BENEFIT COST ANALYSIS OF A PROPOSED TRAWL SYSTEMS PROGRAM

by

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BUREAU OF COMMERCIAL FISHERIES
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The analysis gives an estimate of the benefits that would accrue from the investment of public funds to advance the technology of trawling. A proposed development program would require the use of $504,235 each year over the course of three years. The benefits to be weighed against this cost have been calculated on the basis of five years of operation under the new technology. The costs under consideration in this analysis constitute the use of public funds, hence benefits are measured in terms of a contribution to national economic efficiency; that is, increased output per unit of resource input. This analysis applies specific values to the estimated gains in efficiency. Accrued benefits may be considered increments to the gross national product, and the reallocation of manpower resources into more productive channels.

Parameters for Analysis

The model developed in this analysis is based on the operation of 21 otter trawl type vessels which constitute the Boston offshore large trawler fleet. This group of vessels conducts fishing operations throughout the year on grounds located on the continental shelf 100 to 150 miles from the port of Boston. The catch consists principally of haddock (approximately 75 percent) with smaller
quantities of cod, flounder, and miscellaneous finfish. The catch is landed at the Boston Fish Pier where it is sold at auction. The parameters for this analysis are the operating characteristics and financial results of fleet operations for the year 1965. (Appendices D-1, D-2.)

The proposed trawl systems program divides into six phases which, for purposes of this analysis, are designated as follows:

1A Harvest system;
1B Trawl design;
11A Automated shipboard handling of fish;
11E Extend shelf life and consumer acceptance (quality improvement);
11C Improve weigh out (reduced moisture loss);
11D Harvest and handle total catch.

The effects of these programs have been applied to the operations of the fleet for a single year. The fleet has been divided into four groups, according to net earnings position in 1965. (See Appendix B.)

Benefits and Costs Defined

Primary benefits to be realized from the proposed programs are defined as increases in fleet revenue from fishing, and decreases
in fleet labor costs. Benefits are measured through a direct accounting technique. Calculations are made of the gains in productive time and the savings in man-hour requirements resulting from a more efficient operation, and these results are translated into dollar equivalents. Benefit-cost ratios for the various programs were computed on the basis of implementation of the full system (Appendices A2 and A2-2), and the implementation of individual programs independent of the proposed full system (Appendix A3). Two slightly varying estimates of cost-benefit ratios under each of the above bases are given. One estimate (shown in Appendix A2) treats the full array of increased revenue and labor savings benefits. The other adjusts labor savings benefits to conform with more tenable assumptions and the result is a slightly lower ratio. A further refinement presents three separate ratios for the total program estimate. These are based on the alternative processes that may be utilized in harvesting the total catch.

Gross benefits are considered to be the total for a five-year period discounted to present value at the rate of 3\(\frac{1}{2}\) percent. Net benefits are the discounted gross benefits minus the associated costs which are the estimates of the required industry investments to implement the trawl systems program.
Benefit-Cost Ratios

Each step in the analysis calculates a maximum, median, and minimum result of applying new technology. The adopted estimates shown in the summaries apply the "median" results. On this basis, implementation of the full system proposed by the program would result in a benefit-cost ratio of 14.13, 14.30, or 17.08, if the full array of revenue-producing and labor-savings benefits are added. The adjusted ratios (with some labor saving benefits deleted) are 12.19, 12.36, and 15.13. Thus, under the latter results, each dollar of investment in the trawl fishing program would result in direct primary net benefits of at least $12 and up to $15.

It should be pointed out that the estimated benefits are those that would accrue to the operations of the 21 vessels of the fleet under consideration. Undoubtedly, the techniques and systems developed under the program would find wide application among the more than one thousand otter-trawl type vessels in operation in the United States. Conceivably then the true benefit-cost ratio would be many times the quantity calculated for the Boston fleet operations.

(See Appendices A-2, A 2-2, A-3, A 3-2, A-4.)
Procedures and Results

Phase 1A - Harvest System

The improved harvest system program is designed to reduce materially the amount of time required for the set and haul-back operations, and bag and catch handling. A reasonable estimate of time savings under a new system would be about 30 percent. Nevertheless, for the purposes of this analysis three time-savings assumptions were considered: maximum 40 percent, median 30 percent, and minimum 20 percent. The altered drag sequence that would follow the achievement of efficiencies built into an improved system are set forth in Appendix C-1A. The drag sequence will be shortened under the proposed system, hence the number of drags possible in a 24-hour period will be increased.

Assuming drags of a 90-minute duration, the time saved under the assumption of a 30 percent improvement in the set, haul, and handling operations increases the number of minutes of dragging time from 900 per 24-hour day under the present system to nearly 1,000. An estimate of the added catch that would result from additional drag time may be made by multiplying the increased drag minutes by the present rate of catch per drag minute. These calculations are made in Appendix C-1A-2 which extends the results to daily and annual accruals in pounds pro-
duced, and in revenue. The increases in revenue under the varying assumptions range between 7 and 15 percent. With prices and with catch rates per minute held as constants, these increases, of course, represent the increased effort made allowable through increased efficiencies. Under the median time savings assumptions, the added production would result in an increase in fleet revenue (for a single year) of $701,010. At the level of catch produced by the offshore fleet in 1965, the rate of catch per man hour for the vessel groups considered in this analysis ranged between 63 and 102 pounds. Assuming that at the 1965 rate of catch the present labor complement is being under-utilized, man-hour productivity would increase in direct proportion to the increase in catch resulting from an improved harvest system. Fewer man-hours then, would be required to harvest the 1965 catch level. If the differential between the man-hours required before and after the implementation of an improved harvest system were considered as redundant labor, the savings in labor could be viewed as a benefit, inasmuch as this productive manpower capacity could be reallocated into other uses. A value can be assigned to these man-hour savings based on the calculated labor expense per man hour for the various vessel groups in the Boston fleet for 1965. As shown in Appendix C-1A-5, the estimated value of labor savings following
implementation of the new harvest system for the fleet would range between $232,000 and $475,000 depending on the degree of efficiency that could be achieved with the new system. A reduction in man-hour requirements, given no change in the number of days a vessel is at sea, reduces the size of crew needed for the fishing operation. Fewer men, in turn, result in fewer shares under the lay system. Crewmen in the fleet under this condition would realize an increase of between 19 and 22 percent over current earnings. (Appendix C-1A-6.)

**Phase 1B - Trawl Design**

The program to improve trawl design and use, it is assumed, would result in an increase in fishing time per given period of time. The basic assumption for measuring benefits under this phase of the trawl systems program is that dragging time per set on the average will be extended from 90 to 126 minutes. With all other conditions remaining unchanged the increased drag time per 24-hour day would amount to 108 minutes. (Appendix C-1B-1.) At the present rate of catch, the 108 minutes per day increase in dragging time per vessel would result in an annual increment in fleet revenue of $764,000, assuming no changes in number of trips, number of days at sea, etc. (Appendix C-1B-2.) (The new drag sequence under these conditions would extend to 180 minutes, allowing eight drags per 24-hour day.)
Phases 1A and 1B Combined

The effect on the drag sequence of combining the efficiencies from an improved harvest system and a new trawl design are set forth in Appendix C-1B-3. Here it is illustrated that the drag time per vessel could be increased from 162 to 221 minutes per day, depending on the level of efficiency achieved under the harvest systems improvement program (phase 1A). Translated into dollars, the expected gain in fleet revenue from implementing the two phases would be between $1.1 and $1.6 million. (Appendix C-1B-4.) From the viewpoint of labor savings, the combined efficiencies of Phases 1A and 1B could result in a dollar savings of between $544,000 and $711,000 for the fleet. If redundant man-hours were eliminated, individual crew shares under the improvements could increase between 42 and 48 percent. The potential labor savings calculations are given in Appendices C-1B-5, C-1B-6, C-1B-7, and C-1B-8.

Phase 11A - Automated Shipboard Handling of Fish

The automated shipboard handling of fish will achieve a savings in labor through reduction in man-hour requirements for processing the harvest aboard ship. It has been estimated that the proposed techniques would result in an increase in man-hour productivity of between 25 and 35 percent. If these percentages are applied to
the present catch rate per man-hour, the result indicates that one-fifth to one-fourth of the present labor complement aboard each vessel would become redundant. Trimming the surplus from the present complement would have the effect of a dollar annual labor savings to the fleet of between $725,000 and $939,000. (See Appendix C-11A-1.)

Phase 11B - Extend Shelf Life and Consumer Acceptance

The inhibition of bacterial growth and flavor loss through chemical treatment (as part of improved shipboard handling) could be expected to enhance the value of the fish landed. A comparison of prices paid for cod and haddock at Atlantic Avenue Pier in Boston (one and two-day caught fish) with Boston Fish Pier landings (two to 10 days 'on ice) demonstrates that within a given species group fresher products will command a higher price. Assuming that the quantities landed at these neighboring facilities constitute a single market, the demand for the newer caught Atlantic Avenue fish appears consistently stronger. Over the period 1959-1965, the differentials between Atlantic Avenue and Boston Fish Pier prices averaged nearly 20 percent in favor of Atlantic Avenue. It is reasonable to assume therefore that a supply of fish landed at the Boston Fish Pier that was "newer caught" than previously would bring a somewhat higher price. If we assume that value is increased by a factor of 15 percent due to the new process, the increment to
annual fleet revenue at the present catch level would be close
to one million dollars, while the increment resulting from fleet
operation under the improved harvest system and trawl design
would be in the neighborhood of $1.2 million. (Appendix C-11B-1.)

Phase 11C - Improve Weigh Out

A program to inhibit moisture loss in ice storage aboard vessels
would result in an increased weigh out. Merely a 5 percent
improvement in the weigh out would result in an added $319,000
to annual fleet revenue at the present harvest level, and approx-
imately $388,000 at the higher level of harvest resulting from
implementation of new efficiencies in the trawl system. (Appendix
C-11C-1.)

Phase 11D - Harvest and Handle Total Catch

The development of a system which would permit the utilization of
the total catch brought aboard in the harvest process would result
in a considerable increase in revenue to the fleet. The increase
in gross revenue would depend on the process incorporated into the
system. Three alternatives have been proposed:

A. Production of a slurried material for further processing
   into a fish meal product.

B. Production of a finished fish meal product.

C. Production of a protein extender material for human
   consumption.
At the harvest level of 1965, approximately 42 million pounds of raw fish materials were discarded overboard as unmarketable. The value of this material processed into a slurried substance for later use in the manufacture of fish meal would probably be as much as $424,000 on the basis of an assumed value of one cent per pound. The production of fish meal directly from the presently discarded raw materials would produce an added revenue of more than $500,000, assuming a recovery rate of 20 percent and a product value of six cents per pound. The gross value to fleet operation of processing the presently discarded material into a protein extender for human consumption would produce a revenue of $1.3 million, assuming a value of 15 cents per pound.

It should be noted that the estimates of added revenue from processing the total catch assume sufficient vessel capacity to accommodate the processing equipment without burdening the required capacity for harvest storage, as well as sufficient manpower reserve to operate the equipment.

_Effects of System on Crew and Vessel Earnings_

Even with no change in the present lay system under which the Boston fleet operates, the additional revenue resulting from increased efficiencies would redound to the benefit of both labor and management.
At present crew sizes, individual shares would increase an average of 64 percent. If crew sizes were trimmed in line with the new man-hour requirements of an improved trawl system, individual crew member incomes would improve between 92 and 102 percent. (Appendix D-5)

The increased revenues resulting from the increased efficiencies would also show up favorably in the financial operating statements of vessel operators. An assumed composite profit and loss statement of fleet operations for one full year following adoption of the new techniques is given in Appendix D-4. The statement reveals that under the new system, the fleet's operating margin (the percent net profit is of operating revenue) would increase from its present 11 percent (before taxes and interest on investment) to about 25 percent. Significantly, the statement indicates that for more than half the fleet, the new system will turn marginal operations into profitable operations. As Appendix D-2 shows, 12 vessels of this 21-vessel fleet had an average operating margin below 10 percent in 1965, and eight of these 12 were below 3 percent. (These margins, it is important to note, are the operating results before allowance is made for taxes, interest on investment, or managerial salaries.) Adoption of the new trawl system would boost the operating margin of the low-earnings group of vessels to 21 percent, and of the other vessels in the fleet to as high as 25 percent.
### Summary of Benefits and Costs of Trawl Improvement Program Assuming Implementation of Full System1/  

<table>
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<th>Program</th>
<th>: Cost :</th>
<th>Benefits</th>
<th>: Benefit/Cost Ratio :</th>
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<td>IA - Harvest Systems</td>
<td>180,000</td>
<td>857,205</td>
<td>8,888,136</td>
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<td>IB - Trawl Design</td>
<td>671,205</td>
<td>2,333,136</td>
<td>21,376,107</td>
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<td>Total IA and IB</td>
<td>857,205</td>
<td>9,203,136</td>
<td>8,888,136</td>
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<td>IIA - Automated Shipboard Handling of Fish</td>
<td>256,500</td>
<td>3,776,147</td>
<td>3,356,147</td>
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<tr>
<td>IIB - Extend Shelf Life and Consumer Acceptance (Quality Improvement)</td>
<td>218,110</td>
<td>5,256,083</td>
<td>5,256,083</td>
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<tr>
<td>IIC - Improve Weigh Out</td>
<td>66,900</td>
<td>1,752,028</td>
<td>1,752,028</td>
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<tr>
<td>IID - Harvest and Handle Total Catch</td>
<td>120,000</td>
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<td>Total Program</td>
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<td>1,512,715</td>
<td>14.76</td>
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### Process:  
- (a) Slurried Material: 2,333,713/2,123,713 19.45/17.70  
- (b) Fish Meal: 2,800,564/2,380,564 23.34/19.84  
- (c) Protein Extender: 7,002,411/6,581,411 58.34/54.84  

**TOTAL PROGRAM**  
1/ See Appendix A-4 for detail.  
2/ Spread over 3 year's period.
### Summary of Benefits and Costs of Trawl Improvement Program

#### Assuming Full System and Deleting Labor Savings in IA & IB

<table>
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<tr>
<th>Program</th>
<th>Cost ($ )</th>
<th>Benefits Gross ($ )</th>
<th>Net ($ )</th>
<th>Benefit/Cost Ratio</th>
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<tr>
<td>IA - Harvest Systems</td>
<td>180,000</td>
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<tr>
<td>IB - Trawl Design</td>
<td>671,205</td>
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<tr>
<td><strong>Total - IA&amp;IB</strong></td>
<td>851,205</td>
<td>6,264,214</td>
<td>5,949,214</td>
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<td>IIA - Automatic Shipboard Handling of Fish</td>
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<td>3,776,147</td>
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<td>IIB - Extended Shelf Life and Consumer Acceptance (Quality Improvement)</td>
<td>218,110</td>
<td>5,256,083</td>
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<td>IIC - Improve Weigh Out</td>
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<td>120,000</td>
<td>2,333,713</td>
<td>2,123,713</td>
<td>19.45</td>
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<tr>
<td>a) Slurried Material</td>
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<td>b) Fish Meal</td>
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<td>c) Protein Extender</td>
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<td>IID - Harvest and Handle Total Catch Process</td>
<td>1,512,715</td>
<td>18,437,185</td>
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<td>(a) 19,382,185</td>
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<td>(b) 19,849,036</td>
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<td>(c) 24,049,883</td>
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* Total benefits would depend on the alternative process used (a), (b), (c) in phase I.D.

/ See Appendix A-4 for detail
## Summary of Benefits and Costs of Single Phases of Trawl Improvement Program Assuming Independent Implementation

<table>
<thead>
<tr>
<th>Program</th>
<th>Cost</th>
<th>Gross</th>
<th>Net</th>
<th>Benefits</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA - Harvest Systems</td>
<td>180,000</td>
<td>4,760,106</td>
<td>4,602,606</td>
<td>26.44</td>
<td>25.57</td>
</tr>
<tr>
<td>IB - Trawl Design</td>
<td>671,205</td>
<td>5,243,940</td>
<td>5,086,440</td>
<td>7.81</td>
<td>7.58</td>
</tr>
<tr>
<td>IIA - Automated Shipboard Handling of Fish</td>
<td>256,500</td>
<td>3,776,147</td>
<td>3,356,147</td>
<td>14.72</td>
<td>13.08</td>
</tr>
<tr>
<td>IIB - Extend Shelf Life and Consumer Acceptance</td>
<td>218,110</td>
<td>4,316,452</td>
<td>4,316,452</td>
<td>19.79</td>
<td>19.79</td>
</tr>
<tr>
<td>IIC - Improve Weigh Out</td>
<td>66,900</td>
<td>1,438,817</td>
<td>1,438,817</td>
<td>21.51</td>
<td>21.51</td>
</tr>
<tr>
<td>IID - Harvest and Handle Total Catch</td>
<td>120,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Slurried Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Fish Meal</td>
<td>2,299,941</td>
<td>1,879,941</td>
<td>1,879,941</td>
<td>19.17</td>
<td>15.66</td>
</tr>
<tr>
<td>(c) Protein Extender</td>
<td>5,749,852</td>
<td>5,329,852</td>
<td>5,329,852</td>
<td>47.91</td>
<td>44.41</td>
</tr>
</tbody>
</table>

1/ See Appendix A-4 for detail.
### Summary of Benefits and Costs of Single Phases of Trawl Improvement Program Assuming Independent Implementation

And Deleting Labor Savings in IA&B

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IA  Harvest Systems</td>
<td>180,000</td>
<td>3,165,060</td>
<td>3,007,560</td>
<td>17.58</td>
<td>16.71</td>
</tr>
<tr>
<td>IB  Trawl Design</td>
<td>671,205</td>
<td>3,481,451</td>
<td>3,323,951</td>
<td>5.19</td>
<td>4.95</td>
</tr>
<tr>
<td>IIA Automated Shipboard Handling of Fish</td>
<td>256,500</td>
<td>3,776,147</td>
<td>3,356,147</td>
<td>14.72</td>
<td>13.08</td>
</tr>
<tr>
<td>IIB Extend Shelf Life and Consumer Acceptance (Quality Improvement)</td>
<td>218,110</td>
<td>4,316,452</td>
<td>4,316,452</td>
<td>19.79</td>
<td>19.79</td>
</tr>
<tr>
<td>IIC Improve Weigh Out</td>
<td>66,900</td>
<td>1,438,817</td>
<td>1,438,817</td>
<td>21.51</td>
<td>21.51</td>
</tr>
<tr>
<td>IID Harvest and Handle Total Catch Process:</td>
<td>120,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Slurried Material</td>
<td></td>
<td>1,916,572</td>
<td>1,706,572</td>
<td>15.97</td>
<td>14.22</td>
</tr>
<tr>
<td>b) Fish Meal</td>
<td></td>
<td>2,299,941</td>
<td>1,879,941</td>
<td>19.17</td>
<td>15.67</td>
</tr>
<tr>
<td>c) Protein Extender</td>
<td></td>
<td>5,749,852</td>
<td>5,329,852</td>
<td>47.91</td>
<td>44.41</td>
</tr>
</tbody>
</table>

\[//\] See Appendix A-4 for Detail
## Estimated Benefit-Cost Ratios for Proposed Trawl Systems Program—(IA) Harvest Systems and (IB) Trawl Design Phases

<table>
<thead>
<tr>
<th>Program</th>
<th>IA Harvest Systems</th>
<th>IB Trawl Design</th>
<th>IA &amp; IB Combined Harvest System and Trawl Design</th>
<th>II A Automated Shipboard Handling</th>
<th>II B Quality Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent Systems Ind. or Systems Ind. System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COST OF PROGRAM</td>
<td>180,000</td>
<td>671,205</td>
<td>851,205</td>
<td>256,500</td>
<td>218,110</td>
</tr>
<tr>
<td>BENEFITS—SINGLE YEAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>1/701,010</td>
<td>4/764,441</td>
<td>6/1,387,423</td>
<td>11/956,025</td>
<td>12/1,164,138</td>
</tr>
<tr>
<td>c) Total</td>
<td>1,054,287</td>
<td>1,154,804</td>
<td>2,038,347</td>
<td>836,356</td>
<td>956,025</td>
</tr>
<tr>
<td>GROSS BENEFITS—(5 yrs. discounted at 3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>3,165,060</td>
<td>3,481,451</td>
<td>6,264,214</td>
<td>4,316,452</td>
<td></td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td>1,595,046</td>
<td>1,762,489</td>
<td>2,938,922</td>
<td>3,776,147</td>
<td></td>
</tr>
<tr>
<td>c) Total</td>
<td>4,760,106</td>
<td>5,243,940</td>
<td>9,203,136</td>
<td>4,316,452</td>
<td></td>
</tr>
<tr>
<td>RATIO: GROSS BENEFITS TO COSTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>17.58</td>
<td>5.19</td>
<td>7.36</td>
<td>19.79</td>
<td>24.10</td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td>8.86</td>
<td>2.63</td>
<td>3.45</td>
<td>14.72</td>
<td>19.79</td>
</tr>
<tr>
<td>c) Total</td>
<td>26.44</td>
<td>7.82</td>
<td>10.81</td>
<td>14.72</td>
<td>24.10</td>
</tr>
<tr>
<td>ASSOCIATED COSTS</td>
<td>3/157,500</td>
<td>3/157,500</td>
<td>8/315,000</td>
<td>10/420,000</td>
<td>--- NEGLIGIBLE ---</td>
</tr>
<tr>
<td>NET BENEFITS—(5 yrs. discounted at 3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>4,602,606</td>
<td>5,086,440</td>
<td>8,888,136</td>
<td>3,356,147</td>
<td></td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATIO: NET BENEFITS TO COSTS</td>
<td>25.57</td>
<td>7.58</td>
<td>10.44</td>
<td>13.08</td>
<td>--- SAME AS GROSS ---</td>
</tr>
</tbody>
</table>
### Estimated Benefit-Cost Ratios for Proposed Trawl Systems Program—(IA) Harvest Systems and (IB) Trawl Design Phases

<table>
<thead>
<tr>
<th>Program</th>
<th>IIC Improve Weigh Out</th>
<th>IID--HARVEST TOTAL CATCH Fish Meal</th>
<th>Protein Extenders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ind. Systems</td>
<td>Ind. Systems</td>
<td>Ind. Systems</td>
</tr>
<tr>
<td>COST OF PROGRAM</td>
<td>66,900</td>
<td>120,000</td>
<td>120,000</td>
</tr>
<tr>
<td>BENEFITS - SINGLE YEAR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>$\frac{13}{318,675}$</td>
<td>$\frac{15}{516,880}$</td>
<td>$\frac{19}{620,280}$</td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td>$\frac{14}{388,046}$</td>
<td>$\frac{16}{509,400}$</td>
<td>$\frac{21}{1,273,500}$</td>
</tr>
<tr>
<td>c) Total</td>
<td>$318,675$</td>
<td>$516,880$</td>
<td>$620,280$</td>
</tr>
<tr>
<td>GROSS BENEFITS (5 yrs. discounted at 3½%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>$1,438,817$</td>
<td>$2,333,713$</td>
<td>$2,800,564$</td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td>$1,752,028$</td>
<td>$2,299,941$</td>
<td>$2,800,564$</td>
</tr>
<tr>
<td>c) Total</td>
<td>$1,438,817$</td>
<td>$2,333,713$</td>
<td>$2,800,564$</td>
</tr>
<tr>
<td>RATIO: GROSS BENEFITS TO COSTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Increased Revenue</td>
<td>21.51</td>
<td>15.97</td>
<td>19.17</td>
</tr>
<tr>
<td>b) Labor Savings</td>
<td>26.19</td>
<td>19.45</td>
<td>23.34</td>
</tr>
<tr>
<td>c) Total</td>
<td>21.51</td>
<td>15.97</td>
<td>19.17</td>
</tr>
<tr>
<td>ASSOCIATED COSTS</td>
<td>NEGLIGIBLE</td>
<td>$\frac{17}{210,000}$</td>
<td>$\frac{20}{420,000}$</td>
</tr>
<tr>
<td>NET BENEFITS (5 yrs. discounted at 3½%)</td>
<td>SAME AS GROSS</td>
<td>$1,706,572$</td>
<td>$2,123,713$</td>
</tr>
<tr>
<td>RATIO: NET BENEFITS TO COSTS</td>
<td>SAME AS GROSS</td>
<td>14.22</td>
<td>17.70</td>
</tr>
</tbody>
</table>
1/ App. C-IA-2 (7b)
2/ App. C-IA-5 (4b)
3/ Investment Requirement @ $7,500 per vessel (21 vessels)
4/ App. C-IB-2 (7)
5/ App. C-IB-7 (4a)
6/ App. C-IB-4 (7b)
7/ App. C-IB-7 (4b)
8/ Investment required @ $15,000 per vessel (21 vessels)
9/ App. C-IIA-1 (10b)
10/ Investment required @ $20,000 per vessel
11/ App. C-IIB-1 (A.2b)
12/ App. C-IIB-1 (B.2b)
13/ App. C-IIC-1 (A.2b)
14/ App. C-IIC-1 (B.2b)
15/ App. C-IID-1 (A.3)
16/ App. C-IID-2 (A.3)
17/ Required Investment @ $10,000 per vessel
18/ App. C-IID-1 (B.3)
19/ App. C-IID-2 (B.3)
20/ Required investment @ $20,000 per vessel
21/ App. C-IID-1 (C.3)
22/ App. C-IID-2 (C.3)
23/ Required investment @ $20,000 per vessel
Appendix B
Classification of Vessels for Analysis purpose

For purposes of this analysis 21 vessels in the present large trawler fleet have been grouped in accordance with net earnings performance in 1965, real or imputed. Full year earnings records were available for 1965 for 18 of these vessels. One new vessel was not in operation the full year, and two had not yet joined the fleet. Performance imputed to the latter two was that of a sister ship that operated the entire year 1965. Vessels were grouped as follows:

<table>
<thead>
<tr>
<th>Group Identification</th>
<th>Number of Vessels in Group</th>
<th>Range of Net Earnings, 1965</th>
<th>Average Net Earnings Per Vessel in Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>Over $75,000</td>
<td>$80,783</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>45,000-75,000</td>
<td>50,734</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>20,000-44,999</td>
<td>28,411</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>Under 20,000</td>
<td>5,649</td>
</tr>
</tbody>
</table>

\[1/\] Before taxes and interest on investment.
### Appendix C-IA-1

**Changes in Drag Sequence Time Resulting from Implementation of Harvest Systems Improvement**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Drag Sequence (Minutes)</th>
<th>Time Savings Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present Sequences</td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(40%)</td>
</tr>
<tr>
<td>Set</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Drag</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Haul</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Lag: (a)</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>(b)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>125</td>
</tr>
</tbody>
</table>

- **Number of drags per 24 hr. day**: 10.0, 11.5, 11.1, 10.7
- **Total minutes dragging**: 900, 1,035, 999, 63
- **Added drag minutes per day**: 135, 99, 63

1/ Attributed to gear handling.
2/ Factors other than gear handling.
Appendix C-IA-2
Computation of Increment (Benefit) to Annual Fleet Revenue Resulting from Implementation of Harvest Systems Improvement (Program IA)

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
<td>(21)</td>
</tr>
</tbody>
</table>

1. Present Catch Rate<sup>1/</sup>
   Per 90 min. drag (Lbs.) | 2,086 | 1,690 | 1,441 | 1,116 |
   Per minute (Lbs.)       | 23.18 | 18.78 | 16.01 | 12.40 |

2. Added Drag Time Per Vessel
   Per 24 hr. Period (Minutes)
   a) Maximum time savings | 135 | 135 | 135 | 135 |
   b) Median time savings   | 99  | 99  | 99  | 99  |
   c) Minimum time savings  | 63  | 63  | 63  | 63  |

3. Added Daily Catch Per Vessel
   a) Maximum time savings | 3,129 | 2,535 | 2,161 | 1,674 |
   b) Median time savings   | 2,295 | 1,859 | 1,585 | 1,228 |
   c) Minimum time savings  | 1,460 | 1,183 | 1,009 | 781  |

4. Assumed Value of Catch<sup>2/</sup>
   Dollars per pound       | .1080 | .1125 | .1047 | .1063 |

5. Added Daily Revenue Per Vessel (Dollars)
   a) Maximum time savings | 337.93 | 285.19 | 226.26 | 177.95 |
   b) Median time savings   | 247.86 | 209.14 | 165.95 | 130.54 |
   c) Minimum time savings  | 157.68 | 133.09 | 105.64 | 83.02  |

6. Assumed Number of Fishing Days Per Vessel Group<sup>3/</sup>
   | 416 | 1,452 | 785 | 1,256 |

7. Annual Increment to Revenue from Fishing (Dollars)
   a) Maximum time savings | 140,579 | 414,096 | 177,614 | 223,505 |
   b) Median time savings   | 103,110 | 303,671 | 130,271 | 163,958 |
   c) Minimum time savings  | 65,595  | 193,247 | 82,927  | 104,273 |

---

<sup>1/</sup> Daily rate of catch per vessel shown in Appendix D-1 at 10 drags per 24-hour day.<br>
<sup>2/</sup> Average price per pound received by vessel class, in year 1965. See Appendix D-1 (14)<br>
<sup>3/</sup> Appendix D-2 (7).
Appendix C-IA-3
Effect of Harvest Systems Improvement on Man-Hour Productivity

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
</tr>
<tr>
<td><strong>1. PRESENT DAILY CATCH RATE PER VESSEL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POUNDS</td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
</tr>
<tr>
<td><strong>2. ADDED CATCH WITH IMPLEMENTATION OF NEW HARVEST SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings of 40%</td>
<td>3,129</td>
<td>2,535</td>
<td>2,162</td>
<td>1,674</td>
</tr>
<tr>
<td>b) Median time savings of 30%</td>
<td>2,295</td>
<td>1,859</td>
<td>1,585</td>
<td>1,228</td>
</tr>
<tr>
<td>c) Minimum time savings of 20%</td>
<td>1,460</td>
<td>1,183</td>
<td>1,008</td>
<td>781</td>
</tr>
<tr>
<td><strong>3. TOTAL DAILY CATCH PER VESSEL WITH NEW HARVEST SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings</td>
<td>23,989</td>
<td>19,435</td>
<td>16,572</td>
<td>12,834</td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>23,155</td>
<td>18,759</td>
<td>15,995</td>
<td>12,388</td>
</tr>
<tr>
<td>c) Minimum time savings</td>
<td>22,320</td>
<td>18,083</td>
<td>15,418</td>
<td>11,941</td>
</tr>
<tr>
<td><strong>4. ASSUMED MAN HOURS PER DAY PER VESSEL</strong></td>
<td>2/204</td>
<td>204</td>
<td>194</td>
<td>176</td>
</tr>
<tr>
<td><strong>5. CATCH PER MAN HOUR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>102.3</td>
<td>82.8</td>
<td>74.3</td>
<td>63.4</td>
</tr>
<tr>
<td>With New Harvest Systems:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings</td>
<td>117.6</td>
<td>95.2</td>
<td>85.4</td>
<td>72.9</td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>113.6</td>
<td>91.9</td>
<td>82.5</td>
<td>70.4</td>
</tr>
<tr>
<td>c) Minimum time savings</td>
<td>109.5</td>
<td>88.6</td>
<td>79.5</td>
<td>67.8</td>
</tr>
</tbody>
</table>

1/ Appendix D-1 (14).
2/ Appendix D-1--number of man days at sea (Line 8) times 12 hours, average work day divided by number of days at sea (Line 6).
### Changes in Man-Hour Harvest Productivity and Requirements Resulting from Implementation of Harvest Systems Improvement

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
</tr>
</tbody>
</table>

#### 1. CATCH PER MAN HOUR

**Condition:**
- Present
- Assumed: 1/ maximum time savings
- Assumed: 2/ median time savings
- Assumed: 3/ minimum time savings

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>102.3</td>
<td>82.8</td>
<td>74.3</td>
<td>63.4</td>
</tr>
<tr>
<td>Assumed: 1/</td>
<td>117.6</td>
<td>95.2</td>
<td>85.4</td>
<td>72.9</td>
</tr>
<tr>
<td>Assumed: 2/</td>
<td>113.6</td>
<td>91.9</td>
<td>82.5</td>
<td>70.4</td>
</tr>
<tr>
<td>Assumed: 3/</td>
<td>109.5</td>
<td>88.6</td>
<td>79.5</td>
<td>67.8</td>
</tr>
</tbody>
</table>

#### 2. ASSUMED DAILY HARVEST PER VESSEL 2/:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
</tr>
</tbody>
</table>

#### 3. DAILY MAN HOUR REQUIREMENTS PER VESSEL AT PRESENT HARVEST LEVEL

**Condition:**
- Present
- Assumed: 1/ maximum time savings
- Assumed: 2/ median time savings
- Assumed: 3/ minimum time savings

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>204</td>
<td>204</td>
<td>194</td>
<td>176</td>
</tr>
<tr>
<td>Assumed: 1/</td>
<td>177</td>
<td>177</td>
<td>169</td>
<td>153</td>
</tr>
<tr>
<td>Assumed: 2/</td>
<td>184</td>
<td>184</td>
<td>175</td>
<td>159</td>
</tr>
<tr>
<td>Assumed: 3/</td>
<td>191</td>
<td>191</td>
<td>181</td>
<td>165</td>
</tr>
</tbody>
</table>

#### 4. NUMBER OF CREWMEN REQUIRED ASSUMING NO CHANGE IN TOTAL HARVEST

**Condition:**
- Present
- Assumed: 1/ maximum time savings
- Assumed: 2/ median time savings
- Assumed: 3/ minimum time savings

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>17.0</td>
<td>17.0</td>
<td>16.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Assumed: 1/</td>
<td>14.7</td>
<td>14.7</td>
<td>14.1</td>
<td>12.7</td>
</tr>
<tr>
<td>Assumed: 2/</td>
<td>15.3</td>
<td>15.3</td>
<td>14.6</td>
<td>13.2</td>
</tr>
<tr>
<td>Assumed: 3/</td>
<td>15.9</td>
<td>15.9</td>
<td>15.1</td>
<td>13.7</td>
</tr>
</tbody>
</table>

---

1/ See Appendix C-IA-3.
2/ Appendix D-1 (14).
### Appendix C-IA-5

Differential in Man Hour Requirements and Resultant Dollar Savings
In Labor Costs Following Implementation of New Harvest Systems and
And Assuming No Change From Present Total Harvested 1/

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

1. **REDUCTION IN DAILY MAN-HOURS REQUIRED PER VESSEL** 2/

   **Assumed Condition:**
   - a) Maximum Time Saving
   - b) Median Time Saving
   - c) Minimum Time Saving

<table>
<thead>
<tr>
<th>Daily Man Hours Per Vessel</th>
<th>Number of Man Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>a) Maximum Time Saving</td>
<td>27</td>
</tr>
<tr>
<td>b) Median Time Saving</td>
<td>20</td>
</tr>
<tr>
<td>c) Minimum Time Saving</td>
<td>13</td>
</tr>
</tbody>
</table>

2. **REDUCTION IN ANNUAL MAN HOUR REQUIREMENTS PER VESSEL CLASS** 3/

   **Assumed Condition:**
   - a) Maximum Time Saving
   - b) Median Time Saving
   - c) Minimum Time Saving

<table>
<thead>
<tr>
<th>Number of Man Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>a) Maximum Time Saving</td>
</tr>
<tr>
<td>b) Median Time Saving</td>
</tr>
<tr>
<td>c) Minimum Time Saving</td>
</tr>
</tbody>
</table>

3. **DOLLAR LABOR SAVINGS PER DAY PER VESSEL** 4/

   **Assumed Condition:**
   - a) Maximum Time Saving
   - b) Median Time Saving
   - c) Minimum Time Saving

<table>
<thead>
<tr>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>a) Maximum Time Saving</td>
</tr>
<tr>
<td>b) Median Time Saving</td>
</tr>
<tr>
<td>c) Minimum Time Saving</td>
</tr>
</tbody>
</table>

4. **ANNUAL DOLLAR LABOR SAVINGS PER VESSEL CLASS**

   **Assumed Condition:**
   - a) Maximum Time Saving
   - b) Median Time Saving
   - c) Minimum Time Saving

<table>
<thead>
<tr>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>a) Maximum Time Saving</td>
</tr>
<tr>
<td>b) Median Time Saving</td>
</tr>
<tr>
<td>c) Minimum Time Saving</td>
</tr>
</tbody>
</table>

1/ With no change in the lay system, most of these savings would revert to the crewmen as increases in individual shares (see Appendix C-IA-6). Benefits to management under this condition would amount to 3.5 to 6% of the total savings in the labor bill.

2/ See Appendix C-IA-4 (3)

3/ See Appendix D1 (6)

4/ Based on labor expense per man hour as follows: Class A = $4.80, B = 4.09, C = 3.42, and D = 2.81. Expenses included direct labor (share + payroll tax), allowance for food and provisions and allowance for liability insurance food and provisions taken at $4.00 per day, insured at $2.00 per day, per man.
Changes in Payments to Crewmen Resulting from Implementation of Harvest Systems Improvement

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
<td>(21)</td>
</tr>
</tbody>
</table>

1. **PRESENT CONDITION**

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of shares per vessel class</strong></td>
<td>34</td>
<td>119</td>
<td>62</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td><strong>Total amount shared ($)</strong></td>
<td>410,907</td>
<td>1,188,099</td>
<td>486,994</td>
<td>572,020</td>
<td>2,658,020</td>
</tr>
<tr>
<td><strong>Amount per share ($)</strong></td>
<td>12,086</td>
<td>9,984</td>
<td>7,855</td>
<td>4,931</td>
<td></td>
</tr>
</tbody>
</table>

2. **MEDIAN TIME SAVINGS ASSUMPTION, WITH NO CHANGE IN TOTAL HARVESTED, AND CREW SIZE REDUCED**

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of shares</strong></td>
<td>31</td>
<td>107</td>
<td>58</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td><strong>Total amount shared ($)</strong></td>
<td>410,907</td>
<td>1,188,099</td>
<td>486,994</td>
<td>572,020</td>
<td>2,658,020</td>
</tr>
<tr>
<td><strong>Amount per share ($)</strong></td>
<td>13,255</td>
<td>11,104</td>
<td>8,397</td>
<td>5,396</td>
<td></td>
</tr>
<tr>
<td><strong>Percentage increase in individual share over present (%)</strong></td>
<td>9.7</td>
<td>11.2</td>
<td>6.9</td>
<td>9.4</td>
<td></td>
</tr>
</tbody>
</table>

3. **MEDIAN TIME SAVINGS ASSUMPTION, WITH ADDED ASSUMPTION THAT NEW LEVEL OF PRODUCTIVITY DOES NOT REPRESENT FULL CAPACITY AND ADDED PRODUCTION COULD BE ABSORBED BY LABOR FORCE ASSUMED IN (2) ABOVE**

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of shares</strong></td>
<td>31</td>
<td>107</td>
<td>58</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td><strong>Total amount shared ($)</strong></td>
<td>456,172</td>
<td>1,318,678</td>
<td>540,535</td>
<td>634,980</td>
<td></td>
</tr>
<tr>
<td><strong>Amount per share ($)</strong></td>
<td>14,715</td>
<td>12,324</td>
<td>9,320</td>
<td>5,990</td>
<td></td>
</tr>
<tr>
<td><strong>Percentage increase in individual share over present (%)</strong></td>
<td>21.8</td>
<td>23.4</td>
<td>18.7</td>
<td>21.6</td>
<td></td>
</tr>
</tbody>
</table>

4. **MEDIAN TIME SAVINGS ASSUMPTION, WITH CREWS RETAINING AT PRESENT SIZE, BUT TOTAL HARVEST INCREASED**

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of shares</strong></td>
<td>34</td>
<td>119</td>
<td>62</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td><strong>Total amount shared ($)</strong></td>
<td>456,172</td>
<td>1,318,678</td>
<td>540,535</td>
<td>634,980</td>
<td></td>
</tr>
<tr>
<td><strong>Amount per share ($)</strong></td>
<td>13,417</td>
<td>11,081</td>
<td>8,720</td>
<td>5,474</td>
<td></td>
</tr>
<tr>
<td><strong>Percentage increase in individual share over present (%)</strong></td>
<td>11.0</td>
<td>11.0</td>
<td>11.0</td>
<td>11.0</td>
<td></td>
</tr>
</tbody>
</table>

---

1/ See Appendix D-2 (footnote 1).

2/ Computed from Appendix C-IA-4(4).

3/ Present amount shared plus increase resulting from increased revenue shown in Appendix IA-2(7). Crew's share of increased total revenue estimated in accordance with relationship between crew shares and total revenue in 1965. (Appendix D-2).
## Appendix C-IB-1

Effect of Improved Trawl Design and Use on Drag Sequence

<table>
<thead>
<tr>
<th>Operation</th>
<th>Single Sequence</th>
<th>Per 24 Hours</th>
<th>Changes in time required per 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Proposed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minutes</td>
<td>Minutes</td>
<td></td>
</tr>
<tr>
<td>Improved Trawl Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set</td>
<td>15</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td>Drag</td>
<td>90</td>
<td>126</td>
<td>900</td>
</tr>
<tr>
<td>Haul</td>
<td>15</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td>Lag: (a)</td>
<td>18</td>
<td>18</td>
<td>180</td>
</tr>
<tr>
<td>Lag: (b)</td>
<td>6</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>180</td>
<td>1,440</td>
</tr>
<tr>
<td>Drags per 24-hour period</td>
<td>10</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>
Appendix C-IB-2

Computation of Increment (Benefit) to Annual Fleet Revenue
Resulting from Development of New Trawl Design and Use

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
<td>(21)</td>
</tr>
<tr>
<td>1. PRESENT CATCH RATE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per 90 min. drag (pounds)</td>
<td>2,086</td>
<td>1,690</td>
<td>1,441</td>
<td>1,116</td>
<td></td>
</tr>
<tr>
<td>Per minute (pounds)</td>
<td>23.18</td>
<td>18.77</td>
<td>16.01</td>
<td>12.40</td>
<td></td>
</tr>
<tr>
<td>2. ADDED DRAG TIME PER VESSEL WITH NEW TRAWL DESIGN, PER 24 HOUR PERIOD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Minutes)</td>
<td>108</td>
<td>108</td>
<td>108</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>3. ADDED DAILY CATCH PER VESSEL, ASSUMING NO CHANGE IN DRAG RATE PER MINUTE (Pounds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2,503</td>
<td>2,027</td>
<td>1,729</td>
<td>1,339</td>
<td></td>
</tr>
<tr>
<td>4. ASSUMED VALUE OF CATCH, PER POUND (Dollars)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.1080</td>
<td>.1125</td>
<td>.1047</td>
<td>.1063</td>
<td></td>
</tr>
<tr>
<td>5. ADDED DAILY REVENUE PER VESSEL (Dollars)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>270.32</td>
<td>228.04</td>
<td>181.03</td>
<td>142.33</td>
<td></td>
</tr>
<tr>
<td>6. ASSUMED NUMBER OF FISHING DAYS PER VESSEL GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>416</td>
<td>1,452</td>
<td>785</td>
<td>1,256</td>
<td></td>
</tr>
<tr>
<td>7. ANNUAL INCREMENT TO REVENUE FROM FISHING (Dollars)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>112,453</td>
<td>331,114</td>
<td>142,108</td>
<td>178,766</td>
<td>764,441</td>
</tr>
</tbody>
</table>

1/ See Appendix C-IB-1
Appendix C-IB-3
Effect on Drag Sequence of Combining Improvements in Harvest Systems with Improved Trawl Design and Use

<table>
<thead>
<tr>
<th>Operation</th>
<th>Assuming new trawl design and use&lt;sup&gt;1/&lt;/sup&gt;</th>
<th>Assuming new trawl design and improved harvest system&lt;sup&gt;2/&lt;/sup&gt;</th>
<th>Time Saving</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Median</td>
<td>Minimum</td>
<td></td>
</tr>
<tr>
<td>Set</td>
<td>15</td>
<td>9</td>
<td>10.5</td>
<td>12</td>
</tr>
<tr>
<td>Drag</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>Haul</td>
<td>15</td>
<td>9</td>
<td>10.5</td>
<td>12</td>
</tr>
<tr>
<td>Lag: (a)</td>
<td>18</td>
<td>11</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>(b)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>161</td>
<td>166</td>
<td>171</td>
</tr>
<tr>
<td>Number of drags per 24-hour day</td>
<td>8.0</td>
<td>8.9</td>
<td>8.7</td>
<td>8.4</td>
</tr>
<tr>
<td>Number of minutes dragging per 24-hour day</td>
<td>1,008</td>
<td>1,121</td>
<td>1,096</td>
<td>1,062</td>
</tr>
<tr>
<td>Added drag time over present operations (minutes)&lt;sup&gt;3/&lt;/sup&gt;</td>
<td>108</td>
<td>221</td>
<td>196</td>
<td>162</td>
</tr>
</tbody>
</table>

<sup>1/</sup> See Appendix C-IB-1.
<sup>2/</sup> See Appendix C-IA-1.
<sup>3/</sup> Assumed present operations at 10 drags per day of 90 minutes duration.
Appendix C-IB-4
Computation of Increment (Benefit) to Annual Fleet Revenue
Resulting from Development of New Harvest System and New Trawl Design and Use

<table>
<thead>
<tr>
<th>Operation</th>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>A (2)</td>
<td>B (7)</td>
</tr>
</tbody>
</table>

1. ASSUMED CATCH RATE--POUNDS PER MINUTE

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds</td>
<td>23.18</td>
<td>18.77</td>
<td>16.01</td>
<td>12.40</td>
<td></td>
</tr>
</tbody>
</table>

2. ADDED DRAG TIME PER VESSEL PER 24 HOUR PERIOD (Minutes)
   a) Maximum time savings | 221 | 221 | 221 | 221 |
   b) Median time savings | 196 | 196 | 196 | 196 |
   c) Minimum time savings | 158 | 158 | 158 | 158 |

3. ADDED DAILY CATCH PER VESSEL
   a) Maximum time savings | 5,123 | 4,148 | 3,538 | 2,740 |
   b) Median time savings | 4,543 | 3,679 | 3,138 | 2,430 |
   c) Minimum time savings | 3,662 | 2,966 | 2,530 | 1,959 |

4. ASSUMED VALUE OF CATCH, PER POUND

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollars</td>
<td>.1080</td>
<td>.1125</td>
<td>.1047</td>
<td>.1063</td>
<td></td>
</tr>
</tbody>
</table>

5. ADDED DAILY REVENUE PER VESSEL
   a) Maximum time savings | 553.28 | 466.65 | 370.43 | 291.26 |
   b) Median time savings | 490.64 | 413.89 | 328.55 | 258.31 |
   c) Minimum time savings | 395.50 | 333.68 | 264.89 | 208.24 |

6. ASSUMED NUMBER OF FISHING DAYS PER VESSEL GROUP

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>416</td>
<td>1,452</td>
<td>785</td>
<td>1,256</td>
<td></td>
</tr>
</tbody>
</table>

7. ANNUAL INCREMENT TO REVENUE FROM FISHING
   a) Maximum time savings | 230,164 | 677,576 | 290,788 | 365,822 | 1,564,350 |
   b) Median time savings | 204,106 | 600,968 | 257,912 | 324,437 | 1,387,423 |
   c) Minimum time savings | 164,528 | 484,503 | 207,939 | 261,549 | 1,118,519 |

1/ See Appendix C-IB-2.
2/ Average prices for 1965. See Appendix D-2.
3/ See Appendix D-1.
Appendix C-IB-5  
Effect of Trawl and Harvest Systems  
Improvement on Man-Hour Productivity

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
</tr>
</tbody>
</table>

1. PRESENT DAILY CATCH RATE PER VESSEL ADDED, WITH NEW TRAWL DESIGN1/  

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added, with new trawl design</td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
</tr>
<tr>
<td>Total</td>
<td>23,363</td>
<td>18,927</td>
<td>16,139</td>
<td>12,499</td>
</tr>
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</table>

2. ADDED WITH COMBINED EFFECT OF NEW TRAWL DESIGN AND IMPROVED HARVEST SYSTEM2/  

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Maximum time savings</td>
<td>5,123</td>
<td>4,148</td>
<td>3,538</td>
<td>2,740</td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>4,543</td>
<td>3,679</td>
<td>3,138</td>
<td>2,430</td>
</tr>
<tr>
<td>c) Minimum time savings</td>
<td>3,662</td>
<td>2,966</td>
<td>2,530</td>
<td>1,959</td>
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</table>

3. TOTAL DAILY CATCH PER VESSEL WITH COMBINED EFFECTS  

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Maximum time savings</td>
<td>25,983</td>
<td>21,048</td>
<td>17,948</td>
<td>13,900</td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>25,403</td>
<td>20,579</td>
<td>17,548</td>
<td>13,590</td>
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<tr>
<td>c) Minimum time savings</td>
<td>24,522</td>
<td>19,866</td>
<td>16,940</td>
<td>13,119</td>
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4. ASSUMED MAN HOURS PER DAY PER VESSEL.3/  

<table>
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<tr>
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<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>204</td>
<td>204</td>
<td>194</td>
<td>176</td>
</tr>
</tbody>
</table>

5. CATCH PER MAN HOUR CONDITION  

<table>
<thead>
<tr>
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<th>Present</th>
<th>Assumed:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a) New trawl design</td>
<td>b) Combined--new trawl design and improved harvest system:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>102.3</td>
<td>114.6</td>
<td>127.4</td>
<td>120.3</td>
</tr>
<tr>
<td></td>
<td>82.8</td>
<td>92.7</td>
<td>103.2</td>
<td>97.4</td>
</tr>
<tr>
<td></td>
<td>74.3</td>
<td>83.2</td>
<td>92.6</td>
<td>87.4</td>
</tr>
<tr>
<td></td>
<td>63.4</td>
<td>71.0</td>
<td>79.0</td>
<td>74.6</td>
</tr>
</tbody>
</table>

1/ Appendix C-IB-2.  
2/ Appendix C-IB-4.  
3/ Present crew sizes (See Appendix C-IA-3)
Appendix C-IB-6

Effect of Trawl and Harvest Systems Improvement on Manpower Requirements

<table>
<thead>
<tr>
<th></th>
<th>Vessel Class</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>1. CATCH PER MAN HOUR</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Condition: Present</td>
<td>102.3</td>
<td>82.8</td>
<td>74.3</td>
<td>63.4</td>
</tr>
<tr>
<td>Assumed:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) New Trawl Design</td>
<td>114.6</td>
<td>92.7</td>
<td>83.2</td>
<td>71.0</td>
</tr>
<tr>
<td>b) Combined New Trawl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Improved Harvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System 1/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maximum Time Savings</td>
<td>127.4</td>
<td>103.2</td>
<td>92.6</td>
<td>79.0</td>
</tr>
<tr>
<td>- Median Time Savings</td>
<td>124.6</td>
<td>100.9</td>
<td>90.5</td>
<td>77.2</td>
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<tr>
<td>- Minimum Time Savings</td>
<td>120.3</td>
<td>97.4</td>
<td>87.4</td>
<td>74.6</td>
</tr>
<tr>
<td>2. ASSUMED DAILY HARVEST PER VESSEL</td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
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<td>3. DAILY MAN HOUR REQUIREMENTS</td>
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<td></td>
<td></td>
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<tr>
<td>PER VESSEL AT PRESENT HARVEST LEVEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Condition: Present</td>
<td>204</td>
<td>204</td>
<td>194</td>
<td>176</td>
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<tr>
<td>Assumed:</td>
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</tr>
<tr>
<td>a) New Trawl Design</td>
<td>182</td>
<td>182</td>
<td>173</td>
<td>157</td>
</tr>
<tr>
<td>b) Combined - New Trawl Design and Improved Harvest System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maximum Time Savings</td>
<td>164</td>
<td>164</td>
<td>156</td>
<td>141</td>
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<tr>
<td>- Median Time Savings</td>
<td>167</td>
<td>167</td>
<td>159</td>
<td>145</td>
</tr>
<tr>
<td>- Minimum Time Savings</td>
<td>173</td>
<td>173</td>
<td>165</td>
<td>150</td>
</tr>
<tr>
<td>4. NUMBER OF CREWMEN REQUIRED ASSUMING NO CHANGE IN TOTAL HARVEST 2/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition: Present</td>
<td>17.0</td>
<td>17.0</td>
<td>16.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Assumed:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) New Trawl Design</td>
<td>15.2</td>
<td>15.2</td>
<td>14.4</td>
<td>13.1</td>
</tr>
<tr>
<td>b) Combined - New Trawl &amp; Improved Harvest System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maximum</td>
<td>13.7</td>
<td>13.7</td>
<td>13.0</td>
<td>11.7</td>
</tr>
<tr>
<td>- Median</td>
<td>13.9</td>
<td>13.9</td>
<td>13.2</td>
<td>12.1</td>
</tr>
<tr>
<td>- Minimum</td>
<td>14.4</td>
<td>14.4</td>
<td>13.7</td>
<td>12.5</td>
</tr>
</tbody>
</table>

1/ See Appendix C-IB-5

2/ Man hours required divide by 12 man hours per day per man.
Appendix C-13-7
Differential in Man Hour Requirements and Savings in Labor Costs Flowing From New Trawl Design and Improved Harvest Systems, Assuming Present Harvest Level

<table>
<thead>
<tr>
<th></th>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
</tr>
</tbody>
</table>

1. REDUCTION IN DAILY MAN HOURS REQUIRED PER VESSEL
   Assumed Condition:
   a) New Trawl Design
   b) Combined New Trawl & Improved Harvest System
      - Maximum Time Saving
      - Median Time Saving
      - Minimum Time Saving

<table>
<thead>
<tr>
<th></th>
<th>(Number of Vessels)</th>
<th>(2)</th>
<th>(7)</th>
<th>(4)</th>
<th>(8)</th>
<th>(21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Man Hours Per Vessel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) New Trawl Design</td>
<td></td>
<td>22</td>
<td>22</td>
<td>21</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>b) Combined New Trawl &amp; Improved Harvest System</td>
<td></td>
<td>40</td>
<td>40</td>
<td>38</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum Time Saving</td>
<td>40</td>
<td>40</td>
<td>38</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median Time Saving</td>
<td>37</td>
<td>37</td>
<td>35</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum Time Saving</td>
<td>31</td>
<td>31</td>
<td>29</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

2. REDUCTION IN ANNUAL MAN HOUR REQUIREMENTS PER VESSEL CLASS
   Assumed Condition:
   a) New Trawl Design
   b) Combined New Trawl & Improved Harvest System
      - Maximum
      - Median
      - Minimum

<table>
<thead>
<tr>
<th></th>
<th>(Number of Vessels)</th>
<th>(2)</th>
<th>(7)</th>
<th>(4)</th>
<th>(8)</th>
<th>(21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Man Hours Per Vessel</td>
<td></td>
<td>11,924</td>
<td>41,426</td>
<td>21,903</td>
<td>31,597</td>
<td></td>
</tr>
<tr>
<td>a) New Trawl Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Combined New Trawl &amp; Improved Harvest System</td>
<td></td>
<td>21,680</td>
<td>75,320</td>
<td>39,634</td>
<td>58,205</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>21,680</td>
<td>75,320</td>
<td>39,634</td>
<td>58,205</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>20,054</td>
<td>69,671</td>
<td>36,505</td>
<td>51,553</td>
<td></td>
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<tr>
<td></td>
<td>Minimum</td>
<td>16,802</td>
<td>58,373</td>
<td>30,247</td>
<td>43,238</td>
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</table>

3. DOLLAR LABOR SAVINGS PER DAY PER VESSEL CLASS
   Assumed Condition:
   a) New Trawl Design
   b) Combined New Trawl & Improved Harvest System
      - Maximum
      - Median
      - Minimum

<table>
<thead>
<tr>
<th></th>
<th>(Number of Vessels)</th>
<th>(2)</th>
<th>(7)</th>
<th>(4)</th>
<th>(8)</th>
<th>(21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar Labor Savings Per Day</td>
<td></td>
<td>105.60</td>
<td>89.98</td>
<td>71.82</td>
<td>53.39</td>
<td></td>
</tr>
<tr>
<td>a) New Trawl Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Combined New Trawl &amp; Improved Harvest System</td>
<td></td>
<td>192.00</td>
<td>163.60</td>
<td>129.86</td>
<td>98.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>192.00</td>
<td>163.60</td>
<td>129.86</td>
<td>98.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>177.60</td>
<td>151.33</td>
<td>119.70</td>
<td>87.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>148.80</td>
<td>126.79</td>
<td>99.18</td>
<td>73.06</td>
<td></td>
</tr>
</tbody>
</table>

4. ANNUAL DOLLAR LABOR SAVINGS PER VESSEL CLASS
   Assumed Condition:
   a) New Trawl Design
   b) Maximum
      - Median
      - Minimum

<table>
<thead>
<tr>
<th></th>
<th>(Number of Vessels)</th>
<th>(2)</th>
<th>(7)</th>
<th>(4)</th>
<th>(8)</th>
<th>(21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Dollar Labor Savings</td>
<td></td>
<td>57,235</td>
<td>169,432</td>
<td>74,908</td>
<td>88,788</td>
<td>390,363</td>
</tr>
<tr>
<td>a) New Trawl Design</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Maximum</td>
<td></td>
<td>104,064</td>
<td>308,059</td>
<td>135,548</td>
<td>163,556</td>
<td>711,227</td>
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<tr>
<td></td>
<td>Median</td>
<td>96,259</td>
<td>284,954</td>
<td>124,847</td>
<td>144,864</td>
<td>650,924</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>80,650</td>
<td>238,746</td>
<td>103,445</td>
<td>121,499</td>
<td>544,340</td>
</tr>
</tbody>
</table>

1/ Based on Vessel Days at Sea as follows:
   Class A: 542
   Class B: 1,833
   Class C: 1,043
   Class D: 1,663

2/ Computed on following pages
   Class A: $4.80 per man hour
   Class B: 4.09 per man hour
   Class C: 3.42 per man hour
   Class D: 2.81 per man hour

33
Appendix C-IB-8
Changes in Payments to Crewmen resulting from
New Trawl Design and Harvest Systems Improvement

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

1. **PRESENT CONDITION:**
   a) Total Number of Shares per vessel class: 34
   b) Total Amount Shared ($): 410,907
   c) Amount per Share ($): 12,086

2. **NEW TRAWL DESIGN ASSUMPTION,**
   WITH NO CHANGE IN TOTAL HARVEST
   AND CREW SIZE REDUCED
   a) Total Number of Shares: 30
   b) Total Amount Shared ($): 410,907
   c) Amount per Share ($): 13,697
   d) % Increase over Present: 13.3

3. **NEW TRAWL DESIGN COMBINED WITH**
   **IMPROVED HARVEST SYSTEM-MEDIAN**
   **TIME SAVING ASSUMPTION AND NO**
   **CHANGE IN TOTAL HARVEST**
   a) Total Number of Shares: 28
   b) Total Amount Shared ($): 410,907
   c) Amount per Share ($): 14,675
   d) % Increase over Present: 21.4

4. **NEW TRAWL DESIGN - ASSUMING**
   **INCREASED HARVEST WITH SMALLER CREW**
   a) Total Number of Shares: 30
   b) Total Amount Shared ($): 460,274
   c) Amount per Share ($): 15,342
   d) % Increase over Present: 26.9

5. **NEW TRAWL DESIGN COMBINED WITH IMPROVED**
   **HARVEST SYSTEM-ASSUMING MEDIAN TIME SAVINGS,**
   **INCREASED HARVEST AND SMALLER CREW**
   a) Total number of Shares: 28
   b) Tot. Amt. Shared ($) 460,509
   c) Amount per Share ($) 17,875
   d) % Increase over Present 47.9

6. **NEW TRAWL DESIGNED COMBINED WITH**
   **IMPROVED HARVEST SYSTEM-ASSUMING**
   **MEDIAN TIME SAVINGS, INCREASED HARVEST,**
   **BUT NO CHANGE IN CREW SIZE**
   a) Total Number of Shares: 34
   b) Total Amount Shared ($) 500,509
   c) Amount per Share ($) 14,721
   d) % Increase over Present 21.8
Appendix C-IB-8 (continued)

1/ See Appendix D-2

2/ From Appendix C-IB-6(4)

3/ Present Shared plus crews' percentage of increase due to increased revenue shown in Appendix C-IB-2(7). Crew percentage computed on basis of 1965 relationship crew share of total revenue (Appendix__).

4/ Present plus crew percentage of increase shown in Appendix C-IB-4(7).
Savings in Labor Costs Resulting from Automated Shipboard Handling of Fish Assuming Present Catch Level

<table>
<thead>
<tr>
<th></th>
<th>Vessel Class</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>1. DAILY CATCH PER VESSEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Present)</td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. MAN HOURS PER VESSEL</td>
<td>204</td>
<td>204</td>
<td>194</td>
<td>176</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PER DAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. CATCH PER MAN PER HOUR</td>
<td>102.3</td>
<td>82.8</td>
<td>74.3</td>
<td>63.4</td>
<td></td>
<td></td>
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<tr>
<td>4. INCREASED MAN HOUR CATCH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FROM AUTOMATIC HANDLING</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings--35%</td>
<td>138.1</td>
<td>111.8</td>
<td>100.3</td>
<td>85.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Median time savings--30%</td>
<td>133.1</td>
<td>107.6</td>
<td>96.6</td>
<td>82.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Minimum time savings--25%</td>
<td>127.9</td>
<td>103.5</td>
<td>92.9</td>
<td>79.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. MAN HOURS REQUIRED AT NEW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTPUT LEVEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings</td>
<td>151</td>
<td>151</td>
<td>144</td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>157</td>
<td>157</td>
<td>149</td>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Minimum time savings</td>
<td>163</td>
<td>163</td>
<td>155</td>
<td>141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. DAILY MAN HOURS SAVED AT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEW OUTPUT LEVEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum time savings</td>
<td>53</td>
<td>53</td>
<td>50</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Median time savings</td>
<td>47</td>
<td>47</td>
<td>45</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Minimum time savings</td>
<td>41</td>
<td>41</td>
<td>39</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. LABOR COST PER MAN HOUR</td>
<td>4.80</td>
<td>4.09</td>
<td>3.42</td>
<td>2.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. DOLLAR LABOR SAVING PER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VESSEL PER DAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum</td>
<td>254.50</td>
<td>216.77</td>
<td>171.00</td>
<td>129.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Median</td>
<td>225.60</td>
<td>192.23</td>
<td>153.90</td>
<td>115.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Minimum</td>
<td>196.80</td>
<td>167.69</td>
<td>133.38</td>
<td>98.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. ASSUMED NUMBER OF DAYS AT</td>
<td>542</td>
<td>1,883</td>
<td>1,043</td>
<td>1,663</td>
<td>5,131</td>
<td></td>
</tr>
<tr>
<td>SEA PER VESSEL GROUP PER YEAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. ANNUAL DOLLAR LABOR SAVINGS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Maximum</td>
<td>137,885</td>
<td>408,178</td>
<td>178,353</td>
<td>214,959</td>
<td>939,375</td>
<td></td>
</tr>
<tr>
<td>b) Median</td>
<td>122,275</td>
<td>361,969</td>
<td>160,518</td>
<td>191,594</td>
<td>836,356</td>
<td></td>
</tr>
<tr>
<td>c) Minimum</td>
<td>106,666</td>
<td>315,760</td>
<td>139,115</td>
<td>163,556</td>
<td>725,097</td>
<td></td>
</tr>
</tbody>
</table>

1/ See Appendix C-IIA-3.
2/ See Appendix C-IIA-5.
3/ Appendix D-1 (6).
Appendix C-IIB-1

Increases in the Value of Catch Due to Higher Prices Resulting From Quality Improvement through Processes to Extend Shelf Life And Increase Consumer Acceptance

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>PRESENT CATCH LEVEL</td>
<td></td>
</tr>
<tr>
<td>1. Value of Annual Catch($)</td>
<td>936,700</td>
</tr>
<tr>
<td>2. Assumed Increase In Value Due to Improved Quality</td>
<td></td>
</tr>
<tr>
<td>a) Maximum - 20%</td>
<td>187,340</td>
</tr>
<tr>
<td>b) Median - 15%</td>
<td>140,505</td>
</tr>
<tr>
<td>c) Minimum - 10%</td>
<td>93,670</td>
</tr>
</tbody>
</table>

CATCH LEVEL WITH IMPROVED HARVEST SYSTEM AND NEW TRAWL DESIGN |

| 1. Value of Annual Catch | 1,140,806 | 3,362,468 | 1,442,012 | 1,815,637 | 7,760,923 |
| 2. Assumed Increase in Value Due to Improved Quality |
| a) Maximum - 20% | 228,161 | 672,494 | 288,402 | 363,127 | 1,552,185 |
| b) Median - 15% | 171,121 | 504,370 | 216,302 | 272,346 | 1,164,138 |
| c) Minimum - 10% | 114,081 | 336,247 | 144,201 | 181,564 | 776,092 |

1/ Appendix D1

2/ Estimate based on fish sales at 2 Boston locations (See Appendix C-IIB-2)

3/ Present catch value plus increasement shown in Appendix C-IIB-4 (7B)
## Price Differential Between Fishlandings at Atlantic Avenue Pier (Boston) and Boston Fish Pier 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Price Per Pound</th>
<th>Percent Atlantic Ave. of Boston Fish Pier</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Haddock and Cod Landings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Atlantic Ave. Boston Fish Pier</td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>12.05</td>
<td>10.72</td>
</tr>
<tr>
<td>1960</td>
<td>10.36</td>
<td>8.82</td>
</tr>
<tr>
<td>1961</td>
<td>10.25</td>
<td>8.26</td>
</tr>
<tr>
<td>1962</td>
<td>10.41</td>
<td>9.09</td>
</tr>
<tr>
<td>1963</td>
<td>11.88</td>
<td>10.46</td>
</tr>
<tr>
<td>1964</td>
<td>12.27</td>
<td>10.02</td>
</tr>
<tr>
<td>1965</td>
<td>15.28</td>
<td>11.44</td>
</tr>
</tbody>
</table>

Av. = 19.73

1/ Fish landed at Atlantic are caught by small traulers which generally make shorter trips (1-2 days) then the larger vessels that land at Boston Fish Pier (8-9 day trips). Therefore, landings at Atlantic Ave. would consist of fish newer caught then the majority of fish landed at the Fish Pier.
## APPENDIX C-II-C-1

Increase in Catch Value Resulting from Improving Weigh-out at Port Through Moisture Loss Inhibition

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Present Catch Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Value of annual catch $1/</td>
<td>936,700</td>
<td>2,761,500</td>
<td>1,184,100</td>
<td>1,491,200</td>
<td>6,373,500</td>
</tr>
<tr>
<td>2) Assumed increase in value due to increased weigh-out at port</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 10% increase</td>
<td>93,670</td>
<td>276,150</td>
<td>118,410</td>
<td>149,120</td>
<td>637,350</td>
</tr>
<tr>
<td>b) 5% increase</td>
<td>46,835</td>
<td>138,075</td>
<td>59,205</td>
<td>74,560</td>
<td>318,675</td>
</tr>
<tr>
<td>B. Catch Level With Improved Harvest System &amp; New Trawl Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Value of annual catch $2/</td>
<td>1,140,806</td>
<td>3,362,468</td>
<td>1,442,012</td>
<td>1,815,637</td>
<td>7,760,923</td>
</tr>
<tr>
<td>2) Assumed increase in value due to increased weigh-out at port</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 10% increase</td>
<td>114,081</td>
<td>336,247</td>
<td>-144,201</td>
<td>181,564</td>
<td>776,092</td>
</tr>
<tr>
<td>b) 5% increase</td>
<td>57,040</td>
<td>168,123</td>
<td>72,101</td>
<td>90,782</td>
<td>388,046</td>
</tr>
</tbody>
</table>

$1/$ Appendix D-1

$2/$ Present catch value plus increment shown in Appendix C-IB-4 (7b)
Appendix C-II-D-1
Increment to Total Revenue Resulting from Processing Total Catch (Three Alternative Processes)--Assuming No Change in Total Catch

<table>
<thead>
<tr>
<th>Process with Present Catch</th>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>A. Slurried Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight(^1) (1,000 pounds)</td>
<td>6,290</td>
<td>17,792</td>
</tr>
<tr>
<td>2. Recovery @ 100%</td>
<td>6,290</td>
<td>17,792</td>
</tr>
<tr>
<td>3. Product value @ 1¢/lb in $</td>
<td>62,900</td>
<td>177,920</td>
</tr>
<tr>
<td>B. Fish Meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight(^1) (1,000 pounds)</td>
<td>6,290</td>
<td>17,792</td>
</tr>
<tr>
<td>2. Recovery @ 20%</td>
<td>1,258</td>
<td>3,558</td>
</tr>
<tr>
<td>3. Product value @ 6¢/lb in $</td>
<td>75,480</td>
<td>213,480</td>
</tr>
<tr>
<td>C. Meat Extracts; Protein Extenders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight(^1) (1,000 pounds)</td>
<td>6,290</td>
<td>17,792</td>
</tr>
<tr>
<td>2. Recovery @ 20%</td>
<td>1,258</td>
<td>3,558</td>
</tr>
<tr>
<td>3. Product value @ 15¢/lb in $</td>
<td>188,700</td>
<td>533,700</td>
</tr>
</tbody>
</table>

\(^1\) See Appendix C-II-D-3
Appendix C-IID-2
Increment to Total Revenue Resulting from Processing Total Catch (Three Alternative Processes) Assuming Increased Total Catch Due to New Trawl Systems

<table>
<thead>
<tr>
<th>Process with increased catch from improved harvest system and new trawl design</th>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>A. Slurried Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight¹/(1,000 pounds)</td>
<td>7,661</td>
<td>21,664</td>
</tr>
<tr>
<td>2. Recovery @ 100%</td>
<td>7,661</td>
<td>21,664</td>
</tr>
<tr>
<td>3. Product value @ 1c/lb. in $</td>
<td>76,610</td>
<td>216,640</td>
</tr>
<tr>
<td>B. Fish Meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight¹/(1,000 pounds)</td>
<td>7,661</td>
<td>21,664</td>
</tr>
<tr>
<td>2. Recovery @ 20%</td>
<td>1,532</td>
<td>4,333</td>
</tr>
<tr>
<td>3. Product value @ 6c/lb in $</td>
<td>91,920</td>
<td>259,980</td>
</tr>
<tr>
<td>C. Meat Extracts; Protein Extenders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Raw material weight¹/(1,000 pounds)</td>
<td>7,661</td>
<td>21,664</td>
</tr>
<tr>
<td>2. Recovery @ 20%</td>
<td>1,532</td>
<td>4,333</td>
</tr>
<tr>
<td>3. Product value @ 15c/lb in $</td>
<td>229,800</td>
<td>649,950</td>
</tr>
</tbody>
</table>

¹/ See Appendix C-IID-3.
### Computation of Quantity of Catch Presently Discarded as Non-Marketable

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/ 2</td>
<td>3/</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present Annual Catch (1000 lbs)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Round weight</td>
<td>9,977</td>
<td>23,221</td>
<td>13,008</td>
<td>16,125</td>
<td>67,331</td>
</tr>
<tr>
<td>b) As landed (drawn)</td>
<td>8,676</td>
<td>24,540</td>
<td>11,311</td>
<td>14,022</td>
<td>58,549</td>
</tr>
<tr>
<td>c) Discarded Offal</td>
<td>1,301</td>
<td>3,681</td>
<td>1,697</td>
<td>2,103</td>
<td>8,782</td>
</tr>
<tr>
<td></td>
<td>1,989</td>
<td>14,111</td>
<td>6,504</td>
<td>8,063</td>
<td>33,667</td>
</tr>
<tr>
<td>Estimated non-Marktables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discarded under present system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Discarded Weight</td>
<td>6,290</td>
<td>17,792</td>
<td>8,201</td>
<td>10,166</td>
<td>42,449</td>
</tr>
</tbody>
</table>

### Catch level with improved harvest system and new trawl design - Annual (1000 lbs) 3/

<table>
<thead>
<tr>
<th>Present Annual Catch (1000 lbs)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Round Weight</td>
<td>12,153</td>
<td>34,363</td>
<td>15,841</td>
<td>19,629</td>
<td>81,987</td>
</tr>
<tr>
<td>b) As landed (drawn)</td>
<td>10,568</td>
<td>29,881</td>
<td>13,775</td>
<td>17,069</td>
<td>71,293</td>
</tr>
<tr>
<td>c) Discarded Offal</td>
<td>1,585</td>
<td>4,482</td>
<td>2,066</td>
<td>2,560</td>
<td>10,694</td>
</tr>
<tr>
<td>Estimated non-Marktables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discarded under Present System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Discarded Weight</td>
<td>7,661</td>
<td>21,664</td>
<td>9,986</td>
<td>12,374</td>
<td>51,698</td>
</tr>
</tbody>
</table>

1/ Round weight figures shown in Appendix D-1 increased by factor of 1.15.
2/ On basis of 1/3 of total haul
3/ Based on increment shown in Appendix C-1B-4
### APPENDIX D-1

**Operating Statistics Boston Offshore Trawler Fleet, Year 1965, Grouped by Vessel Earnings Class**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Vessels</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
<td>(21)</td>
</tr>
<tr>
<td>Catch (thou. Pounds)</td>
<td>8,676</td>
<td>24,540</td>
<td>11,311</td>
<td>14,022</td>
<td>58,549</td>
</tr>
<tr>
<td>Revenue (thou. dollars)</td>
<td>936.7</td>
<td>2,761.5</td>
<td>1,184.1</td>
<td>1,491.2</td>
<td>6,373.5</td>
</tr>
<tr>
<td>Average Price Received per lb. (cents)</td>
<td>10.80</td>
<td>11.25</td>
<td>10.47</td>
<td>10.63</td>
<td>10.89</td>
</tr>
<tr>
<td>Number of trips</td>
<td>63</td>
<td>148</td>
<td>112</td>
<td>183</td>
<td>506</td>
</tr>
<tr>
<td>Number of days at sea</td>
<td>542</td>
<td>1,883</td>
<td>1,043</td>
<td>1,663</td>
<td>5,131</td>
</tr>
<tr>
<td>Number of days fishing</td>
<td>416</td>
<td>1,452</td>
<td>785</td>
<td>1,256</td>
<td>3,999</td>
</tr>
<tr>
<td>Number of man days at sea</td>
<td>9,214</td>
<td>32,011</td>
<td>16,249</td>
<td>24,393</td>
<td>81,867</td>
</tr>
<tr>
<td>Number of man days fishing</td>
<td>7,065</td>
<td>24,679</td>
<td>12,703</td>
<td>18,431</td>
<td>62,878</td>
</tr>
<tr>
<td>Net running time - days at sea less days fishing</td>
<td>126</td>
<td>431</td>
<td>258</td>
<td>407</td>
<td>1,222</td>
</tr>
<tr>
<td>Days running time per 10 days fishing time</td>
<td>3.0:10</td>
<td>3.0:10</td>
<td>3.3:10</td>
<td>3.2:10</td>
<td>3.1:10</td>
</tr>
<tr>
<td>Net days in port</td>
<td>188</td>
<td>672</td>
<td>417</td>
<td>1,257</td>
<td>2,534</td>
</tr>
<tr>
<td>Days in port per 10 days sea time</td>
<td>3.5:10</td>
<td>3.6:10</td>
<td>4.0:10</td>
<td>7.6:10</td>
<td>4.9:10</td>
</tr>
<tr>
<td>Catch per day fishing - lbs. per vessel</td>
<td>20,860</td>
<td>16,900</td>
<td>14,410</td>
<td>11,160</td>
<td></td>
</tr>
<tr>
<td>Catch per man day fishing</td>
<td>1,228</td>
<td>994</td>
<td>890</td>
<td>761</td>
<td></td>
</tr>
<tr>
<td>Lbs. per vessel</td>
<td>2,252</td>
<td>1,902</td>
<td>1,580</td>
<td>1,187</td>
<td></td>
</tr>
<tr>
<td>Revenue per day fishing</td>
<td>132.62</td>
<td>111.83</td>
<td>93.18</td>
<td>80.89</td>
<td></td>
</tr>
<tr>
<td>Revenue per man day fishing</td>
<td>1,228</td>
<td>994</td>
<td>890</td>
<td>761</td>
<td></td>
</tr>
</tbody>
</table>

Source: Vessel Trip Settlement Sheets
## APPENDIX D-2

Composite P & L Statement, Boston Offshore Trawler Fleet,
Year 1965, Grouped by Earning Class

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>(Number of Vessels)</th>
<th>A (2)</th>
<th>B (7)</th>
<th>C (4)</th>
<th>D (8)</th>
<th>Total (21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Revenues</td>
<td>Proceeds from catch</td>
<td>936,700</td>
<td>2,761,500</td>
<td>1,184,100</td>
<td>1,491,200</td>
<td>6,373,500</td>
</tr>
<tr>
<td>Direct Operating Expense</td>
<td>Labor: Crew Shares 1/2</td>
<td>410,907</td>
<td>1,188,099</td>
<td>486,994</td>
<td>572,020</td>
<td>2,658,020</td>
</tr>
<tr>
<td></td>
<td>Bonus</td>
<td>40,647</td>
<td>121,197</td>
<td>53,345</td>
<td>69,765</td>
<td>284,954</td>
</tr>
<tr>
<td></td>
<td>Payroll taxes</td>
<td>24,655</td>
<td>71,285</td>
<td>29,219</td>
<td>34,321</td>
<td>159,480</td>
</tr>
<tr>
<td></td>
<td>Total labor</td>
<td>476,209</td>
<td>1,380,581</td>
<td>569,558</td>
<td>676,106</td>
<td>3,102,454</td>
</tr>
<tr>
<td></td>
<td>Trip expense</td>
<td>162,466</td>
<td>501,250</td>
<td>230,229</td>
<td>337,787</td>
<td>1,240,732</td>
</tr>
<tr>
<td>Maintenance &amp; Repair</td>
<td></td>
<td>70,460</td>
<td>228,795</td>
<td>117,670</td>
<td>196,075</td>
<td>613,000</td>
</tr>
<tr>
<td>Total Direct Operating Expense</td>
<td></td>
<td>709,135</td>
<td>2,110,626</td>
<td>926,457</td>
<td>1,209,968</td>
<td>4,956,186</td>
</tr>
<tr>
<td>Indirect Expense</td>
<td>Insurance</td>
<td>31,000</td>
<td>108,500</td>
<td>56,500</td>
<td>105,000</td>
<td>301,000</td>
</tr>
<tr>
<td></td>
<td>Depreciation</td>
<td>15,000</td>
<td>117,500</td>
<td>47,500</td>
<td>55,000</td>
<td>235,000</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous Mgmt. Expense</td>
<td>20,000</td>
<td>70,000</td>
<td>40,000</td>
<td>80,000</td>
<td>210,000</td>
</tr>
<tr>
<td>Total Expense</td>
<td></td>
<td>66,000</td>
<td>296,000</td>
<td>144,000</td>
<td>240,000</td>
<td>746,000</td>
</tr>
<tr>
<td>Total Direct &amp; Indirect Expense</td>
<td></td>
<td>775,135</td>
<td>2,406,626</td>
<td>1,070,457</td>
<td>1,449,968</td>
<td>5,702,186</td>
</tr>
<tr>
<td>Net Profit (before taxes &amp; interest)</td>
<td></td>
<td>161,565</td>
<td>354,874</td>
<td>113,643</td>
<td>41,232</td>
<td>671,314</td>
</tr>
</tbody>
</table>

| %: Net Profit to Op. Rev. | 17.2 | 12.9 | 9.6 | 2.8 | 10.5 |
| %: Op. Rev. to Opr. Exp. | 120.8 | 114.7 | 110.6 | 102.8 | 111.8 |

1/ Number of shares per group as follows: Class A-34; B-119; C-66; D-116
APPENDIX D-3

Operating Costs and Revenues Per Man Day at Sea,
Boston Offshore Trawler Fleet, Year 1965, Grouped
By Vessel Earnings Class

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Number of Vessels)</td>
<td>(2)</td>
<td>(7)</td>
<td>(4)</td>
<td>(8)</td>
</tr>
<tr>
<td>(Number of man days at sea)</td>
<td>(9214)</td>
<td>(32011)</td>
<td>(16249)</td>
<td>(24393)</td>
</tr>
<tr>
<td>Operating Revenues</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proceeds from catch</td>
<td>101.74</td>
<td>86.29</td>
<td>72.87</td>
<td>61.12</td>
</tr>
<tr>
<td>Direct Operating Expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew shares</td>
<td>44.60</td>
<td>37.12</td>
<td>29.97</td>
<td>23.45</td>
</tr>
<tr>
<td>Bonuses</td>
<td>4.40</td>
<td>3.79</td>
<td>3.29</td>
<td>2.86</td>
</tr>
<tr>
<td>Payroll Taxes</td>
<td>2.68</td>
<td>2.23</td>
<td>1.80</td>
<td>1.41</td>
</tr>
<tr>
<td>Total Labor</td>
<td>51.68</td>
<td>43.14</td>
<td>35.06</td>
<td>27.72</td>
</tr>
<tr>
<td>Trip Expense</td>
<td>17.63</td>
<td>15.66</td>
<td>14.72</td>
<td>13.85</td>
</tr>
<tr>
<td>Maintenance &amp; Repair</td>
<td>7.65</td>
<td>7.15</td>
<td>7.24</td>
<td>8.04</td>
</tr>
<tr>
<td>Total Direct Operating Expense</td>
<td>76.96</td>
<td>65.95</td>
<td>57.02</td>
<td>49.61</td>
</tr>
<tr>
<td>Indirect Expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td>3.36</td>
<td>3.39</td>
<td>3.48</td>
<td>4.30</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1.63</td>
<td>3.67</td>
<td>2.92</td>
<td>2.25</td>
</tr>
<tr>
<td>Misc. Management expense</td>
<td>2.17</td>
<td>2.19</td>
<td>2.46</td>
<td>3.28</td>
</tr>
<tr>
<td>Total Indirect Expense</td>
<td>7.16</td>
<td>9.25</td>
<td>8.86</td>
<td>9.83</td>
</tr>
<tr>
<td>Total Direct &amp; Indirect Expense</td>
<td>84.12</td>
<td>75.20</td>
<td>65.88</td>
<td>59.44</td>
</tr>
<tr>
<td>Net Profit (before taxes &amp; interest)</td>
<td>17.62</td>
<td>11.09</td>
<td>6.99</td>
<td>1.68</td>
</tr>
</tbody>
</table>
APPENDIX D-4

Proposed P & L Statement After Implementation of Full New Trawl System*  

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Revenues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proceeds from catch1/</td>
<td>1,445,577</td>
<td>4,251,601</td>
<td>1,830,275</td>
<td>2,302,505</td>
<td>9,829,958</td>
</tr>
<tr>
<td>Direct Operating Expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew Shares2/</td>
<td>634,608</td>
<td>1,828,188</td>
<td>752,213</td>
<td>884,162</td>
<td>4,099,201</td>
</tr>
<tr>
<td>Bonuses3/</td>
<td>62,763</td>
<td>186,475</td>
<td>82,371</td>
<td>107,868</td>
<td>439,477</td>
</tr>
<tr>
<td>Payroll taxes4/</td>
<td>38,076</td>
<td>109,691</td>
<td>45,135</td>
<td>53,050</td>
<td>214,522</td>
</tr>
<tr>
<td>Total labor</td>
<td>735,447</td>
<td>2,124,354</td>
<td>879,749</td>
<td>1,045,080</td>
<td>4,784,630</td>
</tr>
<tr>
<td>Trip Expense5/</td>
<td>162,466</td>
<td>501,250</td>
<td>239,229</td>
<td>337,787</td>
<td>1,240,732</td>
</tr>
<tr>
<td>Maintenance &amp; Repair</td>
<td>70,460</td>
<td>228,795</td>
<td>117,670</td>
<td>196,075</td>
<td>613,000</td>
</tr>
<tr>
<td>Total Direct Operating Expenses</td>
<td>968,373</td>
<td>2,854,399</td>
<td>1,236,648</td>
<td>1,578,942</td>
<td>6,638,362</td>
</tr>
<tr>
<td>Indirect Expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td>31,000</td>
<td>108,500</td>
<td>56,500</td>
<td>105,000</td>
<td>301,000</td>
</tr>
<tr>
<td>Depreciation6/</td>
<td>15,000</td>
<td>117,500</td>
<td>47,500</td>
<td>55,000</td>
<td>235,000</td>
</tr>
<tr>
<td>Misc. Maintenance Expense</td>
<td>20,000</td>
<td>70,000</td>
<td>40,000</td>
<td>80,000</td>
<td>210,000</td>
</tr>
<tr>
<td>Total Indirect Expense</td>
<td>66,000</td>
<td>266,000</td>
<td>117,670</td>
<td>240,000</td>
<td>746,000</td>
</tr>
<tr>
<td>Total Direct &amp; Indirect Expense</td>
<td>1,034,373</td>
<td>3,120,399</td>
<td>1,354,648</td>
<td>1,818,942</td>
<td>7,384,362</td>
</tr>
<tr>
<td>Net Profit (before taxes &amp; interest)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>441,204</td>
<td>1,101,202</td>
<td>449,627</td>
<td>1,183,563</td>
<td>2,645,596</td>
</tr>
<tr>
<td>%: Net Profit to Op. Rev.</td>
<td>28.4</td>
<td>25.9</td>
<td>24.6</td>
<td>21.0</td>
<td>24.9</td>
</tr>
<tr>
<td>%: Op. Rev. to Op. Exp.</td>
<td>139.8</td>
<td>135.0</td>
<td>132.6</td>
<td>126.6</td>
<td>133.1</td>
</tr>
</tbody>
</table>

1/ Operating Revenues—Proceeds from Catch: Calculated by adding proceeds from present catch (Appendix D-2), increment to Revenue resulting from processing slurried material (Appendix D-2), increase in catch value resulting from improving weight out (Appendix CII C-1), increases in the value of catch resulting from Quality Improvement—median (Appendix CII B-1), and increment to revenue resulting from implementation of new harvest system and trawl design.
Appendix D-4 (continued)

2/ Crew Shares: Calculated as same percent of proceeds from catch as in present P&L statement - Appendix D-2 (A-43.9%, B-43.0%, C-41.1%, D-38.4%, and total = A + D).

3/ Bonuses: Calculated as same percent of crew shares as in present P&L statement - Appendix D-2 (A-9.89%, B-10.20%, C-10.95%, D-12.20%, and total = A + D).

4/ Payroll Taxes: 6% of crew shares.

5/ The remaining expenses are identical with present P&L statement - Appendix D-2.

6/ Does not allow for depreciation on new trawl system equipment.

* Number of trips assumed to be same as present.
APPENDIX D-5

Share Payments to Crew After Implementation of Full New Trawl System

<table>
<thead>
<tr>
<th></th>
<th>Vessel Class</th>
<th>Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Present System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Total vessel revenue ($)</td>
<td>936,700</td>
<td>2,761,500</td>
</tr>
<tr>
<td>2) Total shared by crew ($)</td>
<td>410,907</td>
<td>1,188,099</td>
</tr>
<tr>
<td>3) Number of shares</td>
<td>34</td>
<td>119</td>
</tr>
<tr>
<td>4) Amount/Share ($)</td>
<td>12,086</td>
<td>9,984</td>
</tr>
<tr>
<td>New Trawl Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Total vessel revenue ($)</td>
<td>1,445,577</td>
<td>4,251,610</td>
</tr>
<tr>
<td>2) Total shared by crew ($)</td>
<td>634,608</td>
<td>1,828,188</td>
</tr>
<tr>
<td>3) Number of shares</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) no change from present</td>
<td>34</td>
<td>119</td>
</tr>
<tr>
<td>b) utilizing potential labor saving from new system (IIA(5b))</td>
<td>26</td>
<td>91</td>
</tr>
<tr>
<td>4) Amount/Share ($)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) present crew</td>
<td>18,665</td>
<td>15,363</td>
</tr>
<tr>
<td>b) minimal crew</td>
<td>24,408</td>
<td>20,090</td>
</tr>
<tr>
<td>5) Percent increase over present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) present crew</td>
<td>54.4</td>
<td>53.9</td>
</tr>
<tr>
<td>b) minimal crew</td>
<td>102.0</td>
<td>101.2</td>
</tr>
</tbody>
</table>

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


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


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


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


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 have 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.