

## A Statistical and Budgetary Economic Analysis of Florida-Based Gulf of Mexico Red Snapper-Grouper Vessels by Size and Location, 1974-75

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### INTRODUCTION

Economic and biological data on the Gulf of Mexico red snapper-grouper fishery have been limited until the last 2 years. This lack of data became apparent when the industry raised questions about declining catches per unit of fishing effort and lower economic returns. In response, a joint effort by fishery management personnel, regulatory agencies, and educational institutions was made during a colloquium to bring together available information on these fisheries (Bullis and Jones, 1976).

Economic data on prices, marketing, and production in the Gulf of Mexico red snapper-grouper industry are presented by Cato and Prochaska (1976). Further analysis on the costs and returns for Florida-based northern Gulf of Mexico commercial and recreational red snapper-grouper vessels is contained in two bulletins by Prochaska and Cato (1975a, b).

This paper combines the analysis of production data for the northern gulf commercial vessels with additional production data collected from the Florida west coast or southeastern gulf red snapper-grouper production area to provide a comparative report on the

costs and returns for vessels operating in these two areas. Several uses exist for this type of analysis. These data provide a comparative basis from which individual vessel owners and captains can determine any needed changes in their business management or fishing practices. Prospective firms considering entering the fishery will have an estimate of the necessary production inputs, catch levels, and revenues necessary to be a viable production unit. Financial institutions will be better able to evaluate loan applications for vessels in the red snapper-grouper fishery by knowing their profit potential. Finally, an indication of the sales and purchases made by these fishing firms suggests their contribution to the economy.

This paper is based on personal interviews with boat owners and captains representing 20 commercial vessels. Although the boats and vessels were not selected using a statistically drawn sample, the data should provide an accurate representation of the average vessel. Careful evaluation of landings records and discussions with industry leaders led to the two main areas in which data on vessels were collected. Vessels within each area were suggested by commercial fishermen, fishhouse owners, and Sea Grant Advisory agents as those being most representative of commercial fishing areas in each area and size strata. Since these vessels fish offshore for long periods of time, the cost of collecting data from randomly drawn vessels when in port

Vessels such as these are used for snapper and grouper in the southeastern Gulf of Mexico.



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**Table 1.—Production characteristics of Gulf of Mexico commercial red snapper-grouper fishing vessels by vessel size and production areas, annual averages for 1974 and 1975<sup>1</sup>.**

Vessel size and location	Crewmen including captain		Trips per year		Days fished per year		Fishing effort			
	Average	Range	Average	Range	Average	Range	Pounds caught per day <sup>2</sup>			Total
							Red snapper	Grouper	Other	
38 feet to 47 feet (small) Panama City to Pensacola <sup>3</sup>	2.3	2-3	19.0	11-24	199	168-220	164	142	20	326
Tarpon Springs to Madeira Beach <sup>4</sup>	2.1	1-3	20.5	14-24	203	126-240	65	213	31	309
56 feet to 69 feet (large) Panama City to Pensacola <sup>5</sup>	4.7	4-6	11.3	9-12	193	180-220	482	23	168	673
Tarpon Springs to Madeira Beach <sup>6</sup>	3.0	3	16.3	11-22	185	150-220	84	279	32	395

<sup>1</sup>Data from Panama City to Pensacola are from 1974. Data from Tarpon Springs to Madeira Beach are for 1975.

<sup>2</sup>Average catch per year from Table 4 divided by average days fished per year.

<sup>3</sup>An average of four vessels of wood construction ranging from 42 to 47 feet.

<sup>4</sup>An average of three wood, two fiberglass, and one steel vessel ranging from 38 to 45 feet.

<sup>5</sup>An average of four wood and two steel vessels ranging from 57 to 69 feet.

<sup>6</sup>An average of three wood and one fiberglass vessel ranging from 56 to 58 feet.

would be large. Also, the vessels used had accurate cost and return data. Some randomly selected vessels most likely would not have had records as accurate as those selected. The firm's home ports are in a seven-county area ranging from Panama City to Pensacola in northwest Florida, and Madeira Beach to Tarpon Springs<sup>1</sup>, both located in Pinellas County, Fla. (Fig. 1). Florida landings of red snapper in 1974 were 5,168,918 pounds (63 percent of the U.S. total) and landings of grouper and scamps were 6,700,227 pounds (89 percent of the Florida total). Fishing operations for the vessels range as far west as Texas in the western Gulf of Mexico, the Campeche Shelf in the southern Gulf of Mexico, and the West Florida Shelf. The budget analysis reported for each area represents an average vessel in each of two vessel size groups. The small vessels are from 38 to 47 feet in length, large vessels are from 56 to 69 feet in length (Table 1). Size class was determined based on the ability of vessels to fish different areas. Large northern vessels normally range farther and have more extended trips than those in the smaller class. Large southeastern vessels more often fish the Campeche Shelf than do the small ves-

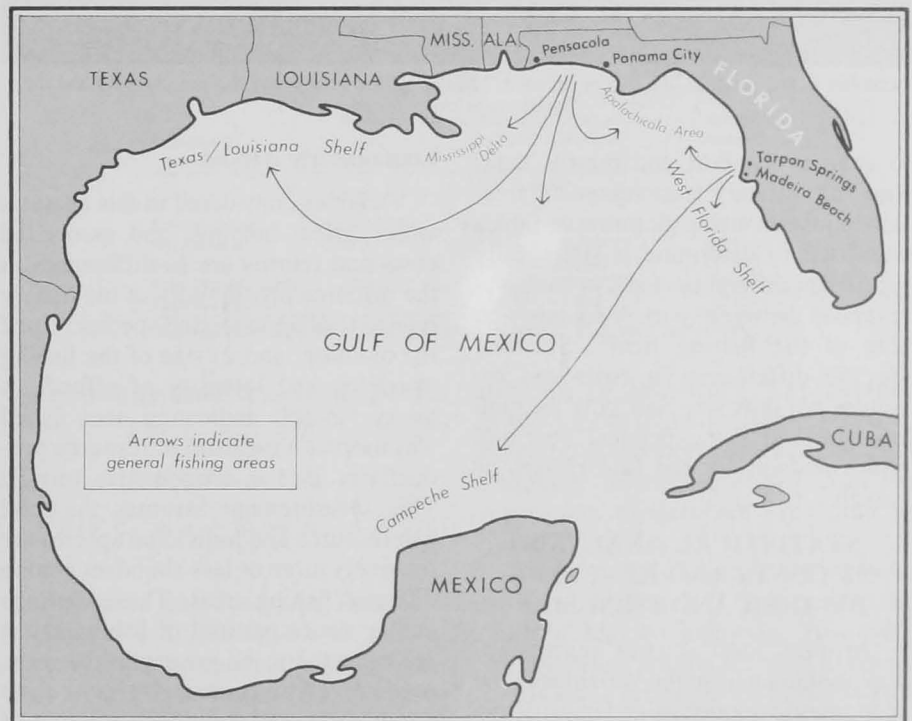


Figure 1.—Port areas and general fishing areas for vessels included in red snapper-grouper cost and returns analysis.

sels which tend to concentrate fishing effort on the West Florida Shelf.

Small vessels carried an average of 2.1 (southeastern gulf) and 2.3 (northern gulf) crewmen (including captain) per trip while the two large classes carried 3.0 and 4.7 crewmen. Average number of trips per year (and days fished per year) was similar for both small vessel classes at 19.0 (199 days) and 20.5 (203 days). Large northern

vessels averaged only 11.3 trips per year (193 days) while the large southeastern vessels averaged 16.3 trips (185 days). Pounds of fish caught per day of fishing effort averaged 673 for the large northern vessels and 395 for the large southeastern vessels. Pounds caught per day for the small northern and southeastern vessels were 326 and 309, respectively.

Two methods of analysis were used

<sup>1</sup>Data for Panama City to Pensacola were for 1974. Vessels from this area will be referred to in the text as the northern gulf vessels. Data for Tarpon Springs to Madeira Beach were for 1975. Vessels from this area will be referred to in the text as southeastern gulf vessels.



Catches of red snapper like this occur on a "down" of the gear when fish are plentiful and the fisherman is experienced.

to analyze the cost and returns data. First, an ordinary least squares regression equation using dummy variables was used to determine if statistically significant differences exist in costs and revenues between port locations and size of the fishing firm<sup>2</sup>. Second, specific differences in costs and revenues by firm size and port location are analyzed using detailed cost and return budgets for the four classes of vessels.

### STATISTICAL ANALYSIS OF COSTS AND REVENUES BY AREA AND FIRM SIZE

Ordinary least squares regression<sup>3</sup> was used to analyze the variables in the econometric model in order to determine the effect of their variation on revenues and costs in the fishery. The theoretical economic and statistical considerations and interpretations of the model are presented in the first section. Empirical estimates and their implications are then discussed.

<sup>2</sup>This comparative analysis assumes that the captains and crewmen of each vessel class have equal fish finding and catching skills. This assumption is necessary due to the inability to measure and document actual differences in fishing "skill" as it might affect operating cost and returns.

<sup>3</sup>This analysis will yield the same results as an analysis of variance with unequal replications.

### Econometric Model

Variables considered in this analysis which affect landings and associated costs and returns are 1) differences in the resource productivity of the fishery related to abundance and species mix of the biomass, and 2) size of the fishing operation and intensity of effort<sup>4</sup>. A proxy variable indicating area fished was used as a measure of resource productivity in the econometric model. This measurement assumes the total fish resource and individual species are relatively more or less abundant among different fishing areas. Thus, landings and revenues per unit of fishing effort are expected to be greater in the more productive fishing area with lower costs per unit of catch since costs per unit of effort should be the same among areas<sup>5</sup>. Consequently, net revenues are theoretically expected to be higher in the more productive fishery.

Size of the fishing vessel has both economic advantages and disadvantages. Increased size allows such advantages as longer trips, more crewmen

<sup>4</sup>These are in addition to other factors such as units of effort which will be addressed later in this paper.

<sup>5</sup>Note that cost per unit of fishing effort and cost per unit of actual catch are two different measures.

and thus more effort per fishing day, and more carrying capacity. At the same time, larger vessels normally incur greater costs due to more extensive fuel demand, the need for more maintenance, and higher crew support costs. The economic question addressed in this study is whether additional revenues associated with size exceed additional costs.

The effect of either of the variables independent of the other could be determined by comparing vessels of the same size between areas or comparing vessels of two or more size classes within one area. Multiple regression techniques allow these independent comparisons with the advantage of using all observations simultaneously rather than using only vessel size and fishing area subsamples. Multiple regression also has the advantage of increased degrees of freedom and the parameter estimates are efficient<sup>6</sup>. In this paper the regression models estimated were of the following form:

$$Y_j = \alpha + \beta_1 A_j + \beta_2 S_j + \beta_3 (AS)_j \quad (1)$$

where:  $Y_j$  = the dependent revenue or cost variable for the  $j$ th vessel

$A_j$  = variable for the area fished by the  $j$ th vessel

$S_j$  = variable for vessel size for the  $j$ th vessel

$(AS)_j$  = interaction term denoting a different response for vessel size depending on area fished

$\alpha$ ,  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  = parameters to be estimated.

The theoretical statement of the effect on  $Y$  of fishing alternative fishing areas adjusted for or independent of differences in vessel size is given by Equation (2):

$$\frac{\partial Y}{\partial A} = \beta_1 + \beta_3 S. \quad (2)$$

The parameter  $\beta_1$  represents the "basic" effect of area on  $Y$  and  $\beta_3$  the additional effect resulting from vessel size. The partial effect on  $Y$  of vessel size adjusted for area is given by

$$\frac{\partial Y}{\partial S} = \beta_2 + \beta_3 A. \quad (3)$$

<sup>6</sup>Unbiased and possess minimum variance.

Again,  $\beta_2$  is the "basic" effect and  $\beta_3$  the additional effect due to area. In this formulation the area effect on  $Y$  is dependent on the size of the fishing vessel [Equation (2)] while the effect of size on  $Y$  is dependent on the area fished [Equation (3)].

### Data Specification

For purposes of this study, specific variables for the five models [estimated with Equation (1)] are defined by Equation (4):

$$Y_{ij} = a + B_1 A_j = B_2 S_j + B_3 (AS)_j \quad (4)$$

$i = 1, 2, \dots, 5$   
 $j = 1, 2, \dots, 20$

where:  $Y_{ij}$  = total revenue ( $i=1$ ), total cost ( $i=2$ ), net revenue ( $i=3$ ), variable cost ( $i=4$ ), and fixed costs ( $i=5$ ) for the  $j$ th vessel

$A_j$  = dummy variable for fishing area of the  $j$ th vessel where  $A = 1$  if northern gulf and  $A = 0$  if southeastern gulf

$S_j$  = dummy variable for size of the  $j$ th vessel where  $S = 1$  if large vessel and  $S = 0$  if small vessel

$(AS)_j$  = interaction term denoting a different response for larger vessels in the northern gulf compared with the southeastern gulf

$a, B_1, B_2,$  and  $B_3$  = parameters to be estimated.

The expected value of  $Y_i$  for small vessels ( $s$ ) fishing in the southeastern gulf ( $e$ ) is

$$E(Y_i)_{se} = a. \quad (5)$$

The constant term  $a$  in Equation (5) represents the mean level of  $Y_i$  for the southeastern gulf small vessel operations. This expected value occurs because all other terms drop from the model when  $A$  and  $S$  take on the value of zero.

Expected values for  $Y_i$  for the other size and fishing area classifications are given by Equations (6), (7), and (8). The term  $B_1$  in Equation (6) represents the additive effect of a small vessel fishing in the northern gulf ( $n$ ) com-

**Table 2.—Regression analysis for revenue and costs by area and vessel size for the Gulf of Mexico red snapper-grouper industry.**

Dependent variable ( $Y_i$ )	Independent variables <sup>1</sup>				$R^2$	$F$ statistic
	Constant	Area (A)	Size (S)	Inter-action (AS)		
Total revenue	30,380 (6,490)	10,972 (10,270)	5,162 (10,270)	50,510 (14,520)	0.80	21.68
Net revenue	10,280 (3,850)	5,241 (6,095)	-2,439 (6,095)	31,353 (8,619)	0.77	17.94
Total cost	20,100 (4,460)	5,730 (7,055)	7,601 (7,055)	19,157 (9,978)	0.65	10.08
Total variable cost	17,210 (3,830)	4,619 (6,049)	4,955 (6,049)	21,908 (8,555)	0.72	13.47
Total fixed cost	2,890 (1,080)	1,111 (1,714)	2,646 (1,714)	-2,750 (2,424)	0.13	0.80

<sup>1</sup>Numbers in parentheses are standard errors. All coefficients and constant term estimates are in dollars. Independent variables are: A = fishing area: 1 = northern gulf, 0 = southeastern gulf, S = vessel size: 1 = large, 0 = small; AS = interaction term.

For some variables the standard errors are larger than the estimated coefficient. However, this was not the case with the interaction term. Inclusion of the interaction term allows the analysis of the question of whether large boats are better in all areas rather than in just one specific area. This term also allows analysis of the significance of a combination of coefficients (see Equation 8 and Table 3). Models were estimated without the interaction term. The independent variables in these models did have lower standard errors in relation to the estimated coefficients. The economic and statistical questions addressed in the paper were more logically addressed by using the models which were specified to include the interaction term.

**Table 3.—Estimated effects of fishing area and vessel size on revenues and costs for the Gulf of Mexico red snapper-grouper industry<sup>1</sup>.**

Dependent variable	Estimated increases due to fishing larger vessels		Estimated increases due to fishing the northern gulf	
	Northern gulf ( $B_2 + B_3$ )	Southeastern gulf ( $B_2$ )	Large vessels ( $B_1 + B_3$ )	Small vessels ( $B_1$ )
----- Dollars -----				
Total revenue	55,672***	5,162	61,842***	10,972*
Net revenue	28,914***	-2,439	36,594***	5,241
Total cost	26,758***	7,601*	24,887***	5,730
Total variable costs	26,863***	4,955	26,527***	4,619
Total fixed costs	-104	2,646**	-1,639	1,111

<sup>1</sup>Confidence levels for 99, 80, and 70 percent indicated by \*\*\*, \*\*, and \*, respectively.

pared with the same vessel fishing in the

$$E(Y_i)_{sn} = a + B_1 \quad (6)$$

$$E(Y_i)_{Le} = a + B_2 \quad (7)$$

$$E(Y_i)_{Ln} = a + B_1 + B_2 + B_3 \quad (8)$$

southeastern gulf [compare Equations (5) and (6)]. Likewise, the term  $B$  in Equation (7) represents the additive effect of a larger vessel ( $L$ ) compared with a smaller vessel, both fishing in the southeastern gulf [compare Equations (5) and (7)]. Equation (8) represents the expected value for large vessels fishing in the northern gulf. In this case the term  $B_3$  represents the interaction effect of size and area.

### Empirical Analysis

Estimated regression coefficients and the explanatory power for each of the five equations estimated are presented in Table 2. With the exception of the equation for total fixed cost, all estimated equations were highly sig-

nificant ( $F$  statistic). Explanatory power for the four significant equations ranged from 65 to 80 percent of the total variation. Inferences drawn from the regression models are presented in Table 3.

Large vessels gross more revenue than smaller vessels in both areas of the Gulf of Mexico analyzed. However, the additional returns accruing to vessel size is much greater in the northern gulf than in the southeastern gulf. The estimated increase in total revenue due to larger size is \$55,672 and is highly significant statistically in the northern gulf compared with an estimated \$5,162 increase in the southeastern gulf which is not significantly different from zero statistically.

Total costs are also positively related to vessel size. Again, the effect is greater for larger vessels in the northern gulf. However, the increase in cost is less than proportional to increases in revenue for larger vessels in the northern gulf thus resulting in a significant



positive net revenue effect. The additional net returns from increased vessel size was \$28,914 annually in the northern gulf while increased size of vessel in the southeastern gulf does not produce an effect significantly different from zero compared with smaller vessels in the same area (Table 3). Added variable costs of increased size in the northern gulf is the primary reason for the additional total cost. The negative effect on total fixed costs in the northern gulf area is not significantly different from zero statistically.

Fishing in the northern gulf increases revenues and costs for both vessel size

**Table 4.—Expected or predicted values of cost and revenues by vessel size and fishing area.**

Dependent variable	Predicted or expected values	
	Northern gulf large vessels [Equation (8)]	Southeastern gulf small vessels [Equation (5)] <sup>1</sup>
	-----Dollars-----	
Total revenue	97,024	30,380
Net revenue	44,435	10,280
Total cost	52,588	20,100
Total variable costs	48,692	17,210
Total fixed costs	3,897	2,890

<sup>1</sup>These estimates are also applicable to large vessels in the southeastern gulf and small vessels in the northern gulf since no statistical significance exists between the expected values for these three groups of vessels.

classes compared with fishing in the southeastern gulf. However, only larger vessels produce significantly more net revenue in the northern gulf with an estimated additional net revenue of \$36,594 for large vessels.

A summary of the expected effects of area and size in terms of predicted or expected values for the average vessels is presented in Table 4. Predicted values for small vessels in the southeastern gulf using Equation (5) are equal to the constant term (mean values for these vessels). These expected values for small vessels in the southeastern gulf (Table 4) also represent the predicted values for large vessels in the southeastern gulf and small vessels in the northern gulf because the added effects expressed in Equations (6) and (7) are not statistically significantly different from zero (Table 3). Expected total revenue is greatest for large vessels in the northern gulf. Net revenues are also greater for these vessels in the northern gulf. Thus in summary, larger profits occur for larger vessels in the northern gulf but not for larger vessels in the southeastern gulf. No significant differences are found between small ves-

sels fishing in the northern gulf compared with small vessels fishing the southeastern gulf.

## COMPARATIVE BUDGET ANALYSIS OF COST AND RETURNS BY AREA AND FIRM SIZE

### Landings and Revenues

Red snapper was the predominate species landed by northern gulf vessels (Table 5). Grouper production almost equaled red snapper production for the small northern gulf vessels but makes up an insignificant portion of the larger vessels' catch. Large vessels travel longer distances from their home ports to fishing grounds where red snapper are most abundant. The large volume of "other" species landed by the large vessels represents sizeable landings of croakers.

Grouper production represents the predominate catch for both the small and large southeastern gulf vessels in contrast to the northern vessels. Red snapper represents about one-fifth of the total catch while the catch of "other" fish was small. Total annual production of all fish was almost equal

**Table 5.—Annual cost and returns for Gulf of Mexico commercial red snapper-grouper vessels by length class and production area, 1974 and 1975<sup>1</sup>.**

Item	38 feet to 47 feet (small)						56 feet to 69 feet (large)					
	Northern gulf			Southeastern gulf			Northern gulf			Southeastern gulf		
	Pounds	Dollars	Percent	Pounds	Dollars	Percent	Pounds	Dollars	Percent	Pounds	Dollars	Percent
<b>Returns</b>												
Red snapper	32,654	26,647	64.4	13,195	11,243	37.0	92,995	83,696	86.3	15,599	13,057	36.7
Grouper	28,325	12,899	31.2	43,334	17,281	56.9	4,409	1,985	2.0	51,518	20,203	56.9
Other	3,991	1,811	4.4	6,196	1,860	6.1	32,424	11,349	11.7	5,888	2,288	6.4
<b>Total</b>	<b>64,970</b>	<b>41,357</b>	<b>100.0</b>	<b>62,725</b>	<b>30,384</b>	<b>100.0</b>	<b>129,828</b>	<b>97,030</b>	<b>100.0</b>	<b>73,005</b>	<b>35,548</b>	<b>100.0</b>
<b>Variable costs</b>												
Fuel and oil		2,207	8.5		1,759	8.7		4,053	7.7		2,248	8.1
Groceries		2,721	10.5		2,166	10.7		5,211	9.9		2,364	8.5
Bait		1,978	7.6		1,804	9.0		5,955	11.3		1,907	6.9
Ice		1,171	4.5		836	4.2		2,317	4.4		1,072	3.9
Repairs and maintenance		4,565	17.5		6,349	31.6		10,278	19.6		6,511	23.5
Crews shares <sup>2</sup>		9,443	36.3		4,299	21.4		20,865	39.7		8,068	29.1
<b>Total</b>		<b>22,085</b>	<b>84.9</b>		<b>17,213</b>	<b>85.6</b>		<b>48,679</b>	<b>92.6</b>		<b>22,170</b>	<b>80.0</b>
<b>Fixed costs</b>												
Depreciation		2,770	10.6		1,875	9.3		3,842	7.3		2,500	9.0
License		52	0.2		52	0.3		55	0.1		52	0.2
Interest		793	3.1		200	1.0		0	0.0		1,620	5.8
Insurance		326	1.3		533	2.7		0	0.0		1,200	4.3
Docking fee		0	0.0		230	1.1		0	0.0		165	0.7
<b>Total</b>		<b>3,941</b>	<b>15.2</b>		<b>2,890</b>	<b>14.4</b>		<b>3,897</b>	<b>7.4</b>		<b>5,537</b>	<b>20.0</b>
<b>Total cost</b>		<b>26,026</b>	<b>100.0</b>		<b>20,103</b>	<b>100.0</b>		<b>52,576</b>	<b>100.0</b>		<b>27,707</b>	<b>100.0</b>
<b>Total net return to captain and owner<sup>3</sup></b>		<b>15,331</b>			<b>10,281</b>			<b>44,454</b>			<b>7,841</b>	

<sup>1</sup>Data from the northern gulf (Panama City to Pensacola, Fla.) are from 1974. Data from the southeastern gulf (Tarpon Springs to Madeira Beach, Fla.) are for 1975. Some percentage totals may not add due to rounding of individual items.

<sup>2</sup>Crew shares are reported net of crew share of expenses.

<sup>3</sup>Total net returns to captain and owner represent captains' salaries, and return to owners' labor, management, and investment.

for the northern and southeastern gulf small vessels at 64,970 and 62,725 pounds, respectively. However, total production for the large northern vessels was 78 percent greater than the large southeastern vessels at 129,828 and 73,005 pounds, respectively.

A comparison of revenues earned per vessel shows the significance of red snapper in the total value of landings (Table 5 and Fig. 2). Red snapper represented 64 percent (\$26,647) and 37 percent (\$11,243) of total value of landings for the northern and southeastern vessels, respectively. For the larger vessels, northern vessels averaged 86 percent (\$83,696) of the value in red snapper while the southeastern larger vessels maintained the same 37 percent (\$13,057) as the small vessels in the southeastern gulf. In addition to the greater tonnage of red snapper landed by the northern gulf vessels, the higher price of red snapper (about double that of grouper) is also responsible for their significant share of total value of landings.

All species are valued in this paper at dockside prices paid to the captain or owner by the initial buyer (fish house). Several vessels were owned by companies rather than individual owners and valued their catch at slightly more than one-half of the common dockside value due to internal record keeping procedures and slightly different crew share arrangements. Dockside prices used in these cases were adjusted to be consistent with prices paid to the independent vessels. Dockside value represents the value the company could receive for their catch if it was sold to other fish houses at the same market level.

Food commodities often experience price fluctuation at the producer levels due to weather, seasonality, and other factors affecting their demand and supply. These kinds of fluctuations have not occurred in the dockside price paid for red snapper in Florida. Monthly and annual average prices have increased steadily during past years. For the years 1972 through 1975, monthly average prices varied less than 4 percent from the annual average. Annual average prices increased from 70.1 cents per



Grouper taken in the Gulf of Mexico are unloaded from the ice box for movement into the processing plant.

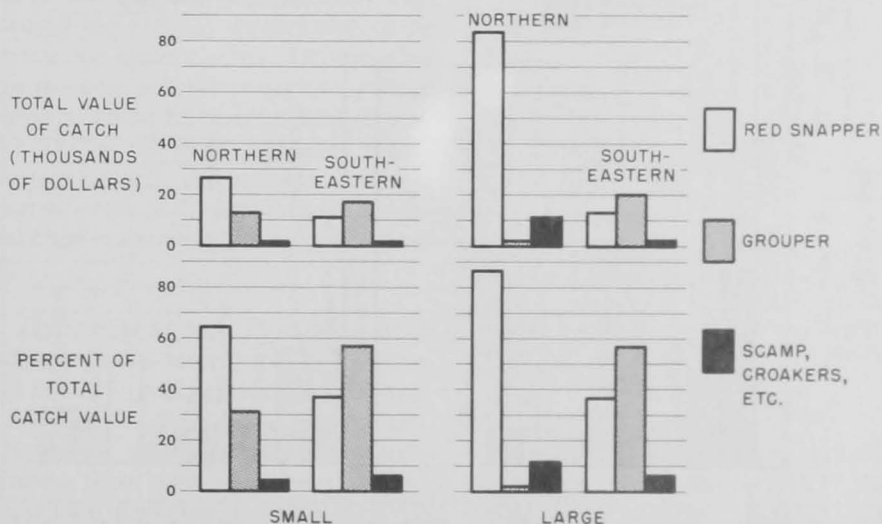


Figure 2.—Comparison of catch composition by value and percent of total catch value for small (38-47 feet) and large (56-69 feet) red snapper-grouper vessels operating in the northern and southeastern areas of the Gulf of Mexico, 1974 and 1975.

pound in 1972 to 85.3 cents per pound in 1975. This stable and increasing price pattern has not caused large annual variations in costs and returns as is often seen in the production of some fish and food commodities.

#### Cost of Production

Total costs of production can be divided into two components—variable and fixed. Variable costs represent

those that are incurred while engaged in the actual process of producing or catching a fish and vary with the amount of fishing effort. Variable costs will rise as the amount of fishing effort increases. That is, the more fishing days spent away from the dock each year, the higher will be the variable costs. Fixed costs represent those costs that are incurred regardless of whether or not the vessel is away from dock.

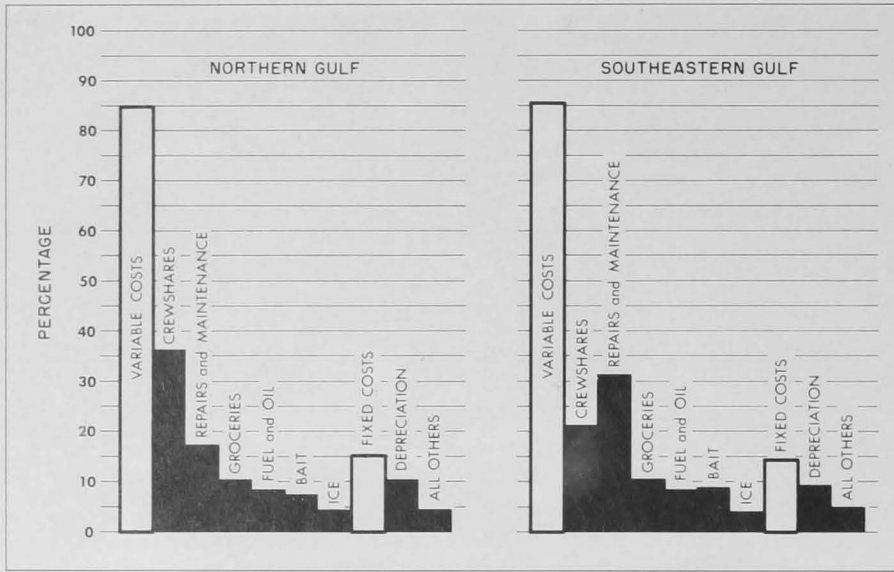


Figure 3.—Comparison of variable and fixed costs by type for small (38-47 feet) red snapper-grouper vessels operating in the northern and southeastern Gulf of Mexico, 1974 and 1975.



Figure 4.—Comparison of variable and fixed costs by type for large (56-69 feet) red snapper-grouper vessels operating in the northern and southeastern Gulf of Mexico, 1974 and 1975.

Total fixed costs will remain the same regardless of the level of fishing effort. The summation of variable and fixed costs represents total production cost. Variable, fixed, and total costs for both sizes of vessels in each area are given in Table 5 and shown in Figures 3 and 4.

#### Variable Costs

Variable costs represent the largest proportion of total costs for all four groups of vessels. These range from 80

percent of total costs for the large southeastern vessels to 92.6 percent of total costs for the large northern vessels. Variable costs represented about 85 percent of total costs for both groups of small vessels. The small southeastern and northern vessels incurred variable costs of \$22,085 and \$17,213, respectively. The large northern vessels variable costs (\$48,679) were more than double that of the other three groups.

*Crew shares.* Crew wages or shares<sup>7</sup> represent the largest variable cost for all vessel classes except the small southeastern vessels. Crew shares ranged from as high as 39.7 percent (\$20,865) of total costs for the large northern vessels to a low of 21.4 percent (\$4,299) of total costs for the small southeastern vessels. Average share per crewman is the total net share to all crewmen on each vessel divided by the average number of crewmen aboard. The small vessels average 1.3 and 1.1 crewmen (excluding captain) per trip with average shares for each crewman equal to \$7,263 and \$3,908 in the northern and southeastern vessels, respectively. Average individual crew shares for the large vessels were \$5,639 (3.7 crewmen per trip) and \$4,034 (2 crewmen per trip) for the northern and southeastern gulf vessels, respectively<sup>8</sup>. Crew share variation occurs more between areas than between vessel size. Since crewmen are paid a share of the gross stock, northern vessel crewmen receive higher shares because their catches have a higher percentage of more valuable red snapper. Total catch was also much higher for the large northern vessels.

*Repairs and Maintenance.* Repairs and maintenance are the second largest variable expense item (17.5 to 23.5 percent of total) for three vessel classes and the largest expense item (31.6 percent of total) for the small southeastern vessels. Repairs and maintenance costs include hull, engine, tackle, and equipment maintenance. Repairs and

<sup>7</sup>Crewmen are generally paid on a share basis which varies among vessels. Often, such expenses as ice, bait, groceries, and fuel are deducted from the gross stock. Then the boat, the captain, and individual crewmen share the remaining stock on a prearranged percentage basis. Sometimes crewmen are paid a bonus for performing cooking or icing duties while at sea. The captain may also receive a bonus depending on the species composition of the catch. Crewmen received payment on a piece rate basis on 3 of the 20 vessels in the sample. In these cases their share of the gross stock is determined to be their individual catch multiplied by a specific price per pound which ranged from 25 to 50 percent of market price. In most cases these crewmen also shared in a small part of total expenses.

<sup>8</sup>Crewmen often vary on a trip basis. Crew wages may not be representative of a crewman's total annual income.



maintenance costs were about the same (\$6,349 as compared with \$6,511) for both the large and small southeastern vessels but much lower total costs of operation for the small vessels made the percentage much higher. Repair and maintenance costs for the small northern vessels were \$4,565 and \$10,278 for the large northern vessels<sup>9</sup>.

*Other Variable Costs.* Fuel and oil, groceries, and bait were almost of equal importance in terms of cost. For all four vessel classes each of these three individual cost categories range from a low of 6.9 percent of total cost to a high of 11.3 percent. Normally, groceries are the highest of the three while bait is the lowest. The exceptions were bait for the small southeastern vessels and the large northern vessels. Ice represented 3.9 to 4.5 percent of total cost.

#### Fixed Costs

Fixed costs as a percent of total cost varied significantly among the four vessel classes ranging from a low of 7.4 percent (\$3,897) for the large northern vessel to 20.0 percent (\$5,537) for the large southeastern vessels. The percentage was about the same (15.1 compared with 14.4) for the small vessels.

*Depreciation.* Hull, engine, and equipment depreciation was higher for large northern vessels in total dollars (\$3,842) than other vessels, although as a percentage of total cost it was the lowest cost item. Two vessels in this class were constructed of steel with longer life expectancies and higher salvage values. However, part of the greater life expectancy and greater salvage values can be attributed to the difference in expenditures for maintenance discussed earlier. All but one vessel in each of the small northern vessels class and large southeastern vessels class were constructed of wood. Average annual depreciation costs were about equal. Vessels were depreciated over a 10-year period. The lowest depreciation was experienced for the small southeastern vessels at \$1,875. One vessel in each of the southeastern

**Table 6.—Annual net returns to captains and owners for Gulf of Mexico commercial red snapper-grouper fishing vessels by vessel size and production areas, 1974 and 1975.<sup>1</sup>**

Item	38 feet to 47 feet (small)		56 feet to 69 feet (large)	
	Northern gulf	Southeastern gulf	Northern gulf	Southeastern gulf
	Dollars			
Total investment	26,526	34,167	67,267	56,250
Total revenue	41,357	30,384	97,030	33,548
Total cost	26,026	20,103	52,576	27,707
Net returns to captain and owner	15,331	10,281	44,454	7,841
Net to captain <sup>2</sup>	6,286	6,168	18,226	5,392
Net to investment <sup>3</sup>	2,122	2,733	5,381	4,500
Net to owners labor and management <sup>4</sup>	6,923	1,380	20,847	-2,051

<sup>1</sup>Based on Table 5.

<sup>2</sup>The captain's share was determined by different methods for several boats. The net captain's share for each vessel for the southeastern area was determined as if the captain was not the vessel owner. The average net captain's share was then determined. The captain's share for the northern gulf area was based on an average of seven vessels where the captain and owner were not the same person and was estimated to be 41 percent of the total net returns.

<sup>3</sup>Net to investment is an imputed return to capital investment at an assumed market rate of 8 percent.

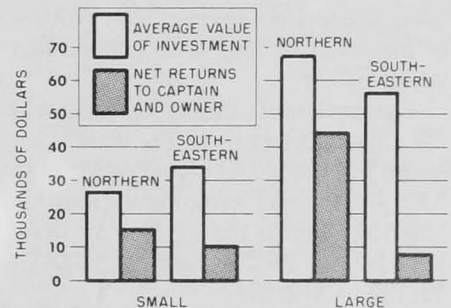
<sup>4</sup>Net returns to owner's labor and management reflect payment for the owner's labor and management. Specific functions include rigging and supervising the maintenance of vessels, procurement of labor and supplies, marketing and office duties such as accounting and personnel management.

vessel classes was older than its taxable depreciation life and no depreciation value was assigned these vessels. This caused the average depreciation to be lower for these classes. Depreciation for those vessel classes excluding these vessels would have been \$2,250 and \$3,300 for the small and large southeastern vessels, respectively. Average current value of investment in each vessel class is shown in Table 6 and Figure 5.

*Other Fixed Costs.* Remaining fixed cost categories were payments for vessel licenses (boat registration), interest on loans, insurance, and docking fees. Owners of the large northern vessels carried their own risk and provided their own financing and thus incurred no expenses for these items. Vessels in the northern gulf paid no docking fees. In those cases where insurance was carried the normal range was 3 to 4 percent of the insured hull value. Since all vessels were not insured in each of the classes, the average insurance cost per vessel shown here is low. The same comment would hold true for interest since some vessels had no mortgages and thus no interest was paid.

#### Total Costs

Total costs were the lowest for the small southeastern vessels, \$20,103. In increasing order total costs for the re-



**Figure 5.—Average level of investment in vessels and gear and net returns to captain and owner for small (38-47 feet) and large (56-69 feet) red snapper-grouper vessels operating in the northern and southeastern Gulf of Mexico, 1974 and 1975.**

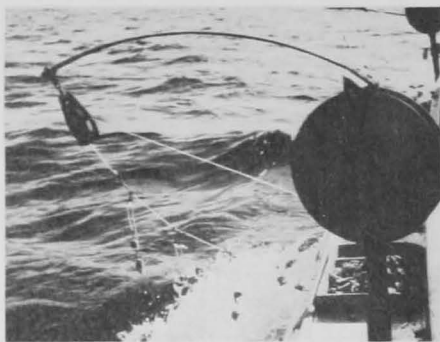
maining three classes were \$26,026 (small northern vessels), \$27,707 (large southeastern vessels), and \$52,576 (large northern vessels). The increased value of the catch for the northern vessels more than offsets the higher costs and makes this vessel class the most profitable from the point of net returns.

#### Net Returns

Total net returns to the captain and owner of the large northern vessels was \$44,454 per year (Table 6 and Fig. 5). This level of returns was almost three times greater than that of any of the other three classes. Net returns for individual vessels in this class ranged from \$37,077 to \$68,794. Average net return

<sup>9</sup>Hull construction data for each vessel class are given in Table 1.





This type of reel is used for snapper and grouper fishing in the Gulf of Mexico. Reels are powered by either a large crank manually operated (sometimes called a one-armed-bandit) or a small electric motor. As many as 12 hooks are sometimes used on the terminal end of each gear.

to the captain was \$18,226 with one captain earning as high as \$28,205. Vessels in this group were owned by individuals other than the captain. The average captain's share was 41 percent of the total net returns to captain and vessel owner.

The next most profitable class was the small northern vessels with a net return to captain and owner of \$15,331 with one vessel ranging as high as \$29,524. Net to the captain on these vessels was \$6,286 with a range of \$3,307 to \$12,104.

Southeastern vessels had net returns to the captain and owner of \$10,281 and \$7,841 for the small and large vessels, respectively. Net returns for the small vessels ranged from \$528 to \$16,999. One large vessel in the southeast showed a small loss and the most profitable had a net return of \$14,340. Average net returns to captains of small vessels was \$6,168 (with a high of \$11,040) while captains of large vessels earned an average of \$5,392 (with a high of \$6,011).

Net return to investment reflects the amount the owners could earn on the capital they have invested in the firm by investing in outside activities such as the financial market. Capital investments per vessel ranged from \$26,526 for the small northern vessels to \$67,267 for the large northern vessels. Investment levels for the small and large southeastern vessels were \$34,167 and \$56,250, respectively. Net return to investment was calculated at 8 percent.

The residual of net return to captain and owner after allowing for the captain's share and return to investment is the return to the owner's labor and management. Specific owner activities include boat maintenance, marketing, personnel, and business management. The net return to owners labor and management for the four classes ranged from a loss of \$2,051 for the large southeastern vessels to a gain of \$20,847 for the large northern vessels.

## INDUSTRY IMPLICATIONS

Captains and owners of fishing vessels are more aware of the profit potential of their individual fishing firms than anyone. Each has the option of purchasing the size of vessel that he chooses and of making the determination of where that vessel fishes. Perhaps foremost in this decision (not ignoring safety and physical production characteristics of the vessel) should be the ability of the vessel to produce an acceptable economic return to the captain and owner. This paper has attempted to demonstrate the importance of the size and production area characteristics of the northern and southeastern Gulf of Mexico red snapper and grouper fishery. Any captain or owner contemplating a change in vessel size or changes in production area should be aware of the importance of each in this fishery.

Just because one vessel is larger than another doesn't mean that vessel will provide a larger net return to the owner. This was illustrated in this paper where larger southeastern Gulf of Mexico vessels had no significantly larger net returns than smaller vessels docked in the same area. This occurred because their costs were relatively lower than the larger vessels although the larger vessels had higher total revenues.

The importance of the production or fishing area also was demonstrated. Both small and large vessels in the northern gulf and higher net returns

than the southeastern gulf vessels (only larger were statistically significant). This was due primarily because the catch composition of the northern gulf boats was weighted predominately toward the higher valued red snapper as compared with grouper-predominated catches of the southeastern vessels. The large northern gulf vessels with almost exclusively red snapper catches showed net returns to the captain and owner about triple that of captains for the other three vessel classes. Although costs were approximately double that of the other three vessel classes, the owners' labor and management for the large northern vessels (\$20,847) was three times that of the small northern vessels (\$6,923) and 15 times that of the small southeastern vessels (\$1,380) while the large southeastern vessels showed a loss for the owners' labor and management. Large vessels (particularly in the northern gulf) are usually owned by multivessel firms which require an office staff. Salaries for the staff are paid from the net returns to the owner. The relatively large net return to ownership of the large vessels also reflects the fact that the owners of these vessels carry all of their own insurance, risk, and provide the required capital.

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