted by Hawaii Opinion interviewed the captains and owners. The sample for the handline survey was provided by NMFS staff and was drawn from the state's listing of boat owners holding commercial fishing licenses. A total of 644 names and addresses were drawn, using a systematic skip to yield a field of 100 successful interviews. This was done since it was anticipated that many of the names would appear as duplicates (due to multiple boat ownership and outdated records) and that many owners would not be active handliners, since the commercial license file included longline, troll, and net fishing gear types as well as handline.

The initial screening of prospective handline respondents was by means of a short mailout survey. This instrument asked whether or not the respondents were active handline fishermen and updated telephone and address data. Respondents who indicated that they were not handliners were eliminated from the sample.

The handline survey was conducted between November 15, 1982 and January 18, 1983. Interviews were conducted on weekdays, weekends, day or evening, at the convenience of the respondents. Up to four attempts were made to contact prospective respondents in the sample.

Of the 100 interviews completed, 24 were based on Oahu, 50 on the island of Hawaii, 17 on Kauai, and 9 on Maui. Of the original 644 names, there were 28 potential respondents who refused interviews or were not available, and 178 that could not be contacted. It is not known to what extent, if any, the non-respondents introduced an element of bias in the survey results. The following summarizes the data collection effort:

644 total sample

100 interviews completed

202 duplicate owner names

136 not active handliners

28 known handliners, but refused or not available for interviews

178 unable to contact

FLEET DESCRIPTION

Based on the surveys completed, Table IV-A summarizes selected attributes of the handline fleet. As indicated, the handline fleet vessels have a mean length of 24 feet. The mean age of the vessels in mid-1982 was 4.4 years, and the mean net tonnage was 2.3 tons.

TABLE IV-A

Selected Attributes of the Handline Fleet

		Respondents Providing Data
Length of boat	23.9 feet	100
Age of Vessel	4.4 years	100
Net Tonnage	2.3 tons	100

Source: Hawaii Opinion, H-83-11C.

OWNERSHIP AND VESSEL FINANCING

Table IV-B indicates that the predominant form of ownership for the handline respondents was that of a sole proprietorship. Of the 100 handline respondents, 92, representing 92% of total, operated as sole proprietorships. The remaining eight handline respondents were distributed amongst partnership, corporate and other forms of ownership.

TABLE IV-B

Vessel Ownership for Handline Respondents

	Respondents Providing Data	Distribution Of Respondents
Sole Proprietorship	92	92.0%
Partnership	4	4.0
Corporation	3	3.0
Other	1	1.0

Source: Hawaii Opinion, H-83-11C.

The form of ownership generally affects the method of financing used for the vessels, inasmuch as sole proprietorships and partnerships generally rely on personal and investor financing, respectively. Table IV-C indicates that of the 100 respondents, 80% indicated that they had used personal funds to finance a portion of the vessel costs, and only 1% had used funds from other investors. Funds derived from a bank loan were used by 25% of the vessels. Government guaranteed loans were used by only three vessels representing 3% of the total.

TABLE IV-C

Method of Financing for Handline Respondents(1)

	Respondents Providing Data	Distribution Of Respondents
Personal Funds	80	80.0%
Other Investors	1	1.0%
Bank Loan	25	25.0%
Government Guaranteed Loan	3	3.0%
Other	16	16.0%

(1) Responses reflect multiple methods of financing.

Source: Hawaii Opinion, H-83-11C.

PURCHASE PRICE AND ESTIMATE OF CURRENT VALUE OF VESSEL

Table IV-D presents a summary of the mean purchase value and estimated current value of handline vessels. The table also includes the computed standard error of the mean and the number of respondents. The standard error of the mean is used to estimate the population mean at a 50.0% confidence interval. The upper and lower limits of the interval represent an estimate of the upper and lower quartiles of a distribution of sample means drawn from the population of handline fishermen. There is a fifty percent (50%) likelihood that the unknown population mean will lie within the interval. There is a twenty five percent (25%) likelihood that the unknown population mean is below the lower limit, and a similar likelihood that it is above the upper limit.

TABLE IV-D

MEAN AND 50% CONFIDENCE INTERVAL PURCHASE PRICE AND ESTIMATED CURRENT VALUE OF VESSEL FOR ALL HANDLINE RESPONDENTS

	Sample Mean	Std Error of Mean	Est. Mean at Lower Limit	50.0% Conf. Upper Limit	Responses
Purchase Price of Boat....................	$17,573	2,864	$15,628	$19,518	97
Current Value of Boat.....................	24,440	4,170	21,608	27,271	96

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

The table reflect the handline fleet being comprised largely of smaller vessels as indicated by the mean purchase price of the handline vessels is $17,573. The estimated mean at the lower and upper limits of the 50% confidence intervals are $15,628 and $21,608, respectively. The mean estimated value of the handline vessels is $24,440, and the estimated mean at the lower and upper limits of the 50% confidence intervals $21,608 and $27,271, respectively. Based on the 4.4 year average age of all vessels, the difference between the purchase price and estimated current value reflects 7.79% annual rate of change. This rate of change approximates the average rate of inflation during the period 1978-81.

TRIP ANALYSIS

The analysis of the trip related data indicates that the handliners typically made frequent trips of less than one day duration. Table IV-E indicates that during the typical month, the handline respondents made 9.02 trips per month with an average duration of 17.5 hours per trip. This infers that an average of 108 trips were made annually (trips per month x 12 months). Based on the average duration of each trip, an average of 1,894 hours annually were spent at sea. The estimated mean at the lower limit of the 50% confidence interval indicates an average of 8.56 trips per month lasting 15.8 hours per trip, representing 103 trips per year and 1,623 hours annually. The estimated mean at the upper limit of the 50% confidence interval indicates an average of 9.48 trips per month lasting 19.2 hours per trip, representing 114 trips per year and 2,184 hours annually.

TABLE IV-E

TRIP ANALYSIS
FOR ALL HANDLINE RESPONDENTS

	Sample Mean	Standard Error of Mean	Est. Mean at 50.0% Conf. Lower Limit	Upper Limit	Responses
Number of Fishing Trips Average Month	9.02	.67	8.56	9.48	97
Duration of Fishing Trip (days)	.73	.10	.66	.80	99
Trips per Year	108.24		102.72	113.76	
Hours at Sea Per Year	1,896		1,627	2,184	

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

CAPITAL, FIXED AND VARIABLE EXPENSES

Table IV-F presents summary statistics for capital, fixed and variable expenses indicated by handline respondents. The table also includes the computed standard error of the mean and the number of respondents. A perspective concerning the distribution of responses is provided by the estimated mean at a 50.0% confidence interval which represents the lower and upper quartiles of the distribution.

The total mean capital, fixed and variable expenses were $15,437. Capital and fixed expenses represented $2,192, or 14.2% of the total, and variable expenses represented $13,246, or 85.4% of the total. The estimated mean for total capital, fixed, and variable expenses at the 50.0% confidence interval indicated a lower limit of $12,908 and an upper limit of $17,967.

TABLE IV-F

MEAN AND 50% CONFIDENCE INTERVAL
CAPITAL, FIXED AND VARIABLE EXPENSES
FOR ALL HANDLINE RESPONDENTS

	Sample Mean	Standard Error of Mean	Est. Mean at Lower Limit	50.0%Conf. Upper Limit	Responses
Capital Expenses and Fixed Expenses:					
Boat Mortgage Paid in 1981	$1,345	414	$1,064	$1,626	100
Trailer Mortgage Paid in 1981	20	20	6	34	99
Other Loans Paid in 1981	295	188	167	422	100
Licenses and Fees	161	67	116	207	98
Accounting and Bookkeeping	0	0	0	0	0
Boat Insurance	365	90	303	426	92
Trailer Insurance	5	3	3	7	90
Sub Total	$2,192		$1,661	$2,722	
Variable Expenses					
Repairs (1981):					
Engine	$1,014	238	853	1,175	99
Hull	269	75	218	320	99
Electronic	105	31	84	125	99
Fish Equipment	263	71	214	311	98
Sub Total	$1,650		$1,369	$1,931	
Fuel and Oil	$3,298	390	$3,033	$3,563	93
Fishing Gear	1,520	258	1,344	1,695	96
Bait	1,259	350	1,021	1,496	95
Ice	848	139	754	943	92
Food	846	172	729	962	86
Auction and Unloading Fees	1,252	435	957	1,548	78
Sub Total	$9,023		$7,838	$10,207	
Share of Fish Paid to Crew and Captain(1)	$2,573	785	$2,040	$3,106	80
TOTAL VARIABLE EXPENSES	$13,246	785	$11,247	$15,244	
TOTAL CAPITAL, FIXED AND VARIABLE EXPENSES	$15,437		$12,908	$17,967	

(1) The share of fish paid to crew and captain is reported in the above table as a wage that does not vary relative to revenue.

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

VARIABLE EXPENSES PER TRIP

Table IV-G presents the variable expenses per trip based on the annual variable costs, presented in Table IV-E, and the estimated trips annually, shown in the previous table. The mean variable expenses are estimated to total $122 per trip. The mean at the lower and upper limits of the 50% confidence intervals are estimated to total $109 per trip and $134 per trip, respectively.

TABLE IV-G

VARIABLE EXPENSE ANALYSIS PER TRIP
FOR ALL HANDLINE RESPONDENTS

	Sample Mean	Est. Mean at Lower Limit	50.0% Conf. Upper Limit
Repairs:			
Engine	$9.37	8.30	10.33
Hull	2.48	2.12	2.81
Electronic	.97	.82	1.10
Fish Equipment	2.43	2.09	2.73
Sub Total	$15.24	13.33	16.98
Fuel and Oil	$30.47	29.53	31.32
Fishing Gear	14.04	13.09	14.90
Bait	11.63	9.94	13.15
Ice	7.84	7.34	8.29
Food	7.81	7.09	8.46
Auction and Unloading Fees	11.57	9.31	13.61
Sub Total	$83.36	76.31	89.72
Share of Fish Paid to Crew and Captain(1)	$23.77	$19.86	$27.30
TOTAL VARIABLE EXPENSES	$122.37	$109.49	$134.01

(1) The share of fish paid to crew and captain is reported in the above table as a wage that does not vary relative to revenue.

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

The analysis presented in Table IV-G indicates that repairs account for 12% of the total variable costs reflecting the fact that going to sea is rough on vessels. The average fuel and oil cost represents 25% of total variable costs. Gear costs represent 11% of total variable costs. Bait and ice represent a total of 13%, and auction and unloading fees represent 9% of total variable costs. The share of fish paid to crew and captain, representing 19% of variable cost, is reported in the table as a wage that does not vary relative to revenue.

COST-EARNINGS ANALYSIS

The analysis of sales was hampered by the non-response rate for questions concerning sales and weight of fish sold. Although all 100 of the respondents surveyed indicated that they had caught tuna, less than 50% responded to the questions related to sales. The non-response rate presented a serious degrees of freedom problem for testing models. A priori, one would hypothesize that the handline fleet in Hawaii is composed of many part-time and/ornon-commercial fishermen as well as some full-time fishermen. While the non-commercial fishermen may sell part of their catch to offset their costs, they do not typically engage in intensive fishing effort or fish on a regular basis. Seasonal fishing patterns may also be a problem. The hypothesis that the handline fleet is composed primarily of part-time and/or non-commercial fishermen is supported by the survey data which indicates that 56% of the handline respondents <u>did not</u> consider fishing to be their primary occupation and 59% had another occupation.

In order to analyze the statistical relationship of revenues and expenses, consideration was given to stratifying the data based on the type of fish caught on the last trip. This alternative was rejected since the last trip could not be concluded to be representative of the mix of fish caught annually. Rejection of this approach is based on the a priori hypothesis that as seasonal changes occur in both the price and/or the availability of a particular species of fish, the handline fishermen would adjust their fishing strategies accordingly. To the extent that sales data was provided by respondents, the data from respondents who sold tuna and/or bottom fish supports this hypothesis. The data indicates that of 50 respondents who reported sales for tuna and/or bottom fish, 26 (52%) sold both tuna and bottom fish, 15 (30%) sold only tuna, and 9 (18%) sold only bottom fish.

An alternative perspective, presented in Table IV-H, is the stratification of the data based on sales reported for 1981. The table presents selected data based on three strata: sales equal to or greater than $10,000; sales less than $10,000; and no sales data. The table also shows comparative data for all respondents.

The stratified data lends support to the hypothesis that the handliners are primarily part-time or non-commercial fishermen. Only 12 of the 52 respondents reporting sales data had sales greater than $10,000. Of the respondents who reported sales in excess of $10,000, 84% considered fishing to be their primary occupation compared to 39% of the respondents with sales less

TABLE IV-H

Selected Data Based on
Stratification of the Handline Respondents by Sales

	Sales Greater Than $10,000	Sales Less Than to $10,000	No Sales Data	All Respondents
Number of Observations	**12**	**40**	**48**	**100**
Boat Length (ft)	26.8	24.6	22.0	23.9
Boat Tonnage (tons)	4.1	2.7	1.5	2.3
Fish Trips per Month	13.20	6.76	9.8	9.0
Crew Size	2.2	2.1	2.0	2.1
Years Commercial Fish	8.75	7.70	14.20	10.9
% Fish Primary Occ.	83.7	38.5	25.0	44.0
Hours per Week Fish	60	34	35	38
Annual Income Index	5.8	2.0	2.8	4.8
% Another Occupation	33.3	62.5	62.5	59.0
Hours per Week Other Occupation	40.0	41.6	40.0	41.2
Total Sales Major Fish	$32,020	3,138	No Data	No Data
Total Expenses	28,239	8,881	11,360	No Data
Net Income (Loss) Sales less Expenses	$3,781	-5,743	NA	NA

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

than \$10,000. Respondents with sales in excess of \$10,000 averaged 60 hours per week fishing compared to an average of 34 hours per week for respondents with sales less than \$10,000. Only 33% of the respondents who had sales in excess of \$10,000 had a second job, compared to 63% for respondents with either sales below \$10,000 or respondents who did not report sales. Also supporting the hypothesis that handliners are not commercial fishermen is the finding that the only group of handliners to achieve a positive earnings, based only on sales of major species, were those with sales over \$10,000. This group represents only 25% of those who responded to the sales question and only 12% of the survey sample.

WEIGHT OF AVERAGE CATCH

Survey data concerning the weight of the average catch reported by respondents, shown in Table IV-I, indicates that respondents reporting higher levels of sales also reported relatively higher average catches. The sample mean for respondents indicating sales equal to or in excess of \$10,000 is approximately 100% greater than the mean for respondents reporting sales less than \$10,000.

TABLE IV-I

Average Weight of Catch
Reported by Handline Respondents
(Pounds)

	Sample Mean	Standard Deviation	Standard Error Of Mean	Range (High/Low)	Number of Responses
All Handline Respondents	215.9	206.4	29.5	975/25	49
Sales of $10,000 or More	375.0	357.9	160.1	975/50	5
Sales less then $10,000	186.3	142.1	30.3	500/35	22
No Sales/Sales Not Reported	209.3	213.9	45.6	950/25	22

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

BREAKEVEN AND RETURN ON INVESTMENT ANALYSIS

The breakeven and return on investment analysis, summarized in this section, makes the a priori assumption that the volume of fish caught and the resulting revenues earned are primarily dependent on the number of trips made annually. In making this assumption, it is acknowledged that the volume weight is also dependent on other variables, such as the amount of gear used, the intensity of fishing effort, and the skill of the captain. These variables are not considered in the analysis.

Breakeven Analysis

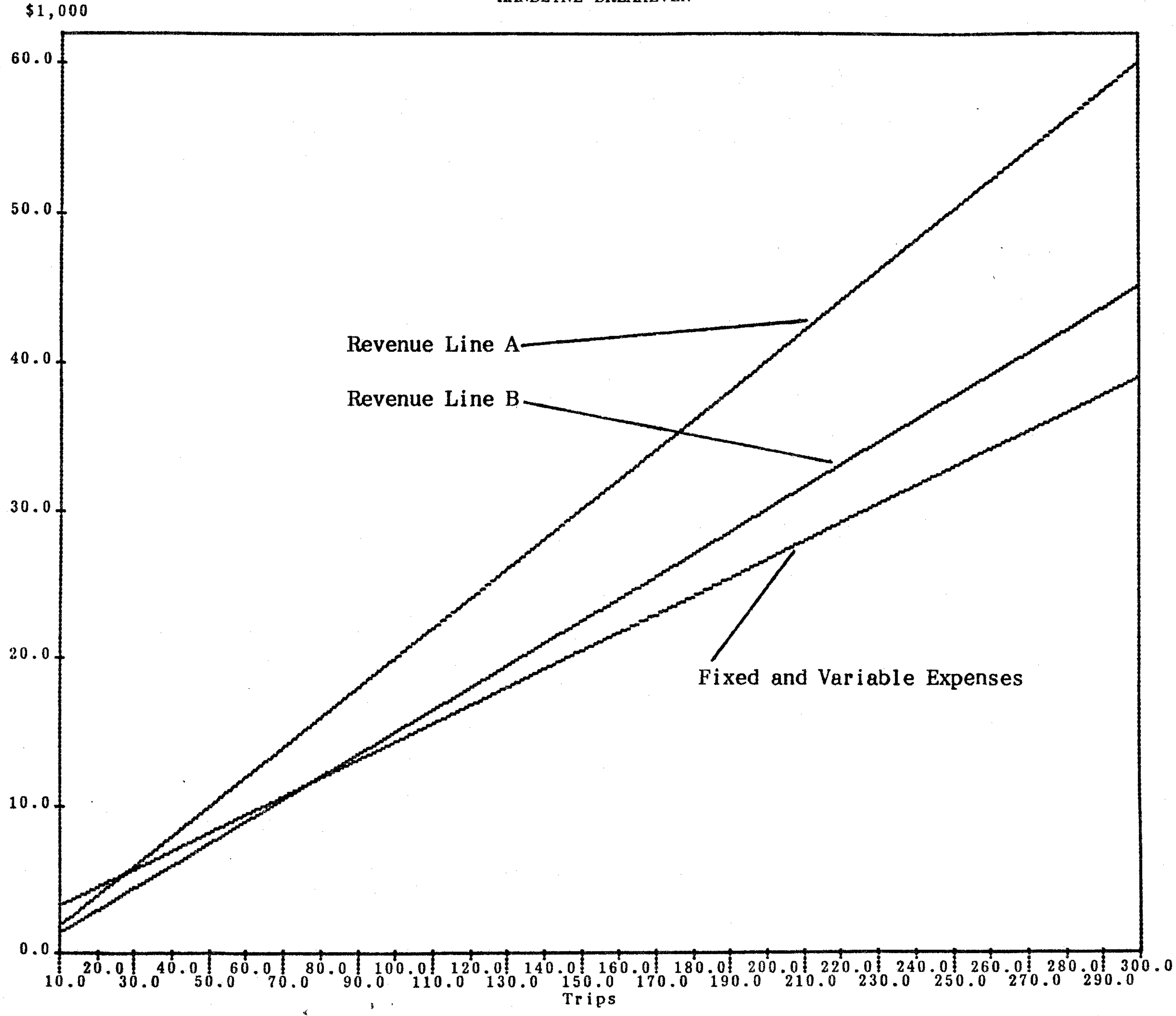
Breakeven analysis is based on relationships between costs and revenues and is useful in determining at which point revenues will cover total costs. The breakeven analysis presented in this section first considers the linear relationship between expenses and revenues. The analysis then considers the volume weight of fishing activity necessary to cover total costs assuming different periods of fishing activity ranging from ten to 300 trips annually.

<u>Breakeven Analysis Depicting Revenues and Expenses</u>

Illustration IV-A is a graph showing the linear relationship between total expenses relative to the revenues that would be derived based on selected assumptions regarding average catch rates per trip and average price per pound. The graph illustrates the impact of increasing the value of the catch per trip by 33% from $150 per trip, "Revenue Line A," to $200 per trip, "Revenue Line B." Revenue Line A indicates that profitable fishing would be attained after approximately 75 trips per year, while Revenue Line B would be profitable after approximately 30 trips per year. The analysis indicates that a 33% increase in the revenue produced per trip would decrease the effort, measured in terms of trips, required to break even by approximately 45 trips or slightly over 60%. This illustrates the sensitivity of the effort required to break even relative to changes in the factors determining average revenue per trip. The principal factors are the volume weight of fish caught per trip the average catch and the average price per pound of fish sold.

ILLUSTRATION IV-A

HANDLINE BREAKEVEN



Analysis Depicting Average Catch to Breakeven

Table IV-J summarizes and Illustration IV-B depicts a graphic plotting of the breakeven analysis for the mean value of all handline responses and the estimated means at the 50% confidence interval based on an assumed average price to the seller of \$2.50 per pound. The analysis computes the average catch per trip required to break even for 10 to 300 trips annually. As would be expected, the fixed costs require an increasing catch per trip for relatively fewer trips annually. The breakeven point decreases at a declining rate as the number of trips increases. Based on the mean value, after 60 trips per year, the breakeven point is 212 pounds per trip, after 90 trips it decreases to 158 pounds per trip, and after 120 trips it is 130 pounds per trip.

Table IV-K summarizes and Illustration IV-C depicts a graphic plotting of the breakeven analysis based on the mean of all handline responses and assumes average prices to the seller of \$2.00, \$2.50, and \$3.00 per pound of fish. The analysis computes the average catch per trip required to break even for 10 to 300 trips annually. As would be expected, the breakeven point decreases at a declining rate as the number of trips per year increases. Also as would be expected, there is an inverse relationship between average price per pound and the volume weight of catch required to break even. For example, a 20% decrease in price from \$2.50 to \$2.00 per pound results in a 25% increase in the breakeven point, while a 25% increase in price from \$2.00 to \$2.50 results in a 20% decrease in the breakeven point.

TABLE IV-J

POUNDS OF FISH REQUIRED TO BREAKEVEN AT $2.50 PER POUND
BASED ON AN ANALYSIS OF ALL HANDLINE RESPONDENTS

	----------Pounds Per Trip----------		
		Estimated Distribution of Mean 50% Confidence Interval	
Trips Per Year	Sample Mean $2.50/lb.	Lower Lmt $2.50/lb.	Upper Lmt. $2.50/lb.
10	137	110	162
20	93	77	108
30	78	66	90
40	71	60	81
50	66	57	75
60	64	55	72
70	61	53	69
80	60	52	67
90	59	51	66
100	58	50	64
110	57	50	64
120	56	49	63
130	56	49	62
140	55	49	61
150	55	48	61
160	54	48	60
170	54	48	60
180	54	47	60
190	54	47	59
200	53	47	59
210	53	47	59
220	53	47	59
230	53	47	58
240	53	47	58
250	52	46	58
260	52	46	58
270	52	46	58
280	52	46	57
290	52	46	57
300	52	46	57

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION IV-B

BREAKEVEN ANALYSIS OF HANDLINE RESPONDENTS

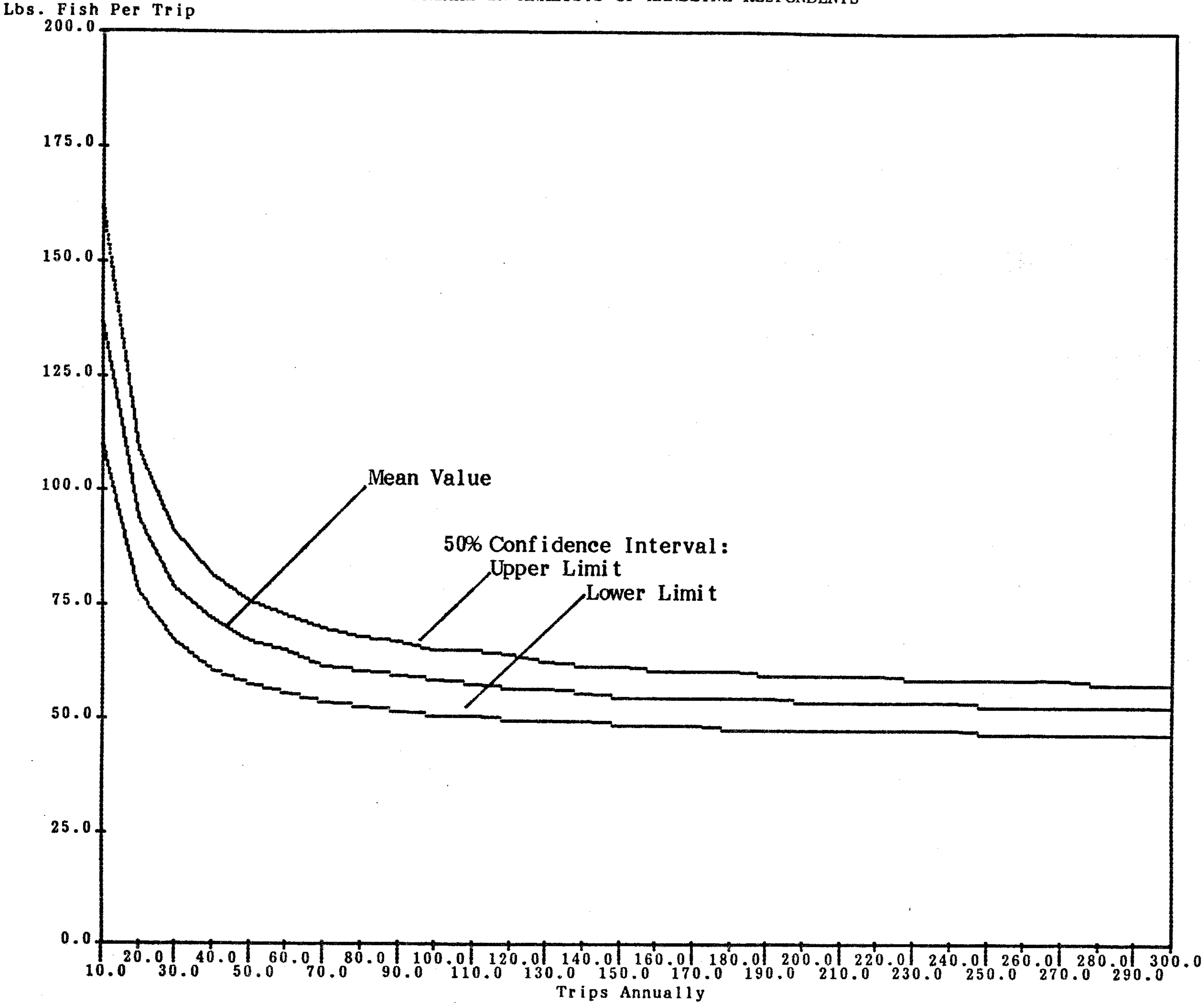


TABLE IV-K

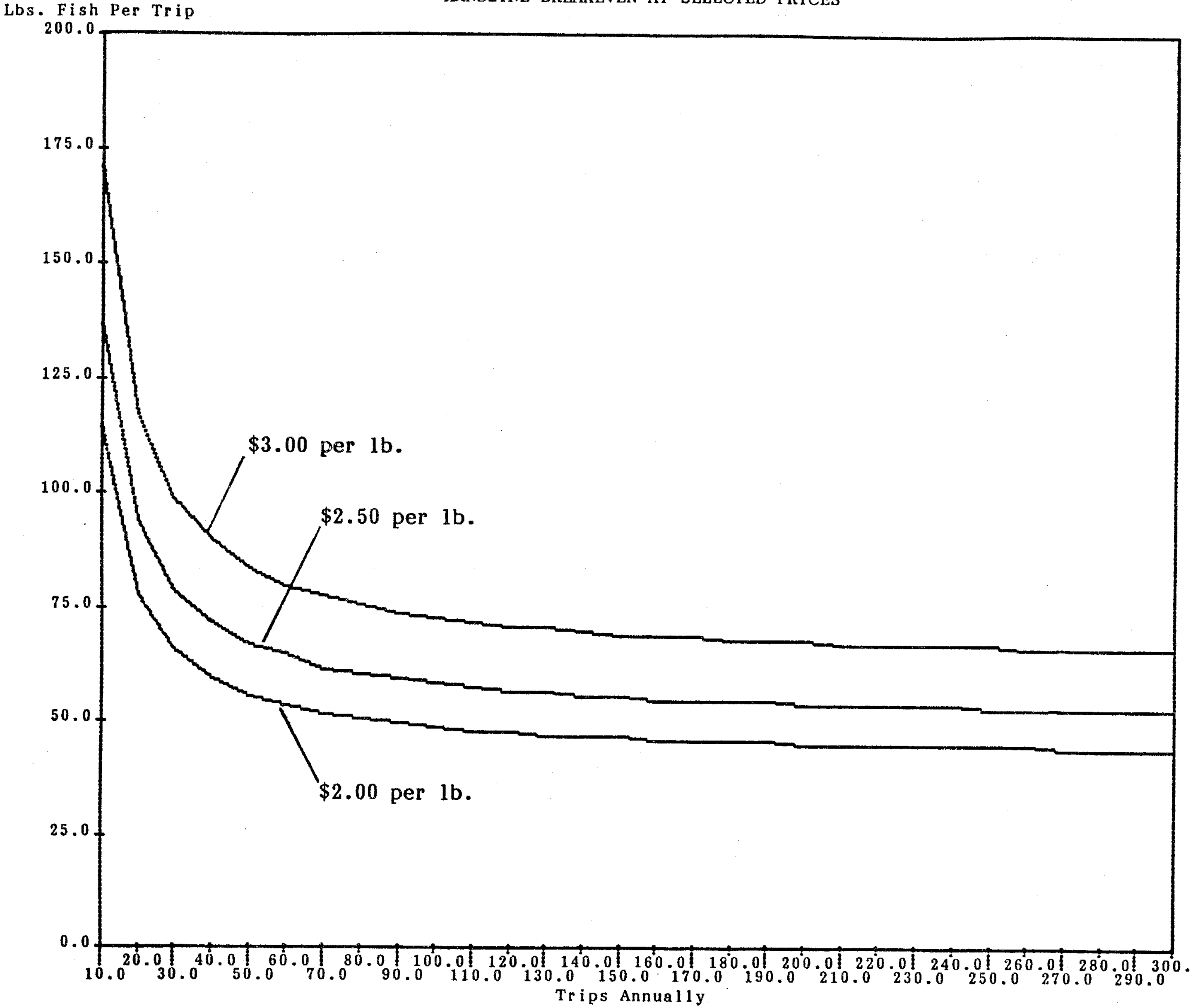
POUNDS OF FISH REQUIRED TO BREAKEVEN AT SELECTED PRICES
BASED ON THE MEAN FOR ALL HANDLINE RESPONDENTS

Trips Per Year	Pounds Per Trip $2.00/lb.	$2.50/lb.	$3.00/lb.
10	171	137	114
20	116	93	77
30	98	78	65
40	89	71	59
50	83	66	55
60	79	64	53
70	77	61	51
80	75	60	50
90	73	59	49
100	72	58	48
110	71	57	47
120	70	56	47
130	70	56	46
140	69	55	46
150	68	55	46
160	68	54	45
170	68	54	45
180	67	54	45
190	67	54	45
200	67	53	44
210	66	53	44
220	66	53	44
230	66	53	44
240	66	53	44
250	66	52	44
260	65	52	44
270	65	52	43
280	65	52	43
290	65	52	43
300	65	52	43

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION IV-C

HANDLINE BREAKEVEN AT SELECTED PRICES



Return on Investment Analysis

The rate of return required by investors may be thought of as being comprised of three parts: the risk-free rate, a premium for business risk, and a premium for financial risk. The risk-free rate is the rate of return that could be earned on United States Treasury securities. The premium for business risk is attributable to the fluctuation of future operating income, and the premium for financial risk is attributable to the fluctuation of future earnings available to the proprietor, partners, or shareholders.

In the case of the handline fleet, the analysis of return on initial investment is used to estimate the volume weight of fishing activity necessary to cover an assumed 25% return on initial investment, and the total fixed, capital and variable costs assuming different periods of fishing activity ranging from 10 to 300 trips annually. Two sets of analysis were prepared and are briefly discussed below.

Table IV-L summarizes and Illustration IV-D depicts a graphic plotting of the return on initial investment analysis for the mean value of all handline responses and the estimated means at the 50% confidence interval based on an assumed 25% rate of return on initial investment and average price to the seller of $2.50 per pound. The analysis computes the average catch per trip required to achieve a 25% return for 10 to 300 trips annually. As would be expected, the catch required to achieve a 25% return on initial investment decreases at a declining rate as the

TABLE IV-L

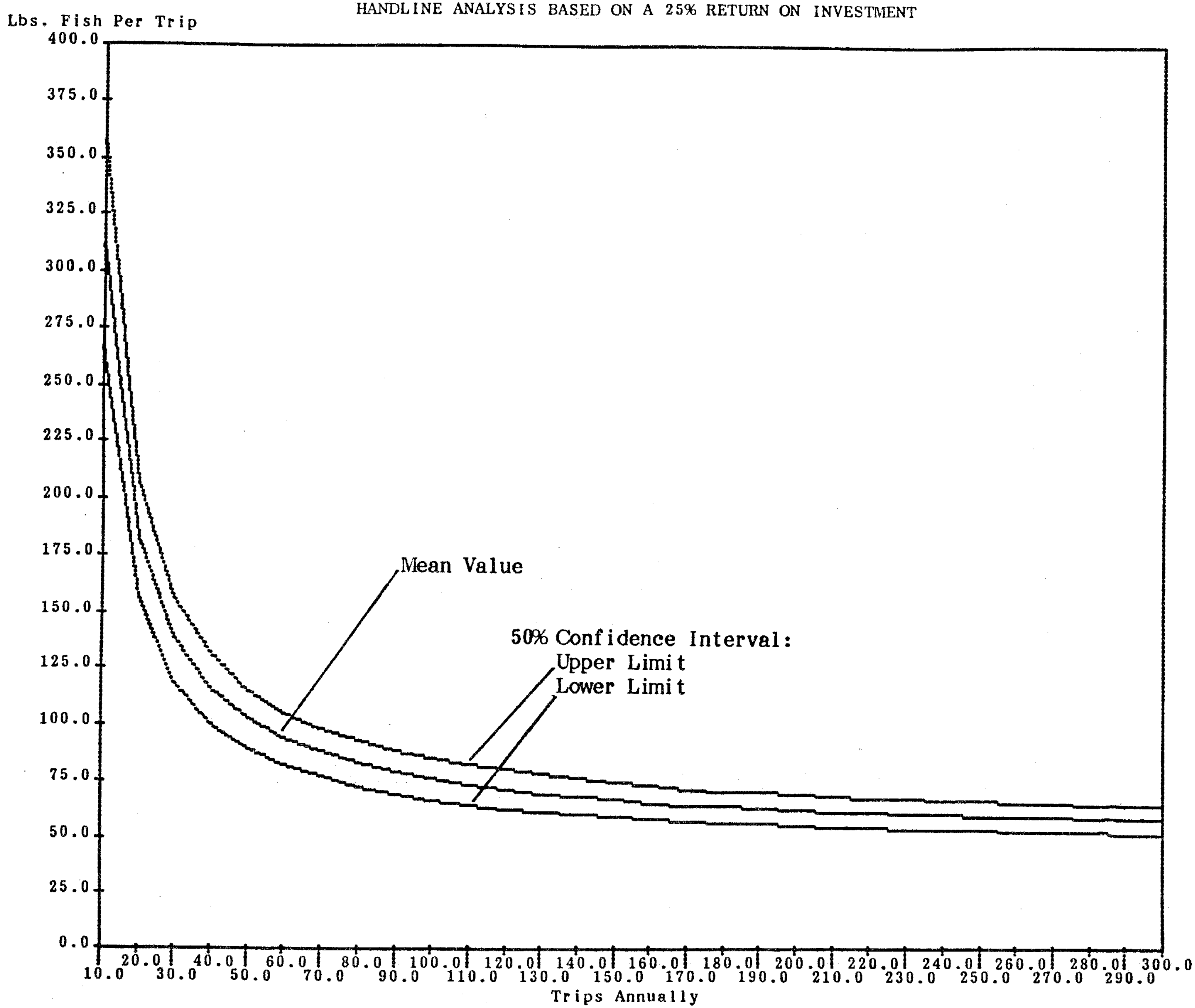
POUNDS OF FISH REQUIRED TO ACHIEVE A 25% RETURN ON INVESTMENT BASED ON AN ANALYSIS OF ALL HANDLINE RESPONDENTS

	Pounds Per Trip		
		Estimated Distribution of Mean 50% Confidence Interval	
Trips Per Year	Sample Mean at 25% ROI $2.50/lb.	Lower Lmt. at 25% ROI $2.50/lb.	Upper Lmt. at 25% ROI $2.50/lb.
10	312	267	358
20	181	155	206
30	137	118	155
40	115	99	130
50	102	88	114
60	93	81	104
70	87	76	97
80	82	72	92
90	78	69	87
100	75	66	84
110	73	64	81
120	71	62	79
130	69	61	77
140	68	60	75
150	67	59	74
160	65	58	73
170	64	57	71
180	64	56	70
190	63	56	70
200	62	55	69
210	61	54	68
220	61	54	67
230	60	53	67
240	60	53	66
250	59	53	66
260	59	52	65
270	59	52	65
280	58	52	64
290	58	51	64
300	58	51	64

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION IV-D

HANDLINE ANALYSIS BASED ON A 25% RETURN ON INVESTMENT



number of trips per year increases. Based on the mean value, after 80 trips per year a 25% return on initial investment is achieved if the average volume weight of fish caught equals or exceeds 193 pounds per trip. After 120 trips annually, the volume weight decreases to 145 pounds per trip, and after 160 trips it is 121 pounds per trip.

Table IV-M summarizes and Illustration IV-E depicts a graphic plotting of the average catch per trip required to achieve a 25% return on initial investment analysis based on the mean of all handline responses and assumes average prices to the seller of $2.00, $2.50, and $3.00 per pound of fish. As would be expected, the catch required decreases at a declining rate as the trips per year increases. Also as would be expected, there is an inverse relationship between average price per pound and the volume weight of catch required to achieve a 25% return. For example, a 20% decrease in price from $2.50 to $2.00 per pound results in a 25% increase in the volume weight required to achieve a 25% return, while a 25% increase in price from $2.00 to $2.50 results in a 20% decrease in the volume weight required.

<u>Breakeven Relative to Return on Investment</u>

The relationship between the volume weight required to achieve the breakeven point and the volume weight required to achieve a 25% return on investment is summarized in Table IV-N and depicted in Illustration IV-F. The analysis is based on an assumed 25% rate of return on initial investment and average price to the seller of $2.50 per pound. The difference between

TABLE IV-M

AVERAGE CATCH PER TRIP REQUIRED
TO ACHIEVE A 25% RETURN ON INVESTMENT AT SELECTED PRICES
BASED ON THE MEAN FOR ALL HANDLINE RESPONDENTS

Trips Per Year	Pounds Per Trip $2.00/lb.	$2.50/lb.	$3.00/lb.
10	390	312	260
20	226	181	151
30	171	137	114
40	144	115	96
50	127	102	85
60	116	93	77
70	108	87	72
80	102	82	68
90	98	78	65
100	94	75	63
110	91	73	61
120	89	71	59
130	87	69	58
140	85	68	56
150	83	67	55
160	82	65	55
170	81	64	54
180	79	64	53
190	79	63	52
200	78	62	52
210	77	61	51
220	76	61	51
230	76	60	50
240	75	60	50
250	74	59	50
260	74	59	49
270	73	59	49
280	73	58	49
290	73	58	48
300	72	58	48

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION IV-E

HANDLINE ANALYSIS BASED ON A 25% ROI AND AND SELECTED PRICES

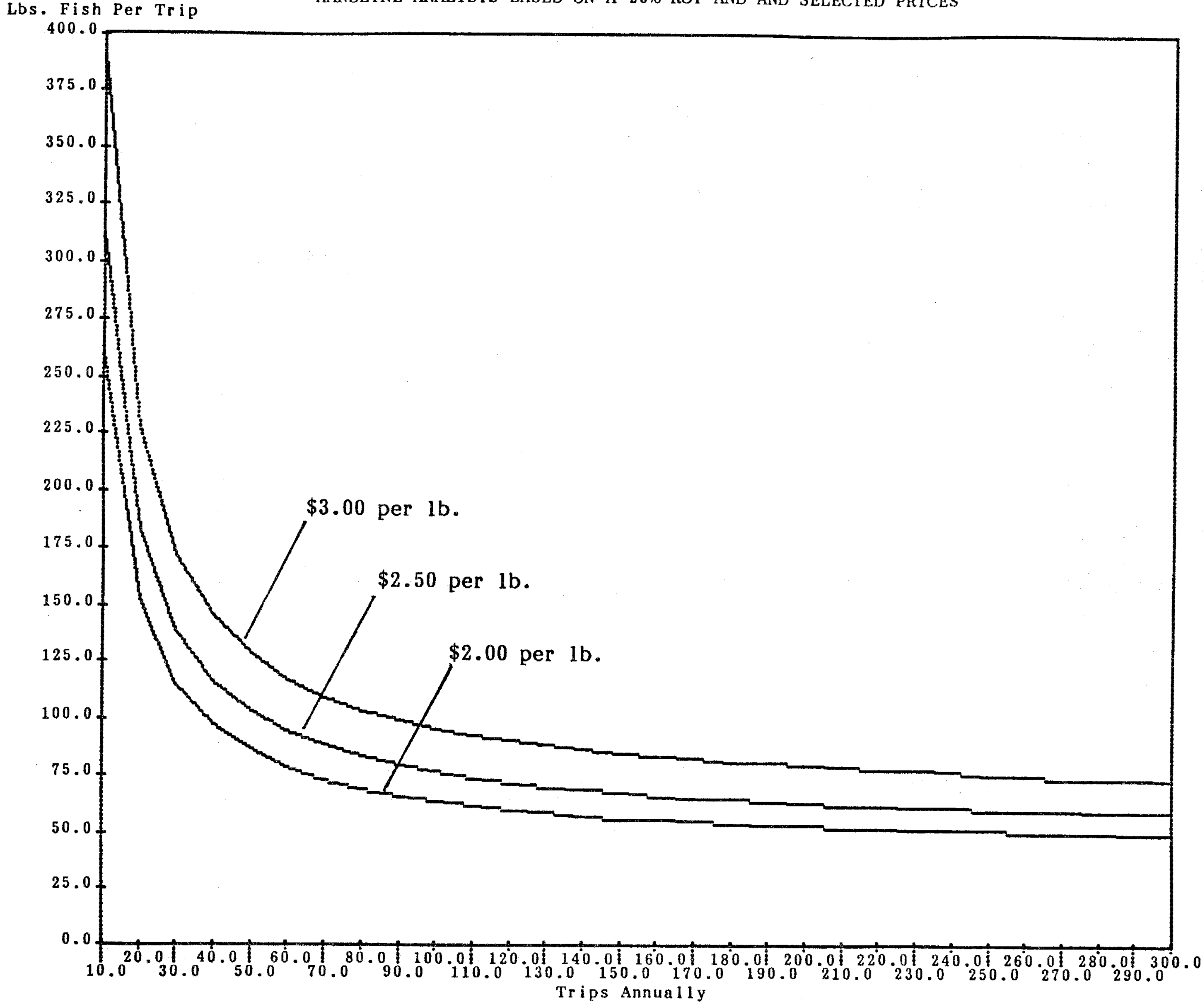


TABLE IV-N

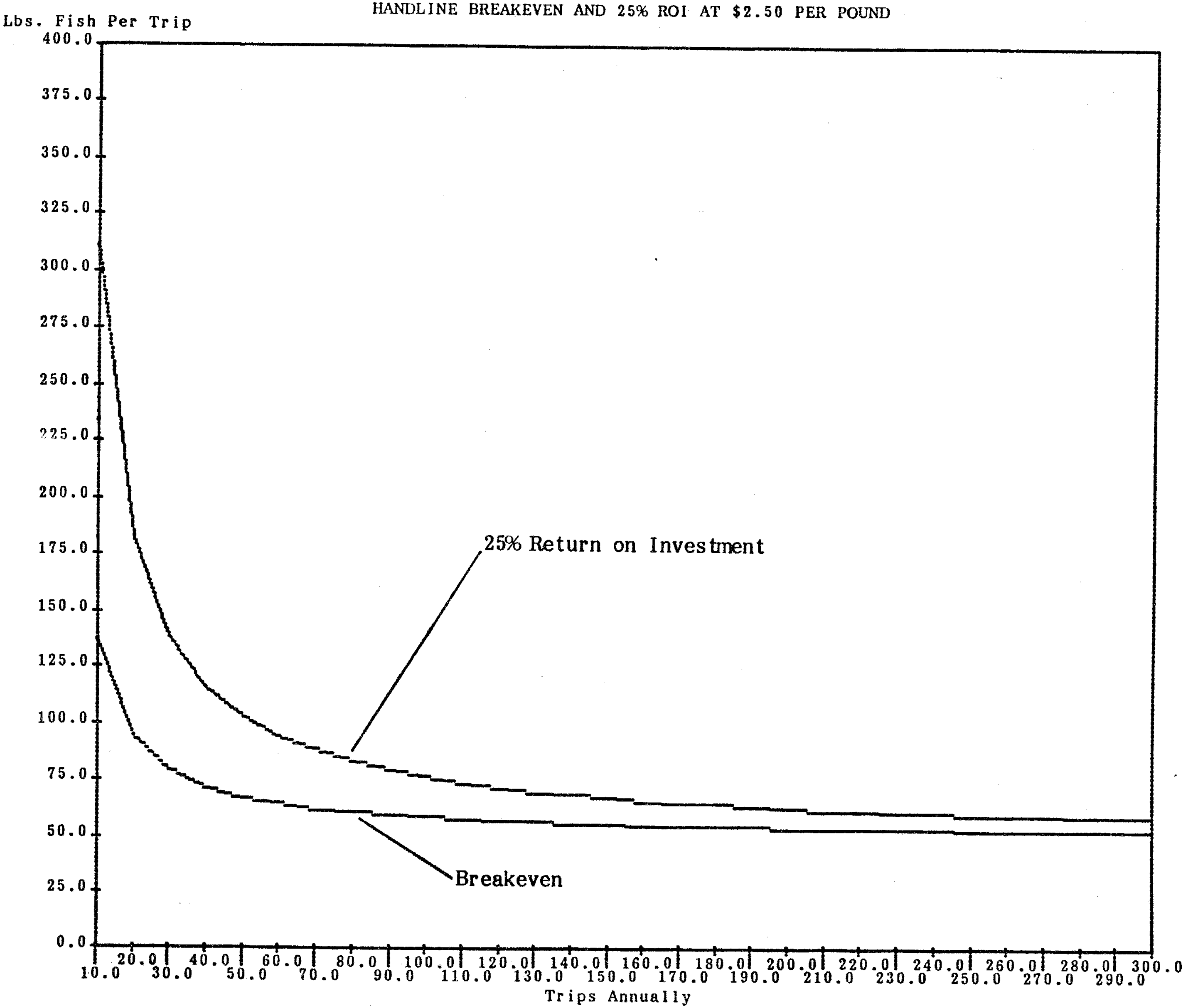
AVERAGE CATCH PER TRIP REQUIRED TO BREAKEVEN
AND TO ACHIEVE A 25% RETURN ON INVESTMENT AT $2.50 PER POUND
BASED ON THE MEAN FOR ALL HANDLINE RESPONDENTS

	Pounds Per Trip		
	Volume Weight Required To:		
Trips Per Year	Breakeven	Achieve A 25% ROI	ROI Less Breakeven
10	137	312	176
20	93	181	88
30	78	137	59
40	71	115	44
50	66	102	35
60	64	93	29
70	61	87	25
80	60	82	22
90	59	78	20
100	58	75	18
110	57	73	16
120	56	71	15
130	56	69	14
140	55	68	13
150	55	67	12
160	54	65	11
170	54	64	10
180	54	64	10
190	54	63	9
200	53	62	9
210	53	61	8
220	53	61	8
230	53	60	8
240	53	60	7
250	52	59	7
260	52	59	7
270	52	59	7
280	52	58	6
290	52	58	6
300	52	58	6

Sources: Data from Hawaii Opinion survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

ILLUSTRATION IV-F

HANDLINE BREAKEVEN AND 25% ROI AT $2.50 PER POUND



the volume weight required to break even and that which is required to achieve a 25% return on initial investment decreases at a declining rate as the number of trips per year increases. After 60 trips per year, an additional 29 pound per trip would be required in order to increase the level of profitablity from the breakeven point to a level which achieves a 25% return on the initial capital investment. This decreases to 20 pounds per trip at 90 trips per year, and 15 pounds per trip at 120 trips per year.

V - SENSITIVITY ANALYSIS AND ASSESSMENT OF SELECTED MANAGEMENT AND DEVELOPMENT POLICIES

This chapter presents a sensitivity analysis based on the longline and handline cost and revenue analysis presented in Chapters III and IV, respectively. The chapter also assesses selected fishery management and development policies concerning maintaining sustainable yields, reducing operating costs, and increasing the per unit sales price to vessels.

SENSITIVITY ANALYSIS

The sensitivity analysis presented in Table V-A provides a basis of comparing the relative impact of changes in either the value of output; the level of effort, measured in terms of either days at sea or trips; and operating costs such as fuel and oil. The analysis indicates that:

- The catch level, or volume weight, required to break even is relatively more sensitive to decreases in the value of output than it is to increases in the value of output. A 1.00% decrease in the value of the longline output results in a 1.34% increase in the catch level required to break even, while a 1.00% increase in value results in a 0.80% decrease in the breakeven catch level.

- The catch level required to break even is relatively more sensitive to changes in the value of output then to changes in effort. While a 1.00 % decrease in the value of the longline output results in a 1.34% increase in the catch level required to break even, a 1.00% decrease in effort (expressed in terms of days at sea or trips) causes a 0.20% increase in the breakeven catch level.

- A 1.00% decrease in fuel and oil costs results in a 0.07% decrease in the longline breakeven catch level, and a 0.21% decrease in the handline breakeven catch level. The impact that decreased fuel and oil costs (or any cost factor) have on the breakeven catch level is in effect diluted by other fixed and variable expenses.

TABLE V-A

Relative Impacts of Changes in Either
Output Value, Level of Effort, or Operating Costs
On The Catch Level of Catch Required to Break Even

	Percentage Impact on Catch Level Required to Break Even	
	Longline	Handline
Change in value of output with effort and expense held constant:		
Value decreases by 1.00%	+1.34%	+1.20%
Value increases by 1.00%	-0.80%	-0.86%
Change in effort with cost and price held constant:		
Price decreases by 1.00%	+0.20%	+0.24%
Price increases by 1.00%	-0.12%	-0.14%
Decrease in fuel and oil costs with other costs, effort and price held constant:		
Price decreases by 1.00%	-0.07%	-0.21%

Source: Computations by A. Lono Lyman, Inc.

ASSESSMENT OF FISHERIES MANAGEMENT AND DEVELOPMENT POLICIES

The assessment of fisheries policies was limited by several factors. The low response rate for revenue data made it necessary to address management and development policies within the limited context of the data provided and the breakeven, return on investment, and sensitivity analysis conducted. The policy assessment does not give any consideration to either other benefits that could be derived or the costs associated with policy implementation.

Because of these factors, the analysis of fishery management and development policies was limited to a general assessment of policies related to maintaining sustainable yields, reducing operating costs, and increasing the per unit sales price to vessels. These are discussed under separate sub headings.

Policies Related to Maintaining Sustainable Yields

Attaining the breakeven catch level is critical to sustaining commercial fishing and achieving a desired return on investment is critical to expansion of commercial fishing. This suggests that policies related to maintaining sustainable yields are a very important factor in maintaining and developing both full-time commercial longline and handline fishing.

As level of effort (measured in terms of days at sea or trips) increase, the catch level separating breakeven and achieving a desired level of return on investment becomes increasingly smaller. For instance, based on a 25% return on original investment the longline data analysis in Table III-L indicates that at 100 days at sea annually, the catch level differential is 118 pounds, decreasing to 59 pounds after 200 days at sea. The handline data analysis in Table IV-N indicates that after 60 trips annually, the catch level differential is 29 pounds, decreasing to 15 pounds after 120 trips annualy.

Management practices that can be used to maintain sustainable yields include limits or bans on fishing, and permits for commercial fishing. To the extent that bottomfishing in the vicinity of the major Hawaiian islands has exceeded or is approaching the sustainable yield levels, then such measures may presently be or soon become appropriate.

Policies that maintain sustainable yields, are generally based on the desirability of both reducing financial and business risk and conservation of scarce resources. Measures which increase the cost of catching a given level of yield, such as area closures, may discriminate against cost efficient vessels, while measures which increase the potential catch may favor efficient operations.

The handline data set indicates that there are two general categories of handline fishermen: commercial and part-time recreational. Maintaining sustainable yields is of significant importance for commercial fishermen who are dependent upon fishing as their sole or as a significant source of personal income. While both commercial and recreational fishing can be affected by excessive fishing, there are several reasons to give greater consideration to commercial fishing even if it entails discriminating against recreational fishing. One reason is that recreational fishing does not have the same profit oriented objectives that commercial fishing has, and thus, by inference, can tend to promote less efficient use of resources than commercial fishing. A second reason is that maintaining and expanding commercial fishing is more dependent upon measures that enhance profitability and reduce financial and business risk factors. Examples of such measures are management policies that limit access fisheries, or restrict the number of vessels in an area. A third factor is that the value of recreational fishing may be less dependent on catch rates compared to commercial fishing.

Policies Related to Reducing Costs

As would be expected, both the longline and handline surveys analysis indicates that improved cost parameters make possible a reduction in the catch level of fish that needs to be caught in order to either breakeven or achieve a desired return on investment. Moreover, the sensitivity analysis presented in Table V-A indicates relatively greater sensitivity to changes in price then changes in individual cost factors.

Cost reduction policies can be categorized as measures which provide in-put or operating subsidies, such as fuel tax rebates or loans at below market interest rates, and measures directed at enhancing the cost-revenue ratio, such as encouraging the use of more efficient equipment. It is concluded that policies related to reducing costs should emphasize cost-revenue efficiency rather than measures that provide an operating cost subsidy. The former is prefered since it would be more likely to result in both economic and social benefits. This is less likely to be provided by a operating cost subsidy, such as a fuel tax rebate, which may actually encourage or maintain inefficiency.

Policies Related to Increasing Per Unit Sales Prices

The sensitivity analysis in Table V-A indicates that the catch level of fish that needs to be caught in order to either breakeven or achieve a desired return on investment is relatively more sensitive to increases in the price per pound then to the changes in operating costs. The greater sensitivity to changes in price suggest that priority should be given to policies which favorably impact the per unit price obtained by the fishermen. Price supports are an example of a fishery development policy that would have a significant impact on maintaining and expanding commercial fishing.

Other policies that could favorably impact the per unit price obtained by fishermen include those related to developing or expanding markets, increasing the vessel owners' access to wholesale and retail distribution and marketing channels. Certain management policies, such as size limits, emphasize higher fillet yield and higher quality premiums and could also benefit the per unit price obtained by the fishermen.

APPENDIX[1]

FINANCIAL ANALYSIS FOR HANDLINE RESPONDENTS
STRATIFIED BY SALES RESPONSE

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(1) Data from Hawaii Opinion Survey, H-83-11C.
Computations by A. Lono Lyman, Inc.

MEAN AND 50% CONFIDENCE INTERVAL
CAPITAL, FIXED AND VARIABLE EXPENSES
FOR ALL HANDLINE RESPONDENTS
WHO REPORTED SALES GREATER THEN OR EQUAL TO $10,000

	Mean	Std. Error of Mean	Est. Mean at 50.0% Conf. Lower Limit	Upper Limit	Responses
Capital and Fixed Expenses:					
Boat Mortgage Paid in 1981..............	$5,429	2,943	$3,369	$7,489	11
Trailer Mortgage Paid in 1981...........	0	0	0	0	12
Other Loans Paid in 1981................	265	265	80	450	12
Licenses and Fees.......................	562	496	216	908	12
Boat Insurance..........................	1,029	484	690	1,367	11
Tailer Insurance........................	27	19	14	41	11
Sub Total..........................	$7,312		$4,369	$10,254	
Variable Expenses					
Repairs (1981):					
Engine................................	$823	255	645	1,001	12
Hull..................................	129	86	69	189	12
Electronic............................	155	99	86	224	12
Fish Equipment........................	292	126	204	379	12
Sub Total..........................	$1,399		$1,005	$1,793	
Fuel and Oil............................	$6,462	1,095	$5,699	$7,225	12
Fishing Gear............................	2,878	1,002	2,180	3,577	12
Bait....................................	1,977	575	1,575	2,380	11
Ice.....................................	1,523	576	1,119	1,926	11
Food....................................	1,216	310	1,000	1,432	12
Auction and Unloading Fees..............	3,939	1,248	3,057	4,820	9
Sub Total..........................	$17,995		$14,630	$21,360	
Share of Fish Paid to Crew and Captain......................	$8,592	4,062	$5,761	$11,423	12
TOTAL VARIABLE EXPENSES...............	$27,986		$21,396	$34,576	
TOTAL CAPITAL, FIXED AND VARIABLE EXPENSES............	$35,298		$25,765	$44,830	

TRIP ANALYSIS
FOR ALL HANDLINE RESPONDENTS
WHO REPORTED SALES GREATER THEN OR EQUAL TO $10,000

	Mean	Responses
Number of Fishing Trips Average Month	13.17	12
Duration of Trip (days)	.96	11
Duration of Trip (hours)	23.04	
Estimated Trips per Year	158.04	
Estimated Hours at Sea Annually	3,641	

VARIABLE EXPENSE ANALYSIS PER TRIP
FOR ALL HANDLINE RESPONDENTS
WHO REPORTED SALES GREATER THEN OR EQUAL TO $10,000

Variable Expenses Per Trip	Mean
Repairs:	
Engine	$5.21
Hull	.82
Electronic	.98
Fish Equipment	1.85
Sub Total	$8.85
Fuel and Oil	$40.89
Fishing Gear	18.21
Bait	12.51
Ice	9.64
Food	7.70
Auction and Unloading Fees	24.92
Sub Total	$113.86
Share of Fish Paid to Crew and Captain	$54.36
TOTAL VARIABLE EXPENSES	$177.08

CAPITAL, FIXED AND VARIABLE EXPENSES FOR ALL HANDLINE RESPONDENTS WHO REPORTED SALES LESS THEN $10,000

	Mean	Std. Error of Mean	Est. Mean at 50.0% Conf. Lower Limit	Upper Limit	Responses
Capital and Fixed Expenses:					
Boat Mortgage Paid in 1981	$716	218	568	865	40
Trailer Mortgage Paid in 1981	0	0	0	0	40
Other Loans Paid in 1981	117	77	64	170	40
Licenses and Fees	141	68	94	187	39
Boat Insurance	197	70	149	245	38
Tailer Insurance	5	3	3	7	37
Sub Total	$1,175		$878	$1,473	
Variable Expenses					
Repairs (1981):					
Engine	$1,135	510	$787	$1,484	40
Hull	292	117	212	372	40
Electronic	110	52	74	145	40
Fish Equipment	183	68	137	230	39
Sub Total	$1,721		$1,210	$2,231	
Fuel and Oil	$2,299	364	$2,051	$2,548	38
Fishing Gear	790	168	675	904	39
Bait	811	252	639	983	39
Ice	575	109	500	649	38
Food	591	140	495	687	38
Auction and Unloading Fees	1,404	934	766	2,041	32
Sub Total	$6,469		$5,125	$7,813	
Share of Fish Paid to Crew and Captain	$985	337	$754	$1,215	35
TOTAL VARIABLE EXPENSES	$9,175		$7,090	$11,259	
TOTAL CAPITAL, FIXED AND VARIABLE EXPENSES	$10,350		$7,967	$12,732	

TRIP ANALYSIS FOR ALL HANDLINE RESPONDENTS WHO REPORTED SALES LESS THEN $10,000

	Mean	Responses
Number of Fishing Trips Average Month	6.76	38
Duration of Trip (days)	.85	40
Duration of Trip (hours)	20.35	
Estimated Trips per Year	81.16	
Estimated Hours at Sea Annually	1,652	

VARIABLE EXPENSE PER TRIP FOR ALL HANDLINE RESPONDENTS WHO REPORTED SALES LESS THEN $10,000

Variable Expenses Per Trip	Mean
Repairs:	
Engine	$13.99
Hull	3.60
Electronic	1.35
Fish Equipment	2.26
Sub Total	$21.20
Fuel and Oil	$28.33
Fishing Gear	9.73
Bait	9.99
Ice	7.08
Food	7.28
Auction and Unloading Fees	17.30
Sub Total	$79.71
Share of Fish Paid to Crew and Captain	$12.13
TOTAL VARIABLE EXPENSES	$113.05

CAPITAL, FIXED AND VARIABLE EXPENSES FOR ALL HANDLINE RESPONDENTS WHO REPORTED NO SALES

	NO SALES REPORTED				
	Mean	Std. Error of Mea	Est. Mean at 50.0% Con Lower Limit	Upper Limit	Responses
Capital and Fixed Expenses:					
Boat Mortgage Paid in 1981	$849	334	621	1,076	48
Trailer Mortgage Paid in 1981	42	42	13	70	48
Other Loans Paid in 1981	450	381	190	710	48
Licenses and Fees	77	0	77	77	47
Boat Insurance	343	129	255	431	43
Tailer Insurance	0	0	0	0	42
Sub Total	$1,760		$1,156	$2,365	
Variable Expenses					
Repairs (1981):					
Engine	$960	247	$791	$1,129	47
Hull	285	121	202	367	47
Electronic	87	40	60	115	47
Fish Equipment	321	134	230	412	47
Sub Total	$1,652		$1,282	$2,023	
Fuel and Oil	$3,297	664	$2,844	$3,751	43
Fishing Gear	1,790	442	1,488	2,092	45
Bait	1,471	691	999	1,943	45
Ice	918	235	757	1,079	43
Food	991	369	739	1,243	36
Auction and Unloading Fees	468	235	308	629	37
Sub Total	$8,936		$7,134	$10,737	
Share of Fish Paid to Crew and Captain	$2,069	98	$2,002	$2,136	33
TOTAL VARIABLE EXPENSES	$12,657		$10,418	$14,896	
TOTAL CAPITAL, FIXED AND VARIABLE EXPENSES	$14,417		$11,574	$17,261	

TRIP ANALYSIS FOR ALL HANDLINE RESPONDENTS WHO REPORTED NO SALES

	Mean	Responses
Number of Fishing Trips Average Month	9.79	47
Duration of Trip (days)	.58	48
Duration of Trip (hours)	13.92	
Estimated Trips per Year	117.48	
Estimated Hours at Sea Annually	1,635	

VARIABLE EXPENSE PER TRIP FOR ALL HANDLINE RESPONDENTS WHO REPORTED NO SALES

	Mean
Repairs:	
Engine	$8.17
Hull	2.42
Electronic	.74
Fish Equipment	2.73
Sub Total	$14.06
Fuel and Oil	$28.07
Fishing Gear	15.24
Bait	12.52
Ice	7.81
Food	8.44
Auction and Unloading Fees	3.99
Sub Total	$76.06
Share of Fish Paid to Crew and Captain	$17.61
TOTAL VARIABLE EXPENSES	$107.74