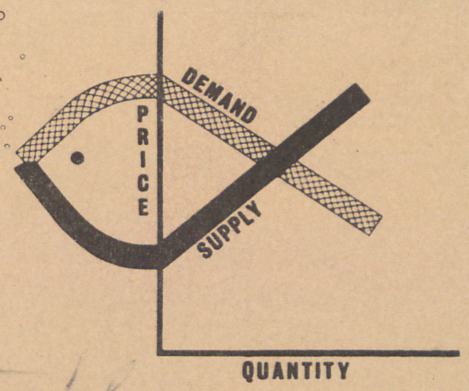

COSTS, EARNINGS AND BORROWING CAPACITY FOR SELECTED U.S. FISHERIES

By

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This is the first of a series of reports on research projects under contract to the U.S. Coast Guard for the purpose of evaluating the effects of alternative safety programs on the cost and earnings of selected United States fisheries.

This first report should be viewed only as a preliminary report which will be further revised and explained by activities resulting from subsequent research.

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INTRODUCTION

In an attempt to improve the safety record of American fishing vessels, the House Merchant Marine and Fisheries Committee has requested the U. S Coast Guard to submit a report on such factors as the condition of commercial fishing vessels, loss and injury rates, and possible new safety programs.

To assist in characteristizing the financial status of major U.S. fisheries and to evaluate the economic effects of certain new vessel safety programs, the U.S. Coast Guard approached the Bureau of Commercial Fisheries for assistance in preparing this report. For this purpose the contract entitled "A Cost-Benefit Analysis of Alternative Safety Programs for U.S. Commercial Fishing Vessels" was initiated on April 1, 1969.

The purpose of this contract is to provide economic information which will complement the Coast Guard's attempts to specify the key characteristics of each major U.S. fishery. As such, some some effort was initially necessary to assure that vessel samples examined independently by the Coast Guard and the Bureau of Commercial Fisheries had certain common characteristics and also that each of these samples were reasonably representative of the

total population of vessels in each fishery. Whenever possible, within reason, the same vessels were used in both samples, with the U. S Coast Guard examining the safety record and the physical condition of the vessel, thus determining the cost of meeting alternative new safety requirements, while the Bureau of Commercial Fisheries, Division of Economic Research examines the costs and earnings of said vessel(s) to determine the ability to finance these new requirements and the ultimate effect on individual fisheries.

Specific items to be supplied by the Bureau of Commercial Fisheries included:

1. Complete lists of all vessels in the agreed upon fisheries for which financial data is available. (These vessel names are to be kept confidential and none of the actual data will be released except when aggregated so as not to reveal individual enterprise).

2. For each fishery a cost and earnings profile will be prepared. This profile will be structured into the appropriate sub-groupings within each fishery so as to reflect upon the profitability of these subgroupings as determined by certain

characteristics such as age, length, horsepower and any other critical vessel characteristics . Measures of profitability, such as cash flow or return on investment will be calculated whenever feasible. All data will be evaluated as to the extent to which it represents current costs and earnings.

3. Anticipating that the adoption of new safety measures may lead to the necessity of borrowing by vessel owners, it was also necessary to ascertain the lending criteria of those public and private sources available to the industry. Therefore, a survey of private institutions was initiated to determine these current practices. An official documentation of Bureau of Commercial Fisheries criteria was also obtained.

4. Information from numbers 2 and 3 above will then be combined to determine

    a. The magnitude of current earnings.
    b. The availability of funds to finance safety improvements.
    c. The degree to which certain vessels in each fishery will either finance improvements from cash reserve, be able to obtain funding from private sources, must rely on the BCF for assistance, or will be unable to obtain needed funds from any source.

Finally, all these elements will be summarized to give some impression of the ability of the U.S. industry to finance safety improvements. References will be made to the possible composition and distribution (among and between fisheries) of financial assistance which may be necessary to avoid extreme hardship involved with certain hypothetical safety programs.

PROFIT AND LOSS, NET WORTH AND RETURN ON INVESTMENT, SELECTED FISHERIES

As stated above, samples from dominant fisheries were examined to determine the dimensions of crucial financial characteristics of these fisheries. Included in this study were: Gulf shrimp (49), Tortugas shrimp (151), Georgia shrimp (50), New Bedford groundfish (38), Boston large trawlers (22), New Bedford scallopers (13), New England small trawlers (46), Atlantic and Gulf menhaden (13), Tuna purse seiners (11), Seattle groundfish (21), and Pacific halibut (32). Totals: 446 vessels, approximately 800 vessel years.

Before proceeding to the fishery-by-fishery results of the analysis in this section, it would be appropriate to explain in some detail the steps to be used and the justification for these procedures.

The primary goal is to ascertain some impression of the financial status of each fishery, with reference to representative subgrouping

within each fishery. Although not all this data is presented here, complete cost and earnings statements, of various forms, were available as a basis for this analysis. Statistical manipulation resolved differences in these statements to reduce all data to a common denominator, cash flow before taxes and depreciation, plus interest. This item is listed in row five of each cell on all the following tables containing summary information.

In the order in which the individual values will appear in subsequent tables, these may be interpreted as follows:

1. Mean Vessel Income: This figure represents reported profits before taxes, with the previously subtracted (as a cost) depreciation allowance added back in.

2. Standard Deviation Vessel Income: The standard deviation of No. 1 above, usually calculated for each subclassification.

3. Mean Vessel Interest: Total reported interest.

4. Standard Deviation Vessel Interest: Standard deviation of (3) above.

5. Mean Returns to Vessel: The summation of (1) and (3) above; i.e., interest, previously subtracted as a cost, has been added back in.

6. Standard Deviation of Mean Returns to Vessel: Standard deviation of (5) above.

7-9. Discounted present value of (5) above, discounted over the estimated remaining life of the vessel and using the alternative discount rates of 12, 18, and 24 percent, using the standard formula

$$\sum_{i=1}^{n} \frac{I_i}{(1+r)^i}$$

where I = (5) above

r = .12, .18, .24

n = estimated remaining life of the vessel.

The computer program used to derive these values maybe found in exhibit I.

EXHIBIT ONE - "BASIC" PROGRAM USED TO GENERATE PRESENT VALUE

FILE:MEC2 - TYPE:BASIC

```
1000  PRINT
1010  PRINT
1020  PRINT
1030  PRINT
1040  R=0
1050  READ N
1060  FOR S=0 TO N
1070  DIM A(0100)
1080  READ A(S)
1090  NEXT S
1100  Q=0
1110  FOR S=0 TO N
1120  IF A(0) \GE 0 THEN G0 TO 1220
1130  P=A(S)/(1+R)**S
1140  Q=Q+P
1150  NEXT S
1160  IF Q\LT 0 THEN 1190
1170  R=R+.002
1180  G0 TO 1100
1190  PRINT " THE MARGINAL EFFIENCY OF CAPITAL IS" (R-.002)*100 "%"
1200  PRINT
1210  PRINT
1220  X=0
1230  Z=0
1240  X=0
1250  FOR S=0 TO N
1260  P=A(S)/((1+R)**S)
1270  IF P \LT 0 THEN G0 TO 1300
1280  Z=P+Z
1290  G0 TO 1310
1300  X=P+X
1310  NEXT S
1320  IF X \EQ 0 THEN G0 TO 1400
1330  IF R \GT 0 THEN G0 TO 1360
1340  PRINT "INTEREST", "PRESENT","BENEFIT"
1350  PRINT "RATE","VALUE","COST RATIO"
1360  PRINT R*100,(Z+X),-Z/X
1370  R=R+.03
1380  IF R \LT .30 THEN G0 TO 1230
1390  G0 TO 1000
1400  IF R \GT 0 THEN G0 TO 1430
1410  PRINT "INTEREST","PRESENT"
1420  PRINT "RATE","VALUE"
1430  PRINT R*100,Z
1440  R=R+.03
1450  IF R \LT .30 THEN G0 TO 1230
1460  G  TO 1000
1470  END
```

Two items would be necessary to proceed to a calculation of ROI. The first of these is the depreciated book value of a vessel. As is probably true in many industries, depreciation is used primarily for taxation purposes. With various methods of depreciation being permitted for tax purposes (e.g., straight-line method, declining balance method) the depreciation allowances shown in financial statements **do not**, in general, reflect the true economic cost associated with the use of fixed assets. The depreciation rates for new vessels are too high, while these rates for old vessels may be too low. It is a very common situation with our aged fishing fleet, that vessels fully depreciated for tax purposes may still have considerable market value due to their earning capacity. For this reason the depreciated book value of a vessel is not the appropriate base for calculation of ROI.

As an example of one problem in using these depreciated values, consider the contradictory case of a vessel with a significant net cash flow and a fully depreciated book value. By using these values a meaningless extraordinary ROI will result.

The second item to be considered on calculation of ROI is the market value of a vessel.

When the income stream is associated with a reasonable market value consistent with the earning potential in a fishery, then a reasonable, representative ROI may be derived.

However, the likelihood of obtaining reasonable measures of market value for vessels is minimal. It might be obtainable with considerable effort for a single sample or a single fishery but the task of obtaining this information for several differing fisheries would be overwhelming.[1/]

An Additional complication involves the calculation of taxes. In some fisheries and/or regions, the presentation of income tax figures includes all the financial activities of one or more individuals involved in the fishing enterprise. This tends to confuse these figures with respect to the actual taxes associated with the fishing enterprise, causing wide variance in net incomes which could be calculated with these figures. Therefore, the income before taxes has been subjected to analysis.

One item which was included by a special effort was interest charges. These help to characterize capital indeptedness, which is

1/ The U. S Coast Guard will attempt to obtain some measure of market value as it conducts physical surveys of vessels in their sample. If acceptable these estimates will be used in future calculations in this study.

a fundamental issue in this investigation by virtue of the fact that increased safety requirements may result in an increase of this indebtedness.

To avoid substituting arbitrary value judgements, a different approach was developed. For each calculation of an ROI, four elements might be involved, (1) the capital base, (2) the net income, (3) a time period, and (4) the rate of return itself. When considering each of these separately, we can conclude with some confidence that we have reasonable knowledge with respect to (2) the net income, an appropriate time period (3), and a rate of return that would be competitive with alternative investment opportunities, given certain considerations of risk (4). This ROI may also reflect uncertainity regarding choice of the appropriate time period.

This leaves the value of the capital base as the only true unknown. With three knowns and one unknown, we have chosen to resolve a complex issue by using the simple mathematical technique of using knowns to solve for an unknown. In this instance, the discounted present value, which is derived, may be compared with existing general knowledge regarding the range of replacement costs existing in each fishery.

Gulf Shrimp Vessels: 1967-1968

Included in this sample are vessels having received financial assistance from the Bureau of Commercial Fisheries under its loan programs. Data is for the years 1967 and 1968. As would be expected the vessels included in this group are predominantly newer vessels. Of the 49 vessels in this sample, 27 are less than five years old. Also, all but two have more than 150 h.p.

The distribution of the sample over four age categories and three horsepower categories may be seen in table 1. Whenever feasible, i.e., whenever each cell has more than four entries, average values and standard deviations for the selected financial characteristics are given. Otherwise, the range of the sample values is given.

The distribution of mean income conforms somewhat to ex ante hypotheses with respect to age and horsepower, that is, within the 150-249 h.p. row mean vessel income before taxes and depreciation minus interest, decreases as vessels become older. Conversely, within age groups this measure of income increases as larger engines are added.

Table 1. Financial Characteristics of Shrimp Vessels with Financial Assistance

(1967-1968)

	VESSEL AGE			
	0-5 years	6-10 years	11-15 years	>15 years
Less Than 150 Horsepower:				
No. vessels (sample)	0	0	2	0
1. Mean vessel income[1]			8693	
2. Std. dev. vessel income			5389 to 11998*	
3. Mean vessel interest[2]			204	
4. Std. dev. vessel interest			0 to 408	
5. Mean returns to vessel[3]			8897	
6. Std. dev. returns to vessel				
7. Present value @ 12%[4]			49500	
8. Present value @ 18%			42808	
9. Present value @ 24%			37743	
150-249 Horsepower:				
No. vessels (sample)	12	8	8	2
1. Mean vessel income[1]	14449	12935	3560	-3043
2. Std. dev. vessel income	3434	4633	7080	-11650 to 5563*
3. Mean vessel interest[2]	1971	1460	528	1075
4. Std. dev. vessel interest	1042	500	513	997 to 1154*
5. Mean returns to vessel[3]	16420	14395	4088	-1968
6. Std. dev. returns to vessel	3588	4660	7080	
7. Present value @ 12%	133324	103563	22744	
8. Present value @ 18%	102170	83393	19669	
9. Present value @ 24%	83070	69835	17342	
Greater Than 250 Horsepower:				
No. vessels (sample)	15		1	1
1. Mean vessel income[1]	18163		12837	11643
2. Std. dev. vessel income	5867			
3. Mean vessel interest[2]	2883		210	678
4. Std. dev. vessel interest	1000			
5. Mean returns to vessel[3]	21046		13047	12321
6. Std. dev. returns to vessel	5951			
7. Present value @ 12%	170885		72590	41913
8. Present value @ 18%	130955		62776	39110
9. Present value @ 24%	106474		55349	36732

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated at 18, 13, 8, 4 years respectively

*Range

The level of these income measures also conforms to a priori estimates. By this, we mean that the Gulf Shrimp Fisherey is known to have been a relatively profitable venture for these years. Despite this fact, such exceptions as exhibited in the 150-249 h.p., 11-15 years group indicate that certain vessels experienced difficulties during this period. The standard deviation of vessel income for this cell emphasizes the wide variation for this group, a further characteristic of these vessels which conforms to a priori hypotheses formed by those of us with prior exposure to financial statistics on the U.S. shrimp fishery. These measures must be interpreted to mean that for certain age-h.p. groupings there is an increasing presence of low or negative incomes, and this increased prevalence tends to lower the average income for these groups.

Interest charges suggest the degree of indebtedness and also serve to adjust taxable income. They serve to indicate that as we decrease the age of the vessel and increase its h.p., interest charges increase and thereby also the associated income measure. Stated directly, newer, larger vessels have more borrowed capital. Once again, however, there is considerable

deviation. In this case this suggests that vessel owners have resorted to a wide variety of financing alternatives, thus leading to considerable variations in the nature and magnitude of indebtedness within certain subgroupings.

Although the net cash flow measures of earning power exhibited as mean vessel income (row #1 in each cell) and mean returns to vessel (row #5 in each cell) are indications of profitability, it was deemed desirable to obtain some measure of return on investment. Using the methods described above, values have been determined for each cell in table 1. These provide an additional measure of the profitability of each group and once again these are consistent with a priori knowledge and the net cash flows.

Beginning with the groups 0-5 years and 150-249 h.p., we see that if a 12 percent ROI (before taxes and depreciation plus interest) is acceptable, then the earning flow would justify the purchase of a vessel valued at $133,324. A more reasonable ROI would be 18 percent, however, and the present value here would be $102,170. Considering the cost of investing in our current monetary environment and the risk of fisheries investments, some may consider 24 percent as the minimum ROI acceptable. For this percent the

discounted present value of boats in this group would be $83,070. Recalling that this figure is before taxes and depreciation plus interest, it is consistent with current pricing practices for new shrimp vessels.

The decrease in these discounted present values is consistent and dramatic as vessels become older. For vessels over 10 years old and horsepower less than 250 the discounted value of the vessels would essentially prohibit further investment. Once again the wide standard deviation in incomes must be acknowledged as a qualifier.

An additional element is the higher present values found in the group with vessels 0-5 years and greater than 250 h.p. These high values in part explain the large size of the subsample in this cell (15) and are consistent with the fact that there has been considerable new entry into the shrimp fishery by vessels in this size group. This new entry is continuing.

In general, these data tend to confirm that the shrimp fishery has many healthy, profitable segments. However, significant numbers of smaller, older vessels do exist that have minimal net cash flows. As these vessels would undoubtedly be affected the most by vessel safety programs, it would be incorrect to conclude that these segments would be impervious to the added cost associated with such programs.

Tortugas Shrimp Fishery: 1964-1965

The 151 vessels contained in this sample were selected from a larger group fishing from the 13 major shrimp landing ports in the Gulf of Mexico. The one selective guide used in choosing these vessels was that they had to make at least one landing in a Tortugas port. If they made more than 50 percent of their landings in one of these ports then it is listed as its home port. A majority of these vessels are so listed and approximately 70 percent of the landings by these vessels were in Tortugas ports.

As this sample is for a major fishery within the Gulf, and it contains both distant water vessels and near shore vessels, landing all species, it is a highly representative sample of the Gulf shrimp fishery as a whole.

Within this sample the distribution by age and h.p. is consistent with data for the years 1967-68 (see table 2). Vessels are concentrated in the 150-249 h.p. bracket. One difference is that the vessels are older on the average, suggesting that the rapid increase in shrimp vessel construction had not yet begun. This is especially evident when looking at the vessels with less than 150 h.p.

Table 2. Financial Characteristics of Tortugas Shrimp Fishery (1964-1965)

	VESSEL AGE			
	0-5 years	6-10 years	11-15 years	>15 years
Less Than 150 Horsepower:				
No. vessels (sample)	1	2	4	26
1. Mean vessel income[1]	544	2348	17961	9077
2. Std. dev. vessel income	.	111-4586*	14117	8077
3. Mean vessel interest[2]	51	461	275	35
4. Std. dev. vessel interest		32-891*	0-1101*	114
5. Mean returns to vessel[3]	595	2809	18230	9112
6. Std. dev. returns to vessel				8077
7. Present value @ 12%[4]	4831	20209	101460	27476
8. Present value @ 18%	3702	16273	87743	25638
9. Present value @ 24%	3010	13627	77362	24079
150-249 Horsepower:				
No. vessels (sample)	7	23	28	45
1. Mean vessel income[1]	21552	13077	9524	10492
2. Std. dev. vessel income	12121	10136	10668	12480
3. Mean vessel interest[2]	955	778	248	111
4. Std. dev. vessel interest	1002	857	536	245
5. Mean returns to vessel[3]	22507	13855	9772	10603
6. Std. dev. returns to vessel	12162	10172	10681	12482
7. Present value @ 12%	182478	99678	54369	36069
8. Present value @ 18%	140046	80265	47018	33656
9. Present value @ 24%	113865	67215	41455	31610
Greater Than 250 Horsepower:				
No. vessels (sample)	3	2	7	3
1. Mean vessel income[1]	8212	11866	19420	6059
2. Std. dev. vessel income	5242-11497*	5319-17729*	14952	(2362)-14479*
3. Mean vessel interest[2]	868	546	418	0
4. Std. dev. vessel interest	0-2604*	0-868*	425	0
5. Mean returns to vessel[3]	9080	12412	19838	6099
6. Std. dev. returns to vessel			14958	
7. Present value @ 12%	73726	89296	110374	20611
8. Present value @ 18%	56498	71905	95451	19232
9. Present value @ 24%	45936	60215	84159	18063

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated at 18, 13, 8, 4 years respectively

*Range

The present values generated by the earnings of these vessels suggest the reason for the shift in overall size to larger vessels. Net cash flows before income taxes and depreciation range from approximately $22,500 for larger vessels to $10,000 for smaller vessels in the 150-249 h.p. group. These incomes are associated with discounted present values of the associated vessels of $182,478 (12 percent) and $113,865 (24 percent) for the newest, largest vessels. The lowest present values, $36,069 (12 percent) and $31,610 (24 percent) are for vessels over 15 years of age. At this point in time, even these lower figures could generate funds for reinvestment, especially if the owner is also the vessel captain, as may often be the case.

The standard deviations in mean returns to vessel suggest that in virtually all cases there will be considerable numbers of vessels with very low, if not negative, vessel incomes. The increasing preponderance of these will partially account for the lower average incomes in older vessels. Although less consistent because of fewer observations, the data available for vessels with more than 250 h.p. reinforce these conclusions.

Because this data is not from the most recent years, some comment on its potential use would be appropriate. In general, the following comments will suppcrt the conclusion that this data may

still be considered as representative of the profitability of shrimp harvesting operations.

The value of shrimp landings increased from $62.7 million in 1964 to slightly over 100 million in 1968. This was a function of a slight increase in landings and an increase in ex-vessel prices from $.35 to $.47 per pound. This price increase was associated with general cost increases in the industry and the U.S. economy of approximately the same magnitude. By these observations, these vessels would retain their same relative profitability.

An additional consideration is the changing technology and changing resource base over time. With increasing pressure on the domestic resource, U.S. vessels began joining the Caribbean fleet in 1965. This trend has continued and is being reinforced by technological developments which lead to increased emphasis on larger vessels with greater navigational and freezing ability. These developments are exemplified in the construction pattern for new vessels and the profitability patterns of older vessels that do not have these technical attributes.

The combination of technological change and price and cost trends has let to a continuation of the same level of profitability over time with the distribution of this profit being increasingly skewed in favor of larger, newer vessels. Large standard deviations suggest that numerous variations from this pattern may be found.

Georgia Shrimp Vessels: 1966

Data contained in this table were gathered initially for a study by Dr. D. H. Carley, Department of Agricultural Economics, Georgia Station, entitled "Economic Analysis of the Commercial Fishery Industry of Georgia," and were provided to the Bureau of Commercial Fisheries on request. As these data were gathered to provide a comprehensive overview of the cost and earnings structure of the Georgia shrimp fishery, they are ideally suited to the purpose of this report.

Data available from this study includes the mean returns to vessels before income taxes and depreciation plus interest. This is sufficient to generate discounted present values at the alternative discount rates (ROI's) of 12 percent, 18 percent and 24 percent. Although there is not a perfectly consistent linear trend it is apparent that larger vessels do generate larger present values. However, of greater importance is the fact that

Table 3. Financial Characteristics of Georgia Shrimp Vessels (1965-1966)

	VESSEL TYPE (By length, in feet)			
	<40	40-49	50-59	>60
No. of vessels (universal)	89	94	60	15
No. of vessels (sample)	7	12	19	12
1. Mean vessel income[1]				
2. Std. dev. vessel income				
3. Mean vessel interest[2]				
4. Std. dev. vessel interest				
5. Mean returns to vessel[3]	2050	5479	4343	6990
6. Std. dev. returns to vessel	2902	4430	3038	4227
7. Present value @ 12%[4]	11406	30606	24163	38891
8. Present value @ 18%	9864	26447	20896	33633
9. Present value @ 24%	8697	23304	18424	29654

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated for over 8 years

*Range

the largest present value generated, $38,891 @ 12 percent for vessels greater than 60 ft. long suggests that the inducement for new capital to enter is low and that if there is entry it is via used, rebuilt or refitted vessels whose other alternative is even less attractive.

Once again the magnitude of the standard deviation allows for some exceptions. Different from other shrimp data however, is the fact that in the Georgia fishery the exception is the profitable vessel, whereas in others the exception was the vessel incurring low or negative returns to vessel.

The Georgia shrimp fishery is a classic case of secular over-capacity with regulation designed to restrict the effect of this capacity on the resource base but with little positive effect on the profitability of this capital. As this situation continues (which it has) there will be considerable pressure on many of the marginal enterprises to drop out of the fishery. Any additional pressure on the cost side, from whatever source, will most likely accelerate this exit considerably, causing extensive short-term hardship to several people employed in this fishery. This fishery, while once again acknowledging the existence of a considerable standard deviation, is not atypical of all shrimp fisheries of the southeast Atlantic seaboard.

New Bedford Groundfish: 1967-1968

This sample consists of operating statements for 38 groundfish vessels for the years 1967 and 1968 table 4 . As can be readily seen, there is no discernable pattern of new vessel construction nor any dominant age-h.p. characteristic for existing vessels, although it may be noted that 19 vessels are greater than 19 years old and 16 have less than 250 h.p.

A look at vessel incomes immediately reveals a distinct characteristic of the vessels in this fishery; one may expect to find both highly profitable and highly unprofitable vessels in this fishery in virtually every age-h.p. As examples of this extreme variability consider the cell of greater than 250 h.p., age 10-18 years. Here for 6 vessels the average mean vessel income is $3495 while the standard deviation from this mean income is $9523. This means the range for these vessels is of such magnitude that the mean value is of little use as an indicator of profitability. Values in the cell greater than 250 h.p. and greater than 29 years indicate the same characteristic, with values ranging from - $1,840 to $16,169.

Table 4 Financial Characteristics of New Bedford Groundfish 1967-1968

	VESSEL AGE			
	<9 years	10-18 years	19-28 years	>29 years
Less Than 150 Horsepower:				
No. vessels (sample)				1
1. Mean vessel income[1]				461
2. Std. dev. vessel income				
3. Mean vessel interest[2]				266
4. Std. dev. vessel interest				
5. Mean returns to vessel[3]				687
6. Std. dev. returns to vessel				
7. Present value @ 12%[4]				
8. Present value @ 18%				
9. Present value @ 24%				
150-200 Horsepower:				
No. vessels (sample)	1	2	9	3
1. Mean vessel income[1]	8,445	9,164	7,705	2,082
2. Std. dev. vessel income		8,321-10,007	6,302	1,994-4,241
3. Mean vessel interest[2]	1,564	705	1,127.	1,794
4. Std. dev. vessel interest		165-1,197*	433	0-877
5. Mean returns to vessel[3]	10,009	9,869	8,823	3,876
6. Std. dev. returns to vessel			6,316	
7. Present value @ 12%	91,837	78,389	43,545	17,848
8. Present value @ 18%	65,445	54,200	33,652	15,996
9. Present value @ 24%	51,690	40,995	27,486	145,17
Greater Than 250 Horsepower:				
No. vessels (sample)	7	6	6	3
1. Mean vessel income[1]	13,055	3,495	6,656	(3,960)
2. Std. dev. vessel income	6,354	9,523	6,245	(16,169)-1,840
3. Mean vessel interest[2]	3,311	1,380	1,044	795
4. Std. dev. vessel interest	1,193	1,240	688	151-1,500
5. Mean returns to vessel[3]	16,366	4,875	7,700	(3,165)
6. Std. dev. returns to vessel	6,465	9,603	6,282	
7. Present value @ 12%	150,166	43,366	61,399	
8. Present value @ 18%	107,011	31,592	47,450	
9. Present value @ 24%	84,521	25,111	38,756	

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated at 36, 27, 17, 6 yrs. respectively

*Range

This suggests that while these low mean incomes for many of these groupings indicates marginal profitability, there will be exceptions and some of these will be of considerable magnitude.

A noticeable exception is for those vessels less than 9 years old and greater than 250 h.p. Although there is still a considerable standard deviation the mean vessel income is sufficiently large so that there is a much more profitable picture for this group. As was the case in the shrimp fishery, this is a reaffirmation of the suspicion that to some degree the newer, larger vessel has a greater likelihood of profitability. We should hasten to add however, that in the traditional sense these vessels are not as large as many of the foreign groundfish vessels fishing the North Atlantic.

Because of the extreme variation in the values for mean returns to vessels the use of ROI in the calculation of present values becomes especially tenuous for this sample. It can be seen however, that to generate a sufficient discounted present value to justify the purchase of a costly groundfish vessel only the income flow represented by the extreme positive standard deviation would be large enough. Once again the exception is the largest, newest vessels where the mean returns to vessel is sufficient to generate a discounted present value of $150,166 @ 12 percent and some of the higher deviations would generate considerably larger present values.

Boston Large Trawlers: 1964-1966

Data contained in table 5 are based on a BCF study on Cost and Earnings in the Boston Large Trawler Fleet. For the purpose of that study one segment of the cost, so-called owner's costs, were estimated because of limited information available. The main part of costs, however, including trip expenses and labor costs (about 2/3 to 3/4 of total costs) is based on detailed information from union trip settlements. Only vessels of over 150 GRT were analyzed.

In this fleet of 22 large trawlers, which fish principally for haddock on Georges Bank, vessels of less than 100 feet in length are, in general, unprofitable. While some of the vessels in this group were still profitable in 1965, the rapid decrease of haddock stocks over the last few years changed entirely the economics of operations. At the end of 1968 only two out of eight vessels were still operating.

In the group of seven vessels of over 100 feet in length, and with engines of less than 600 h.p., the returns to vessel ranged from $4,000 to over $40,000 in 1964-66. Out of this group only the two most successful vessels were still fishing for haddock at the end of 1968.

Table 5. Financial Characteristics of Boston Large Trawlers (as of 1966)

	VESSEL LENGTH	
	<100 feet	>100 feet
Less Than 480 Horsepower:		
No. vessels (sample)	5	
1. Mean vessel income[1]		
2. Std. dev. vessel income		
3. Mean vessel interest[2]		
4. Std. dev. vessel interest		
5. Mean returns to vessel[3]	1,497	
6. Std. dev. returns to vessel		
7. Present value @ 12%[4]	72,757	
8. Present value @ 18%	54,932	
9. Present value @ 24%	44,326	
480-600 Horsepower:		
No. vessels (sample)	3	7
1. Mean vessel income[1]		
2. Std. dev. vessel income		
3. Mean vessel interest[2]		
4. Std. dev. vessel interest		
5. Mean returns to vessel[3]	-13,843	17,590
6. Std. dev. returns to vessel		
7. Present value @ 12%[4]		239,660
8. Present value @ 18%		181,171
9. Present value @ 24%		146,449
Greater Than 600 Horsepower:		
No. vessels (sample)		7
1. Mean vessel income[1]		
2. Std. dev. vessel income		
3. Mean vessel interest[2]		
4. Std. dev. vessel interest		
5. Mean returns to vessel[3]		44,151
6. Std. dev. returns to vessel		
7. Present value @ 12%[4]		538,831
8. Present value @ 18%		406,823
9. Present value @ 24%		328,275

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present values calculated for 12 years

*Range

These few instances of profitability must be reconsidered in light of the latest development in the groundfish fishery of the Northwest Atlantic. ICNAF members recently voted a partial closure of haddock fishing areas due to a severe resource crisis. The effect on New Bedford boats will be two-fold. First, the catch of haddock, even as a small percentage, will decrease and so will the supplementary income provided by it. Further, redundant haddock boats from New Bedford, Boston and other ports may shift to flounder and cod and it is feared that this may eventually lead to some resource difficulties in these fisheries.

Although counteracting measures are being initiated, there is little hope for significant immediate improvement. Given this present environment any additional cost would be an especially severe burden for this fishery. As the data in this sample is recent, this environment is already partially reflected in the cost and earnings statements of these vessels.

The group of larger vessels with engines over 600 h.p. is the most homogeneous one with respect to revenue and returns.

This group consists of three fairly new vessels (year built 1963-65), one completely remodeled in 1962, and three old vessels (20-30 years). Only one of these vessels left the haddock fishery in 1968 (it is now fishing for ocean perch out of Gloucester). On the three newer vessels alone, the interest cost on borrowed capital is around $11,000 per vessel, while the value of a vessel (book value) is now around $200,000. This refers also to the remodeled trawler. As for the three old vessels, the estimated market value is about $180,000 per vessel.

The present value figures from table 5 (at a 24 percent discount rate) indicate, that for the larger vessels (over 100 feet) with 480-600 horsepower, the earnings flow is not adequate to justify the purchase of a new vessel of this type, even with a 50 percent government construction cost subsidy. For a large trawler with more than 600 h.p. (construction cost $600,000-$650,000) new investment could be encouraged only with a substantial amount of subsidy.

It may be assumed that any additional cost of a safety program would force 4-5 more trawlers (marginal vessels) out of operation, and that only 7-8 (out of the 22 vessels analyzed) might be able to continue fishing for haddock.

New Bedford Scallopers: 1967-68

This sample of 13 scallopers has the following mean characteristics: length 80 feet (range 67-90 feet); main engine 494 h.p. (range 155-765); age 12 years (range 2-31 years).

Stratified by two age categories and two horsepower categories, the vessels in each group present similar mean values for returns to vessel (table 6). The dispersion of returns to individual vessels, however, is high as indicated by the standard deviation and ranges. In general, vessels with more horsepower secure higher returns.

The table presents the average performance of vessels for two years. The variation from year to year can be extremely high, as indicated by the following figures: the average return to vessel for the entire sample was $5,785 in 1967, and $17,189 in 1968 (before income taxes and depreciation, interest included). The main reason for this variation was the difference in gross revenue per vessel: $161,066 in 1967 versus $248,562 in 1968, caused by higher ex-vessel prices in 1968.

Table 6. Financial Characteristics of New Bedford Scallopers 1967-1968

	VESSEL AGE			
	0-10 years	>11 years	years	years
Less Than 400 Horsepower:				
No. vessels (sample)	1	4		
1. Mean vessel income[1]	14,260	13,245		
2. Std. dev. vessel income		3,934-16,371		
3. Mean vessel interest[2]	2,926	2,987		
4. Std. dev. vessel interest		307-5,898		
5. Mean returns to vessel[3]	17,186	16,232		
6. Std. dev. returns to vessel				
7. Present value @ 12%[4]	157,000	133,908		
8. Present value @ 18%	112,259	101,826		
9. Present value @ 24%	88,735	82,457		
>400 Horsepower:				
No. vessels (sample)	6	2		
1. Mean vessel income[1]	15,659	7,842		
2. Std. dev. vessel income	5,120	6,870-8,815		
3. Mean vessel interest[2]	4,772	1,791		
4. Std. dev. vessel interest	1,745	1,624-1,958		
5. Mean returns to vessel[3]	20,431	9,633		
6. Std. dev. returns to vessel	1,744			
7. Present value @ 12%[4]	186,644	79,462		
8. Present value @ 18%	133,455	60,427		
9. Present value @ 24%	105,490	48,934		

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated at 30, 20 yrs. respectively

*Range

These statistics suggest that the choice of the operating year may be more important than considerations of vessel characteristics in developing a representation of the financial status of a fishery. This situation is dramatic for this fishery, but it exists for individual vessels in other fisheries where individual rather than overall factors may be causing unusual deviation from a "normal" earnings pattern. This suggests an additional reason for giving due consideration for the composite representativeness of a sample, where such dispersions may be "averaged out," as opposed to focusing on individual vessels.

This further suggests that the impact of such additional costs as may be generated by a safety program may have varying impacts depending on the particular status of a vessel or fishery in the exact year in which it is initiated. More will be said on this timing problem in the section of financing additional costs.

New England Small Trawlers: 1964

Data contained in table 7 were collected initially for a study by Dr. Andreas A. Holmsen, University of Rhode Island, and were provided to the Bureau of Commercial Fisheries on request. This data refers to 46 small trawlers fishing for groundfish out of three ports: Point Judith, Stonington, and Newport. The average

Table 7 . Financial Characteristics of New England Small Trawlers
(Point Judith, Stonington, Newport)
1964

	VESSEL AGE		
	Less than 10	10-20	More than 20
Less Than 200 Horsepower:			
No. vessels (sample)		3	19
1. Mean vessel income[1]		2,985	529
2. Std. dev. vessel income		1059-4452*	2,238
3. Mean vessel interest[2]		406	95
4. Std. dev. vessel interest		228-651 *	206
5. Mean returns to vessel[3]		3,391	624
6. Std. dev. returns to vessel		1287-3783*	2,245
7. Present value @ 12%[4]		25,867	2,519
8. Present value @ 18%		20,373	2,303
9. Present value @ 24%		16,824	2,124
Greater Than 200 Horsepower:			
No. vessels (sample)	4	7	13
1. Mean vessel income[1]	8,753	2,155	4,418
2. Std. dev. vessel income	4880-13,454*	2,256	3,502
3. Mean vessel interest[2]	1,103	352	683
4. Std. dev. vessel interest	0-1,564*	392	598
5. Mean returns to vessel[3]	9,856	2,507	5,101
6. Std. dev. returns to vessel	4904-15,018*	2,265	3,504
7. Present value @ 12%[4]	86,578	19,124	20,595
8. Present value @ 18%	63,581	15,062	18,823
9. Present value @ 24%	50,688	12,439	17,365

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life *Range
Present value calculated at 25, 15, 5 years respectively

age of a vessel in this group was 18 years (end of 1964), the range being 1 to 42 years; the average length is 55 feet (range 35-78 feet); the average horsepower of the main engine is 188 h.p. (range 110-380 h.p.).

In the largest group (19 old vessels with $<$ 200 h.p.) there were 7 vessels with losses (average loss $1,688 per vessel, interest included), and 12 vessels with profits (average $1,973 per vessel). The highest return in this group was $3,943 before depreciation.

In the second largest group (13 old vessels with $>$ 200 h.p.) two vessels showed losses (average loss $697), and 11 vessels gave a return of $5,902 per vessel (range $2,150-$11,346).

As indicated by this data, this is a struggling segment of the New England fishing industry. With the exception of a few of the larger, newer vessels, the earnings flow is nowhere near sufficient to generate a discounted net cash flow sufficient to warrant purchase of new vessels or re-investment in the fishery. Considering the relative price and cost changes since this data was collected, and the decline of the resource base, there is

little cause for expecting a more optimistic picture presently. Despite the outstanding efforts of the Port Judith Fisherman's Cooperative, it may be expected that any additional costs would have a severe impact. This may be especially relevant considering the small size and age of the boats in this fishery.

Atlantic and Gulf Menhaden: 1964-1965

The sample of vessels that we have for the menhaden fleet is not truly representative in that all the vessels are owned and/or operated by one company. There is a suspicion that this company, because of its effective management and accounting practices, may be experiencing higher profits than the average for the rest of the industry.

Inspection of the original data did not reveal any distribution of earnings that could be attributed to the physical characteristics of the vessels (table 8). The data were finally divided into two groups according to where they do the bulk of their fishing, i.e., the Atlantic or Gulf. Surprisingly the standard deviations were small when the data was classified this way.

Mean income for the vessels that fish principally in the Gulf in 1964-1965 was $38,562 with a standard deviation of $7,812. For the Atlantic based vessels the mean income was $12,262 with a standard deviation of $3,765. The prime reason for the profit differing between Gulf and Atlantic is a secular deviation in the resource base. Subsequent years have witnessed further resource declines. Coupled with increasing imports and price declines, the

industry has just experienced a period of losses not revealed by the 1964-65 datas. This has accelerated the withdrawal of many marginal vessels. As the incomes and deviations began to suggest, certain elements of this fishery would be vulnerable to further pressure.

Table 8. Atlantic and Gulf Menhaden Vessels 1964-1965

Gulf Menhaden Fleet

No. vessels (sample)	5
1. Mean vessel income	38,562
2. Std. dev. vessel income	7,814
3. Mean vessel interest[2]	0
4. Std. dev. vessel interest	0
5. Mean returns to vessel[3]	38,562
6. Std. dev. returns to vessel	7,814
7. Present value @ 12%[4]	322,601
8. Present value @ 18%	243,567
9. Present value @ 24%	196,540

Atlantic Menhaden Fleet

No. vessels (sample	8
1. Mean vessel income	12,262
2. Std. dev. vessel income	3,765
3. Mean vessel interest[2]	0
4. Std. dev. vessel interest	0
5. Mean returns to vessel[3]	12,262
6. Std. dev. returns to vessel	3,765
7. Present value @ 12%[4]	102,581
8. Present value @ 18%	77,450
9. Present value @ 24%	62,496

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life *Range
Present values calculated over 20 years

Tuna Purse Seiners: 1963-1968

The analysis for tuna purse seiners will proceed differently from other fisheries because the situation there is changing so rapidly. Problems are being brought about because of the following reasons:

1) Technological change has made large cost reductions possible in the catching of tuna; this has brought about a rapid expansion of the fleet by the addition of large, efficient vessels.

2) The total catch of yellowfin tuna, the principal money fish, is limited by treaty.

The upshot of this is that as the fleet expands, more yellowfin tuna is not landed. Instead, the effective fishing season becomes shorter, decreasing the potential total revenue of all the vessels. In the ordinary course of events, the expansion of the fleet would cease as the shortening season made even the new vessels unprofitable. Such is not the case however, as the fleet, in the last year, has opened up new fishing grounds off Africa that appear at least as productive as the traditional grounds of the Eastern Pacific. Because of the distances involved, only the large vessels can make

the trip to the new grounds. Rather than tuna vessel building slowing down, the pace is actually accelerating. This leaves the smaller vessels, those able to fish only in the Eastern Pacific, with rapidly declining total revenues and profits.

We have the income statements for 11 purse seiners out of a population of 93 for the years 1964-66. These were obtained from the Division of Financial Assistance, who had received them as a part of a subsidy or loan insurance application. We have combined this data with catch data received from IATTC to do the following preliminary analysis of the status of the tuna fleet.

The 11 vessels for which we have information are not typical vessels. Average revenue/day at sea for all vessels less than 450 tons capacity for 1966-68 and for the sample is shown below.

	All Tuna Seiners less than 450 tons	Sample
Revenue/day at sea	$ 1,868	$ 2,171
Capacity	285	277

Although the mean capacity of our sample is about the same as the rest of the fleet, it is on the average 16 percent more productive, therefore if there is a negative prognosis for the sample it would

indicate that most other small vessels in the fleet were in financial difficulty also.

The data were analyzed using the following assumptions for the years 1966-68.

1. Fixed costs for the 11 vessels were extrapolated from the base period and incremented 5 percent per year. In view of the recent inflation and a very rapid rise in insurance premiums this 5 percent is probably on the low side.

2. Trip expenses were average per day at sea in the base period and extrapolated forward with a 5 percent increase per year. Expense/day was multiplied by the number of days at sea actually experienced in 1966-68.

3. Gross stock was arrived at by multiplying average price received in California for each species by each vessel's catch.

4. Gross stock was divided between boat and crew using the fleet's standard lay system.

Based on the above assumptions, table 9 was prepared. The 11 vessels' operating results in 1966 and 1967 were the best for any of the years for which we have data. Crew earnings were high also. The situation in 1968 is a different story as it is the first year the yellowfin limits really took effect.

The analysis divides 1968 into two periods: non-regulated when there is no limit on yellowfin; regulated when the yellowfin is limited to an incidental catch and the fleet has to rely upon skipjack. All fixed costs are deducted from the first period since for the most part they have to be paid irrespective of the time that a vessel spends at sea. Such charges as insurance and the bulk of maintenance and repair fall into this category. Other charges such as gear and supplies depend upon the amount of fish caught, although nets deteriorate to some extent because of exposure to the sun. The additional accuracy gained by distributing estimates of marginal costs to the regulated period would not significantly change the analysis.

In general, 1968 was not a good year for these vessels or the crews. Because of the yellowfin season ending June 18, the vessels' period of high revenue lasted little more than half the year. On

Table 9. Composite Tuna Vessel of Less than 450 Tons Capacity

Name: Capacity: 277 Crew: 12
Official No.: Horsepower: 745 Year Built: 1948

	66-67	(1968) Non-Reg.	(1968) Reg.	(1968) Total	10 percent shorter Non-Reg.	10 percent shorter Reg.	10 percent shorter Total	25 percent shorter Non-Reg.	25 percent shorter Reg.	25 percent shorter Total
Days	214	121	65	188	109	105	214	91	125	214
YF (thou. lbs.)										
SJ										
BF										
Gross Stock	405,455	278,727	64,100	342,827	250,967	103,540	354,507	209,287	123,213	332,500
Trip expense	43,097	27,584	13,113	40,697	26,066	23,134	49,200	22,917	28,185	51,102
Crew share	173,954	120,548	24,473	145,021	107,992	38,594	146,546	89,457	45,613	135,070
Boat share	188,526	130,594	26,513	157,107	116,948	41,811	158,759	96,912	49,414	146,326
Owner's Cost										
Capt. Commission	17,224	12,119	2,148	14,267	10,836	3,441	14,277	8,980	4,060	13,040
Maint. & Repair	44,707	47,034		47,034	49,290		49,034	51,391		51,391
Gear & Supplies	13,756	14,407		14,407	15,128		14,407	15,884		15,884
Insurance	24,058	25,260		25,260	26,523		25,260	27,850		27,850
Other	20,575	21,604		21,604	22,684		21,604	23,818		23,818
Total	120,320	120,424	2,148	123,118	124,461	3,441	127,902	127,923	4,060	131,983
Boat Income	68,206	10,169	24,365	34,534	(7,514)	38,370	30,856	(31,011)	45,353	14,342
Provisions	13,192	7,434	4,422	11,856	6,810	6,471	13,281	5,636	7,709	13,345
Net Crew Share	160,763	113,114	20,052	133,166	101,142	32,123	133,274	83,821	37,904	121,726
Per Man	11,483	8,079	1,432	9,511	7,224	2,294	9,518	5,987	2,707	8,694
Per Man/Per Day (at sea)	54	67	22	50	66	22	44	66	22	41

the average a vessel grossed 2.415 times more money per day at sea during the yellowfin season as after it. If they had been allowed to fish the whole year for yellowfin it would have been a very good year because the catch rates were so high.

Both total profits and wages were lower than in previous years. What the breakdown of the data does show is a dichotomy of interest between the vessel owners and their crews. Crewmen in general make very good wages while the vessels are free to fish for yellowfin since wages depend upon the catch. When forced to fish only for skipjack they become extremely low, in fact, lower than they could make in almost any shore based job. The vessel owners on the other hand make only enough money during the yellowfin season to cover fixed expenses so that to have any operating income at all they have to fish for skipjack during the rest of the year. The upshot of this is that as the tuna fleet expands, its high revenue period will become shorter. The vessels will try to operate by fishing skipjack but will find it increasingly difficult to find anyone willing to go to sea during the regulated period because of low wages.

As a demonstration of the effect, a hypothetical 1969 and 1970 were estimated for the vessels in the sample (table 9). This was done by assuming that each of three vessels fished as much as they were physically able in 1968 and that in 1969 they could only fish 90 percent of the time for yellowfin as was possible in 1968, and 75 percent in 1970. It was also assumed that their total time at sea was about the same as the 66-68 period.

Vessel income, if the vessels fish only during the yellowfin season, will fall from a level of $68,206 (1966-1967) to a loss of $31,011 by 1970. If the vessel owners can get a crew to go to sea for 125 days for $22/day, the vessels will earn $14,342 in 1970.

Pacific Northwest Groundfish Vessels: 1967-1968

A sample of 21 vessels was analyzed with respect to their income generating potentials. Included were vessels with the following mean characteristics: length 64 feet (range 50-78 feet); main engine 215 h.p. (range 70-555 h.p.); age 32 years (range 21-49 years).

Data made available for this sample included, in some cases (12 vessels), interest cost that was not actually paid for borrowed money, but that was calculated as a return to invested capital (at a rate of 6 percent). For this reason, only the returns to vessel (i.e., before any interest charge) are presented in table 10. On 9 vessels with appropriate data the interest cost was $1,687 per vessel. These 9 vessels, however, are not identical with the ones presented in the upper part of table 10 (less than 200 h.p.).

Regression analysis reveals no linear correlation between vessel performance (return to vessel) and main characteristics of a vessel: length, horsepower, and age. The negative correlation with length, and the positive correlation with horsepower and age are all not significant statistically.

With some modification with respect to interest cost, i.e., charging each vessel with an interest cost of $1,687, the cash flow would be $10,000 or over on 10 vessels (out of 21), and $5,000 or less on 1 vessel only.

Table 10. Pacific Northwest Groundfish Vessels

	VESSEL AGE			
	>20 years	years	years	years
Less Than 200 Horsepower:				
No. vessels (sample)	9			
1. Mean vessel income[1]				
2. Std. dev. vessel income				
3. Mean vessel interest[2]				
4. Std. dev. vessel interest				
5. Mean returns to vessel[3]	14,459			
6. Std. dev. returns to vessel	6,812			
7. Present value @ 12%[4]	120,961			
8. Present value @ 18%	91,327			
9. Present value @ 24%	73,693			
Horsepower:				
No. vessels (sample)				
1. Mean vessel income[1]				
2. Std. dev. vessel income				
3. Mean vessel interest[2]				
4. Std. dev. vessel interest				
5. Mean returns to vessel[3]				
6. Std. dev. returns to vessel				
7. Present value @ 12%[4]				
8. Present value @ 18%				
9. Present value @ 24%				
Greater Than 200 Horsepower:				
No. vessels (sample)	12			
1. Mean vessel income[1]				
2. Std. dev. vessel income				
3. Mean vessel interest[2]				
4. Std. dev. vessel interest				
5. Mean returns to vessel[3]	12,593			
6. Std. dev. returns to vessel	11,976			
7. Present value @ 12%[4]	105,350			
8. Present value @ 18%	79,540			
9. Present value @ 24%	64,183			

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated for over 20 years

*Range

This is a relatively healthy fishery, although there are 11 vessels with earnings less than $10,000 and for some of these, additional costs of any magnitude would be a significant percentage of net cash flow. Also relevant is the age of these vessels, with the newest being 21 years old and with the difficulties and uncertainties in the industry the psychology toward new investment in this fishery is very negative: maintenance and repairs are kept to that minimum necessary to keep the vessels operable.

In addition, some of the success of these vessels may be attributed to their ability, though primarily groundfish vessels to switch to alternative fisheries whenever these are particularly attractive. During the years for this data, these alternatives have been good.

Seattle Halibut Vessels: 1966-68

Contained in this sample are 32 halibut vessels with the following mean characteristics: length 57 feet (range 36-76 feet); horsepower of main engine 151 h.p. (range 48-300 h.p.); age 36 years (range 8-57 years). Financial data for most recent years (1966-1968) were obtained partly from BCF files, and partly from the Fishing Vessel Owners' Association in Seattle, Washington.

From the statistics presented in table 11, it appears that there is no linear correlation between vessel performance and such characteristics as age and horsepower. This may be due to the specific way of grouping vessels in this sample, which resulted in forming groups including only one, two, or four vessels. Without any stratification, performance of the entire sample may be characterized by the following figures:

	Mean	Standard Deviation
vessel income	$ 6,770	$ 4,450
interest paid	376	472
returns to vessel	7,076	4,298
present value of returns (discounted over 10 years):		
at 12 percent	44,778	
at 18 percent	37,524	
at 24 percent	32,305	

However, when individual vessels were analyzed, the outcome was entirely different from that stated above. In a regression analysis, with application of the least-squares method, the following relationships were found: (1) the mean vessel income (mean for 3 years) is positively correlated with the size of the vessel (indicated by its length); (2) the vessel income is

Table 11. Financial Characteristics of Seattle Halibut (1966-1968)

	VESSEL AGE			
	<20 years	20-29 years	>30 years	years
Less Than 100 Horsepower:				
No. vessels (sample)	2		4	
1. Mean vessel income[1]	2905		10246	
2. Std. dev. vessel income	1447-4363*		2680-15733*	
3. Mean vessel interest[2]	175		387	
4. Std. dev. vessel interest	0-350*		0-766*	
5. Mean returns to vessel[3]	3080		10633	
6. Std. dev. returns to vessel				
7. Present value @ 12%[4]	34109		117756	
8. Present value @ 18%	28583		98679	
9. Present value @ 24%	24608		84955	
100-199 Horsepower:				
No. vessels (sample)		7	11	
1. Mean vessel income[1]		7747	5709	
2. Std. dev. vessel income		2867	4995	
3. Mean vessel interest[2]		78	507	
4. Std. dev. vessel interest		169	617	
5. Mean returns to vessel[3]		7827	6216	
6. Std. dev. returns to vessel		2872	5033	
7. Present value @ 12%[4]		86678	68839	
8. Present value @ 18%		72635	57686	
9. Present value @ 24%		62534	49664	
Greater Than 200 Horsepower:				
No. vessels (sample)	1	2	5	
1. Mean vessel income[1]	3357	11214	4303	
2. Std. dev. vessel income		6678-15651*	3225	
3. Mean vessel interest[2]	878	49	614	
4. Std. dev. vessel interest		0-99*	463	
5. Mean returns to vessel[3]	4235	11263	4917	
6. Std. dev. returns to vessel			3258	
7. Present value @ 12%[4]	46899	124763	54455	
8. Present value @ 18%	39300	104528	45633	
9. Present value @ 24%	33835	89990	39286	

[1]Before income taxes and depreciation minus interest
[2]Interest paid on borrowed capital
[3]Before income taxes and depreciation plus interest
[4]Returns to vessel discounted over expected useful life
Present value calculated for over 10 years

*Range

negatively correlated with horsepower of the main engine, and the age of the vessel. Thus, a larger vessel (with 6 crewmen) is able to secure a higher income than a smaller vessel (3-4 crewmen) of the same age, and with the same engine; higher repair and maintenance cost of a larger engine, and higher repair and maintenance cost and insurance cost of an older vessel have a downward effect on vessel income.

The estimating equation is of the form:

$$Y_{est} = -4{,}807 + \underset{(3.11)}{352.7}\ X_2 - \underset{(2.08)}{28.7}\ X_3 - \underset{(1.62)}{115.7}\ X_4$$

where: Y_{est} = vessel income before taxes and depreciation (mean for 3 years)

X_2 = length of vessel (in feet)

X_3 = horsepower of main engine

X_4 = age of vessel (years)

(t-values for corresponding coefficients are given in parentheses)

This correlation, with $R^2=0.26$, is significant at the 5 percent probability level.

To analyze further the cash flow for a vessel in this sample, it may be stated that 28 percent of vessels secured an average cash flow of $10,000 or more, and 40 percent of vessels -- $5,000 or less.

It may be seen from this data that although the halibut fishery is regulated to provide maximum sustainable yield, incomes vary considerably although for the years examined, few are extraordinarily high. With 40 percent having cash flows of less than $5,000, many boats would be considered marginal in terms of their ability to sustain additional costs. However, although size, age and h.p. do effect income, the range is so broad as to inhibit judgements on financial adaptability for subgroupings within this sample of 32 vessels.

Also significant is a recent dramatic price upswing. 1969 ex-vessel prices for halibut have doubled compared to 1968. This has been associated with the abrogation of import pressures from improperly labeled Greenland Halibut and an unusually short supply of carry-over stocks, both causing upward price pressures. Although this is providing considerable money flow into the fishery at this time, no real estimate can be made at this time of the situation which may occur next year or whenever a safety program may be initiated which would effect the costs of vessels in this fishery.

GENERAL FINANCIAL CONDITIONS

Before proceeding to particulars it is necessary to comment on the present state of the U.S. lending market. Contrary to long term averages and normal ranges that have been exceeded only on rare cases in the U.S., very stringent loan policies have been associated with currently high interest rates and short money supplies. Aside from the particular situation in the fishing industry this overall atmosphere and the measures associated with it means that money availability as a whole has been severely curtailed.

This suggest that a crucial determinant of the impact of a safety program which would send vessel owners into the money market would vary considerably depending on the state of that market. Currently, one of the reasons why money is not available is the money market itself and cutbacks in Government programs, all in an effort to slow down the overheated economy. The timing of future programs with respect to the status of the money market at that time will in part determine the magnitude and the character of the impacts of any mandatory safety programs that may be initiated.

Private Sources

A survey of commercial banks that are located in fishing ports around the country yielded the following information on the availability of credit from lending institutions. Very few, if any, banks will lend a vessel owner money to repair his vessel, except if he has some other relationship with them, such as the bank holding the mortgage on his vessel. In this case the bank will make the loan in order to protect its investment. The reason given for this is that vessel repair loans cost too much money to service. The banks have to spend too much time and money worrying about whether the vessel is insured and collecting payment.

There are very few banks that will lend money for such major items as engines. The major sources of credit for repair loans are repair yards, small loan companies and supply houses. Credit charges at such places are high and most loans have to be repaid within a year.

The current credit squeeze is particularly evident in certain fisheries. In New England large numbers of vessels in a state of disrepair are still fishing. Any of the banks involved find themselves quite vulnerable to losses. One bank lost two vessels (mortgages and loans held) in one week during this survey.

In the menhaden fishery, particularly the Atlantic menhaden, funds were in such short supply that some operators were in danger of losing their line of credit for operating cash, a situation never before encountered in this industry.

BCF Loan Fund

The BCF has a loan fund of $12 million that can be used to make vessel loans. However, there are many other demands upon the fund in addition to repair loans. Since the inception of the fund in 1956, $29 million in loans have been made and of this approximately $3.5 million has been made in the category that might be legitimately called repair loans. The average repair loan has been around $8,000 and the average number extended has been 32 loans per year.

Clearly then, if there is any major demand made for repair loans the BCF loan fund as presently funded will not be able to be of any help in extending credit for these purposes.

Eligibility for BCF Loan

Under the current BCF Loan Program an applicant must meet the following credit requirements:

a. Each applicant must furnish proof that the financial assistance needed is not otherwise available on reasonable terms.

b. There must be evidence of applicant's ability to operate successfully.

c. The past earnings record and future prospects must show the applicant's ability to repay the loan out of earnings of the vessel.

d. The loan must be sound value and so secured that repayment is reasonably assured.

Should there be pressures for loans from significant numbers of vessels in several fisheries across the U.S. assuming unlimited BCF funds, it is likely that large numbers would qualify for BCF loans despite the fact that repair loans have been few in the past. This is one instance where the assumption of unlimited funds makes a significant difference in the impact of any cost inducing program.

The following presentation makes some attempt to estimate the number of vessels, by characteristic subgroupings, that would be found in each position of the lending market, depending on the earning capacity and financial resources of these vessels.

Of the many problems in making such estimates, the primary difficulty involves estimating the personal assest of vessel owners and the degree to which these may be available to the fishing enterprise.

Measures of Loan Capacity

When a loan to a fishing vessel owner is being considered, there are three things that the lender focuses upon. One is the past performance of the vessel and its operator, i.e., is he a producer; two, what are the assets he can post as collateral, such as his vessel, and his house; the third is his current debts and his record of past payment of other debts. The limitations of the data with which we have worked preclude analyzing any more of the above three tests.

Since an operator must pass this first test before he can go further in the borrowing process, this will give an approximate number of those who will be unable to borrow no matter what their attributes are with regard to the other criteria mentioned. This breakdown of the sample into those who can or cannot borrow, based on current income, can then be related to the whole fishery.

Vessel income in the tables (line 1) includes amounts that must be paid to amortize existing loans. Since this is a payment of capital it does not count as an expense for tax purposes. Nevertheless, if such a payment is not made the owner will be bankrupt.

In the calculations of vessel income the owner-captain's wage share of vessel earnings was deducted. This was assumed to give the owner-captain sufficient income to meet his living expenses. Therefore, the amounts shown in line 1 of the tables would be available to meet expenses such as taxes and debt retirement.

Another problem that must be considered is the interpretation of the results between age classes in a fishery. If, for example, a new vessel in a high horsepower category is shown to be losing money, this may be only a temporary phenomenon caused by bad luck or bad management, but which will be corrected by a change in luck or management. The same low monetary return, if earned in a low horsepower, high age category will have a better chance of being a permanent phenomenon which will eventually cause the scrapping of the vessel.

PROFITABILITY, THE NEED FOR MONEY, AND THE CURRENT STATUS OF SELECTED U.S. FISHERIES

The Gulf Shrimp Fleet

The shrimp fleet, although it has had eight good years, is still in the position of not having credit available for repair loans from banks, except in the case of those owners who have a special relationship with a bank such as it holds the first mortgage on the vessel. Other than that, banks are simply not interested. Because the fleet has had a relatively long period of prosperity, cash reserves of many of the owners should be at a high level. Even in this period of prosperity, many of the operators have had losses and if conditions change, such as a decline in the abundance of shrimp, the financial situation could deteriorate very rapidly.

A principal source of repair loans are the repair yards and small loan companies.

A table was prepared by pooling the information in tables 1 and 2. It was assumed that vessels in a given age, horsepower category performed the same in 1967-68 period as they had in the 1964-65 period. For each cell in the new table (table 12), a pooled mean income and standard deviation was calculated.[1/] The average amount of income needed to amortize present loans was then estimated for each cell by working backwards from the mean interest payment to the loan balance. As a first approximation, 10 percent interest was assumed so that the amount to be amortized was 10 times the interest. The estimated loan amortization payment was then subtracted from the mean income, giving the mean amount of cash left over to meet extraordinary expenses. The standard deviation of cash available was calculated by pooling the standard deviation of income and the standard deviation of the interest payment.

1/ Pooled mean equals $(n_1x_1 + n_2x_2)/(n_1+n_2)$

Pooled standard deviation equals $\sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2}}$

n_i=sample size
$\bar{x}_i$=sample mean
s_i=sample standard deviation

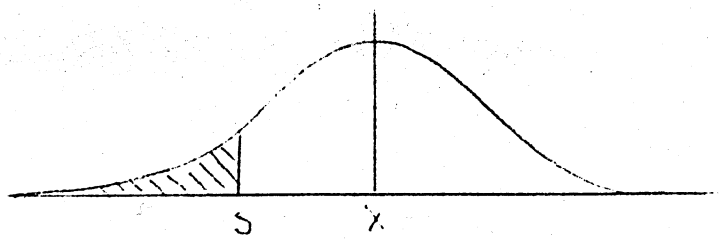
Table 12. Distribution of Cash Available to Repay New Loans and Numbers of Vessels with Different Levels Available. Gulf Shrimp Fleet: From Tables 1 and 2

	VESSEL AGE			
	0-5 years	6-10 years	11-15 years	Greater than 15
Less than 150 Horsepower				
# Universe	71	69	174	570
# sample	1	2	6	26
Mean cash available			12,367	8,727
STD Dev. cash available			14,142	8,136
# less than 0			33	81
# " " 3,000			43	138
# " " 5,000			52	184
150-250 Horsepower				
# Universe	343	312	344	481
# sample	19	31	36	47
Mean cash available	9,080	8,270	5,099	8,399
STD Dev. cash available	9,370	9,843	11,269	12,688
# less than 0	60	63	112	122
# " " 3,000	80	92	146	160
# " " 5,000	113	104	171	189
Greater than 250 Horsepower				
# Universe	341	31	74	33
# sample	18	2	8	4
Mean cash available	8,100		14,677	
STD Dev. cash available	5,504		15,525	
# less than 0	24		13	
# " " 3,000	60		17	
# " " 5,000	98		20	

Next we assumed that mean income was distributed normally in both the population and the sample. Then the percentage of vessels falling into various income categories was calculated using the following formula which translates a given value y

$$z = \frac{y-x}{s}$$

into standard deviates which can be translated into percentages of a normally distributed population.



Three levels of vessel income were solved for in each cell; the number that had less than no income, $3,000 income and $5,000 income. The breakdown is shown in table 12. In total, out of the 2,900 vessels that participate in the Gulf shrimp fishery, there were at least 508 with less than $0, 736 with less than $3,000, and 931 with less than $5,000 income available to pay off additional loans.2/

2/ Each category contains the category preceeding.

Since the incidence of vessel safety costs will probably differ with the age of vessels, this should be a useful technique for delineating those vessels with inadequate incomes in each strata of the population.

Georgia Shrimp

The sample of data that we have for the Georgia shrimp is not representative of the South Atlantic shrimp fishery because most of the vessels in the sample are old vessels. Only 20% of the vessels in the sample are less than 10 years old whereas 30% of the vessels in the population are less than 10 years old. So the data as reported would have to be considered representative of only the older vessels. At the present time we do not know the distribution by length of the vessels older than 10 years in the South Atlantic shrimp fishery.

We can assume, however, that the data is representative of vessels in the South Atlantic that are over 10 years. Interest payments were not reported by Dr. Carley, but considering the age of the vessels and the difficulty of obtaining loans in this area, they are probably low. The accompanying table (table 13) shows the percentage of vessels in each lenth class of vessels over 10 years old that will have difficulty meeting any extraordinary expenses from current income.

Table 13. South Atlantic Shrimp Estimated Cash Available to Repay New Loans and Percentages of Population of Vessels Older Than 10 Years That Will Not Have Certain Amounts.

	VESSEL TYPE (By length, in feet)			
	<40	40-49	50-59	>60
No. of vessels (sample)	7	12	19	12
Mean cash available				
Std. dev. cash available				
Percentage less than $0	22.36%	10.93%	7.78%	4.95%
Percentage less than $3,000	63.0%	28.77%	33.0%	17.36%
Percentage less than $5,000	84.38%	45.62%	58.71%	31.92%

New England

New England fishing vessel owners are unable to borrow from banks to finance repairs. The experience of banks making loans to fishermen has been very bad and at the present time most banks that have lent in the past are in the position where they should foreclose on many loans. Since so many are in jeopardy, they do not wish to wreak havoc on their communities by foreclosing.

Almost all repairs must be financed through the repair yards and because of poor experience getting paid in the past they use the practice of increasing repair costs with a high mark-up to cover the high risks of this type of financing. This has caused excessively high repair costs for the fishermen.

The Small and Medium Trawlers

The data in tables 4 and 7 were merged by making a strong assumption that the financial situation in the trawler fleet has not changed between the two periods in which the data were collected. Then it was assumed that these vessels were representative of the same size and age vessels in the whole New England fleet.

By making assumptions about the size of debts and the rate of amortization, table 14 was prepared. This shows: 1) the distribution of the universe of New England trawlers less than 400 horsepower by age classes; 2) the number of vessels in our samples from each class; 3) the mean income available for additional changes; and, 4) the standard deviation of that income. The table then shows the numbers of vessels in each class that have less than 0 income available, $3,000 income available and $5,000 income available.

The results can be summarized as follows:

177 vessels or 47% of the universe have less than 0 dollars additional financial capacity.

249 vessels or 67% of the universe have less than $3,000 dollars additional financial capacity.

285 vessels or 77% of the universe have less than $5,000 dollars additional financial capacity.

The continuing deterioration of the financial situation of this fleet is almost a certainty in the future if present harvesting patterns are continued, i.e., excess pressure on a few stocks of fish. There are some shifts taking place at the present time as some of the smaller vessels are converting to shrimping in Maine and Gloucester, Massachusetts, but it is too early to tell whether this is going to be a viable fishery over the long term.

Table 14. Cash Available, New England Small and Medium Trawlers, with Estimated Numbers of Universe That Will Not Have Given Amounts.

	VESSEL AGE		
	10 years	10-20 years	>20 years
Less than 150 Horsepower:			
# Universe	5	18	108
# sample	0	0	11
Mean cash available			213
Std. dev. cash available			2,563
# less than 0			51
# less than 3,000			84
# less than 5,000			98
150-200 Horsepower:			
# Universe	2	16	69
# sample	0	5	19
Mean cash available		534	-1,869
Std. dev. cash available		1,770	2,489
# less than 0		7	42
# less than 3,000		12	53
# less than 5,000		14	58
Between 200-400 Horsepower:			
# Universe	17	29	105
# sample	13	14	26
Mean cash available	2,514	-863	-601
Std. dev. cash available	5,800	5,027	6,711
# less than 0	6	16	55
# less than 3,000	9	20	71
# less than 5,000	11	23	81

The Boston Large Trawlers

The Boston large trawlers have severe problems at the present time. The haddock resource upon which they depend is severely depleted. The market they supplied is atrophying because they are unable to supply it, and most of their vessels are very old. As a consequence of this, at the present time only seven of the large trawlers are left in Boston.

The Bureau of Commercial Fisheries is trying to develop alternative species for the haddock, but the prognosis for this program with its present level of funding is very poor.

New Bedford Scallopers

Although, as stated previously, the New Bedford scallop fleet had a very good year last year, it is in a long term decline because of a resource problem. Many of the vessels have gone to Alaska to fish for scallops there, and if the Bureau of Commercial Fisheries is successful in opening up the scallop beds off Florida to commercial exploitation, more will probably go there. When they do move to new grounds, the reason will be that their financial capacity is increased by making the move.

At the present time, the loan amortization capacity of the scallop fleet is as follows: 50 percent have none; 62 percent have less than $3,000; and 70 percent have less than $5,000.

The Menhaden Fleet

As mentioned earlier, the Atlantic menhaden fishery is just now recovering slightly from import pressures in 1968. These, in combination with resource problems, resulted in severe financial pressures.

This industry is unique in that it is dominated by large integrated firms. Most of the vessels in this sample would be serviced and refitted at company owned years. Financial transaction would be internal. The one dominant fact is the reported difficulty in obtaining short term operating cash during the 1968 crisis. Under these circumstances, money would certainly not be available for vessel remodeling or other revisions associated with a safety program.

Given this background, the following factors are determinants:

1. The level of imports.
2. The price level - in the range of $110-160/ton.
3. The overall structure of the financial market.
4. The resource base.

At the high price level, with low imports and a good resource base, only a small number of private boats, marginal operators, would be significantly effected by additional costs. At the other extreme however, the entire fishery would be vulnerable, including a majority of the boats in this sample.

Tuna Purse Seiners

The financial aspects of the tuna purse seiners can be divided into two groups; 1) those vessels that can fish in the Atlantic as well as the Pacific, and 2) those that can fish only the Pacific.

The vessels in category one are by and large new, modern, luxury fishing vessels and are profitable. It is difficult to imagine a safety standard that could be applied to these vessels which they do not currently meet.

The vessels in category two, about 60 vessels, are heading into financial difficulties because of the situation described previously and many of them may be permanently tied up by the time any new safety program will be implemented. This assumes that the vessels' expenses will continue as they are today. It may be that to keep going they will reduce expenditures for maintenance and repairs and so will become increasingly unseaworthy as

time passes. Since these vessels are extremely specialized there is little likelihood that they will be used in other fisheries in the U.S. There is a high probability that unless there are further changes in tuna technology that they will be exported to places such as Korea or Ecuador.

Seattle Halibut

There is very little money available from banks in the Seattle area for fishermen. There is one bank that will consider repair loans for fishermen but this is inadequate to serve all users. Most of the money from repair loans comes from repair yards or small loan companies.

The vessel incomes reported for the halibut, even though they are current through 1968, are already out of date. The name of an imported substitute for halibut, "Greenland halibut" was ordered changed by the FDA to Greenland turbot. This change has changed the psychology in the market and the prices of halibut have since doubled (from around $.20/lb. to $.46/lb.). If maintained, and it looks as though it will be, this change will more than double the incomes of the vessel owners, assuming the number of vessels in this fishery remains relatively constant. For this reason the financial capacity of the halibut vessels has

increased to a new higher level. Based on the last 3 years earnings, we would estimate that 33 percent of the halibut fleet had less than zero amortization capacity.

Pacific Northwest Groundfish

The borrowing situation in Pacific groundfish is the same as for halibut.

Because of difficulties with the data on interest as reported previously, it is difficult to arrive at a figure for an amortization charge. The interest charges that are reported are biased in that they are from vessels that have loans with the BCF whereas all vessels may not have loans or these may be the only vessels with loans. Making a strong assumption that the average vessel in this fleet has amortization charges of $4,000 and then proceeding through calculations previously outlined yielded the following results:

25 percent have less than 0 loan amortization capacity

33 percent have less than $3,000 loan amortization capacity

38 percent have less than $5,000 loan amortization capacity

GENERAL SUMMARY

It is tautological that all industries, no matter how high their "average" level of profitability, always contain a portion that performs in a subnormal manner, generating only marginal, if any, profits. The U.S. fishing industry is an exception to this pattern only in that certain fisheries apparently have larger distressed segments than is "normal" for all U.S. industry as a whole.

This characteristic is especially noticeable in New England groundfish and may be best recognized by the fact that Secretary Hickel recently declared the haddock fishery a disaster. At one time up to 400 vessels were involved in this fishery. Further, Georgia Shrimp, Small Tuna purse seiners, Seattle groundfish and even some portions of Gulf shrimp and Seattle Halibut are also vulnerable.

This situation is further emphasized by the condition of the lending market where there are essentially no funds available for repair loans. This suggests that any additional costs must be supported by cash flows, other individual sources, or by financial assistance from the Bureau of Commercial Fisheries.

Measures of cash flow are contained in this report by fishery, whereas the extent of other individual sources cannot be evaluated. Current BCF funding limitations preclude additional assistance beyond past levels. However, given increased funds, lending criteria are such that large numbers of vessels would qualify for assistance.

A final note relates to the precise relevance of the preceeding presentation to a vessel safety program at the time in which its impact may be felt. The key variables are the state of the financial market and unanticipated changes in resource supplies, costs, and product prices all of which could significantly affect profitability and the ability to absorb costs associated with new safety programs. In addition, in micro-analysis caution must be exercised in the evaluation of supposedly "typical" vessels that for some unknown reason exhibit an atypical earnings pattern for the year analyzed.

This leads to a final conclusion that although vulnerability in varying degrees has been demonstrated for the fisheries examined here, a final judgement must await decisions on the costs of alternative safety programs and a date for the initiation of these programs.

29. Costs, Earnings and Borrowing Capacity for Selected U. S. Fisheries, by A. Sokoloski, E. Carlson, and B. Noetzel.

30. Fish Cycles: A harmonic analysis by F. Waugh and M. Miller.

31. Benefit-Cost Analysis as Applied to Commercial Fisheries Programs, by F. Bell.

32. Economic Study of San Pedro Wetfish Boats by W. F. Perrin and B. Noetzel.

33. A Survey of Fish Purchases by Socio-Economic Characteristics - First Quarterly Report - February, May, April, 1969 by Darrel A. Nash.

34. A Survey of Fish Purchases by Socio-Economic Characteristics, Second Quarterly Report - May June July by D. Nash.

35. A Simplified Guide to Benefit-Cost Analysis for BCF Programs by F. Bell.

36. Estimation of the Optimal Number of Vessels in a Fishery: Theoretical and Empirical Basis for Fishery Management by F. Bell.

37. Major Economic Trends in Selected U.S. Master Plan Fisheries: A Graphical Survey by Richard K. Kinoshita and Frederick W. Bell

38. Market Potential for the San Pedro Wetfish Fishery by D. Nash

(continued from inside front cover)

14. A Price Incentive Plan for Distressed Fisheries by A. A. Sokoloski and E. W. Carlson.

15. Demand and Prices for Shrimp by D. Cleary.

16. Industry Analysis of Gulf Area Frozen Processed Shrimp and an Estimation of Its Economic Adaptability to Radiation Processing by D. Nash and M. Miller.

17. An Economic Evaluation of Columbia River Anadromous Fish Programs by J. A. Richards.

18. Economic Projections of the World Demand and Supply of Tuna, 1970 - 90 by F. Bell.

19. Economic Feasibility of a Seafood Processing Operation in the Inner City of Milwaukee by D. Cleary.

20. The 1969 Fishing Fleet Improvement Act: Some Advantages of its Passage by the Division of Economic Research.

21. An Economic Analysis of Policy Alternatives for Managing the Georges Bank Haddock Fishery by L. W. Van Meir.

22. Some Analyses of Fish Prices by F. Waugh and V. Norton.

23. Some Economic Characteristics of Pond-Raised Catfish Enterprises by J. E. Greenfield

24. Elements Crucial to the Future of Alaska Commercial Fisheries by D. Nash, A. Sokoloski, and D. Cleary.

25. Effects on the Shrimp Processing Industry of Meeting the Requirements of Wholesome Fishery Products Legislation by D. Nash and M. Miller.

26. Benefit Cost Analysis of a Proposed Trawl Systems Program by M. Miller.

27. An Economic Analysis of Future Problems in Developing the World Tuna Resource: Recommendations for the Future Direction of the BCF Tuna Program by F. Bell.

28. Economic Efficiency in Common Property Natural Resource Use: A Case Study of the Ocean Fishery by D. W. Bromley

The goal of the Division of Economic Research is to engage in economic studies which will provide industry and government with costs, production and earnings analyses; furnish projections and forecasts of food fish and industrial fish needs for the U. S.; develop an overall plan to develop each U. S. fishery to its maximum economic potential and serve as an advisory service in evaluating alternative programs within the Bureau of Commercial Fisheries.

In the process of working towards these goals an array of written materials has been generated representing items ranging from interim discussion papers to contract reports. These items are available to interested professionals in limited quantities of offset reproduction. These "Working Papers" are not to be construed as official BCF publications and the analytical techniques used and conclusions reached in no way represent a final policy determination endorsed by the U. S. Bureau of Commercial Fisheries.