

The Economic Impact of South Carolina's Commercial Shrimp Industry, 1987

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SUMMARY

The purpose of this study was to determine the economic impact of the commercial shrimp fishery on South Carolina and subregions within the state. An input-output model was used to assess four types of impacts: 1) output (sales), 2) total income, 3) value-added, and 4) employment. Using the U.S. Forest Service economic impact model, IMPLAN, and data collected from the shrimp industry, impact multipliers were generated for the entire state of South Carolina, for the state's coastal region, and for three coastal sub-state regions (Northern, i.e. Horry and Georgetown counties, Central, i.e. Berkeley, Dorchester, Charleston and Colleton counties, and Southern, i.e. Beaufort and Jasper counties).

The analysis shows that in 1987, the commercial shrimp industry in South Carolina contributed, directly and indirectly, an estimated \$31.4 million in sales (output) to the state's economy. Moreover, the commercial shrimp industry is responsible for generating about \$16.3 million in total income, \$17.8 million in value-added and in 1,672 seasonal and full-time jobs in South Carolina's economy.

Almost all of the economic impacts of the commercial shrimp fishery in South Carolina were confined to the state's coastal region. Nearly 95 percent of the impact on total sales (output) and more than 97 percent of the impact on employment occur within the coastal counties. Within the coastal region, the largest impacts were observed in the the Central region centered around Charleston. About 59 percent of the impact on sales and 54 percent of the impact on employment occur within that four-county area.

PURPOSE

The economic contribution that various industries make toward the state's economy is considered, among other factors, in

public policy and regulatory activities. Since economic impact is often one of the major considerations, it is important to know the contribution that the commercial shrimp fishery makes to the economy of South Carolina.

In 1987, the South Carolina shrimp fishery generated about 54 percent of the ex-vessel value of total commercial fishery landings in South Carolina (Table 1). In terms of ex-vessel value, the nearest competitor is the blue crab fishery, with ten percent of total sales (Table 1). In 1987, the direct employment (seasonal and full-time) created by the fisheries industry as a whole in South Carolina was approximately 3,800. About 44 percent of that direct employment was attributed to the shrimp industry (Fig. 1).

The shrimp industry, like other food industries, is divided into harvesting, wholesale (packing), and processing sectors. Since there is only a limited amount of shrimp processing in South Carolina, this study will focus on harvesting and packing (wholesale). The harvesting sector consists of catching and landing of shrimp. The packing (wholesale) sector (packers are also called "dealers") activities include de-heading, sorting and packing of shrimp in ice for shipping. Much of the shrimp harvested is sold through the packing (wholesale) houses. Since many packers purchase their shrimp from and sell many inputs (e.g., ice, fuel, etc.) to the harvesters, the economic impact of commercial shrimping will be evaluated at the packer's level.

OBJECTIVES

The purpose of this study is to assess the economic contributions of the shrimping industry to South Carolina and coastal counties. Specific objectives are:

1. To determine the economic relationship between the shrimp industry and other industries in the state;

2. To quantify the industry's economic impact on output (sales), income and employment in South Carolina.

Previous studies which assess the economic impact of commercial fisheries on the coastal zone of the United States were also reviewed.

PREVIOUS STUDIES

Andrews and Rossi (1986) reviewed six studies to analyze the economic impact of commercial fisheries. Input-output (I-O) procedures (see METHOD OF ANALYSIS section for discussion of I-O modeling) were used in the following studies: 1) Southern New England Marine Region (SNEMR) (Rorholm, et al., 1967), 2) SNEMR (Grigalunas and 1982), 3) Cape Cod (King and Storey, 1974), 4) Rhode Island (Callaghan and Comerford, 1978), 5) Ocean County, New Jersey (Rossi, Andrews and Persaud, 1985) and 6) Maine (Briggs, Townsend and Wilson, 1982).

The study by Rorholm, et al., (1967) is the most comprehensive and involved 11 coastal counties in Rhode Island, Connecticut and Massachusetts. This study used existing input-output tables for the states in conjunction with expert opinion on the structure of the fishing industry. The other studies defined marine sectors differently. As a result, a comparison among the different studies of the impact multipliers is not possible (Andrews and Rossi, 1986). However, from the size of the multipliers, fish harvesting and processing both appear to have a greater impact on regional economic output than other marine-related sectors and other (non marine) economic activity. Fish-related wholesale and retail trade have relatively large income multiplier effects. The analysis supports a positive relationship between higher multipliers and larger regions (Andrews and Rossi, 1986).

Marine-related sectors were found to have significant impacts on local state economies in the northeastern United

States. For example, Callaghan and Comerford (1978) pointed out that the fishing fleet, "...apart from its major transactions within the industry and other economic units, is historically a tourist attraction". The tourist aspects of the fishing industry also provide economic benefits to the state of Rhode Island (Callaghan and Comerford, 1978).

Two studies of California's commercial fisheries employed the fisheries related "input-output" model called the "California Interindustry Fisheries (CIF) Model" (King and Flagg, 1982, and King and Shellhammer, 1981). CIF was developed for the specific purpose of evaluating fisheries impacts. It included 20 fish harvesting sectors and 9 fish processing sectors. Other non-fishery industrial sectors were aggregated into 35 sectors to produce a 64 sector model.

The CIF model was based on the 398 sector input-output analysis of the 1980 California economy by the U.S. Department of Interior (U.S. Forest Service). King and Flagg (1982) and King and Shellhammer (1981) used the CIF model to show the interdependence of the various economic sectors (i.e. how changing sales in one industrial sector permeate the rest of the economy).

The West Coast seafood industry study used the West Coast Fisheries Economic Assessment model, which utilizes operating accounting budgets that evaluate and classify data by significance and by cost category (Radtke and Jensen, 1987). Radtke and Jensen (1987) transferred the data into cash flows which were utilized to evaluate direct income impacts upon harvesters, processors and local business firms. They used the cash flows as expenditures data in an I-O model developed by the U.S. Forest Service called the IMPLAN model (see METHOD OF ANALYSIS section for a description of IMPLAN). Radtke and Jensen (1987) claimed that the fish harvest-

ing and fish processing sectors in the IMPLAN are not adequately defined. As a result, they used a representative budget to estimate impacts of changes and individual expenditures to estimate total community income impact.

Radtke and Jensen (1987) concluded that their model provides strong evidence that consumer-supported business firms in the coastal communities (retail, housing, medical services, etc) are affected by variations in fishing activity through specific fishing industry firms such as vessel repair or gear suppliers. Such findings are supported by the fact that commercial fisheries are labor intensive. Accordingly, much of the revenue from the fishing sector moves directly to the household sector. Like Andrews and Rossi (1986), Radtke and Jensen (1987) also found that the retail trade is impacted heavily by fishing activity.

Jones, et al., (1974) used regional input-output economic multiplier analysis in the study of the impact of commercial shrimp landings in the economy of Texas and coastal regions. They divided an area of the Texas coast into three regions, the Brownsville-Aransas, and Port Lavaca-Galveston and Beaumont-Port Arthur Gulf Coast. In terms of indirect and induced output, Jones, et al., 1974, found that food processing, petroleum products, wholesale trade, retail trade and services industries supported the fisheries industry significantly.

Bundy (1988) used IMPLAN to undertake an economic assessment of Maryland's oyster fishery and to show the interrelationship of commercial fishing to other industries within the state of Maryland. The analysis showed that the greatest value of output generated as a result of oyster harvesting activity came from transportation and warehousing. It also indicated that the greatest income impact was from boat building and repair.

The entire chain of distribution, from

the fishermen in the harvesting sector through final distribution to consumers by retail markets and restaurants, was included in the study of the Southeastern U.S. fishing industry conducted by Centaur Associates (CA) (1984). CA estimated impacts for the harvesting, processing, wholesale distribution, retail and restaurant distribution levels related to Southeastern marine fisheries for the Gulf of Mexico and South Atlantic Region.

CA employed the 156 sector model for the national economy for 1977 developed by the Bureau of Labor Statistics and divided wholesalers into two groups, primary wholesalers and secondary wholesalers. Shrimp packers (dealers) data was aggregated with the shrimp processors. In addition, CA did not include induced impacts because it was assumed that if consumers shifted purchase away from fishery products, the induced effects would still occur throughout the whole economy.

METHOD OF ANALYSIS

Input-Output Models

Regional input-output modeling, which underlies most of the work referred to in the previous studies, was chosen as the methodology for this analysis. The pioneering work on input-output analysis was done by W. Leontief (Leontief, 1976) in the 1930's. Input-output models are used to reveal the interdependence of sectors and to evaluate the changes in the intersectoral flow of goods and the resulting changes in income and employment within a defined region caused by a unit change in output from a specific sector. These impacts are measured as economy-wide direct, indirect, and induced effects of the changes in sales by a specific industry (e.g. Miller and Blair, 1985).

Input-output analysis begins with a transactions table. The transactions table summarizes the economic linkages among the sectors of a region. Each cell in this

table shows the value of goods and services purchased by an industry or sector in the region either from itself, from other industries in the region, or from other economic entities outside the region. In other words, sales of a given producing sector to other sectors, to itself, and to ultimate consumers, is shown along each row.

Table 2 illustrates a simple hypothetical aggregated version of a transactions table described by Palmer et al. (1985):

"Reading down each column of the table, all purchases of the column sectors from the related row sectors are reported. For example, agriculture in the first column is shown purchasing 12 units of goods from itself, 6 from manufacturing, 8 from services such as banking and finance and 18 from labor. Reading along the row, agriculture sells 12 to itself, 8 to manufacturing, 4 to services and 20 to final demand or the final consumer. Summation of the sales results in a total output of 44. Also summing agricultural purchases gives 44 in total outlay."

Manipulation of the transactions table, using matrix algebra, allows calculation of the direct, indirect, and induced and total effects of final demand changes in any given sector. We can define the various effects as follows:

Direct Effect: The direct impact is the dollar amount of purchases by packers (dealers) from shrimpers and all other suppliers to pack shrimp and provide other services.

Indirect Effect: The purchases made by the packers will cause shrimpers and suppliers to purchase additional inputs in the form of labor, additional inventory, etc. Indirect impacts include the selling of goods and services which are in turn used to provide other goods and services needed for fishing activities. A good example is the purchase of raw materials to repair or build boats.

Induced Effect: Wages and/or profits

are created for packers and the suppliers of the fishing industry as harvesters and packers purchase the various inputs they use in the production and distribution of shrimp. The subsequent spending of these wages and profits by workers and owners on a variety of consumer goods creates income for others throughout the rest of the economy. The resulting impacts due to these expenditures are known as induced impacts.

Total Effect: The total effect is the summation of the direct, indirect and induced effects. The total effect on the local community depends upon the amount of packer's sales dollar which recirculated within the local economy.

Regionalizing National I-O Models

In recent years, computer based models, many on microcomputers, have been developed which require minimal data from the user (Brucker, et al., 1987). Among these "ready-made" systems, which provide regional I-O models for all U.S. regions are RIMS II, IMPLAN, ADOTMATR, RSRI and SCHAFFER (Brucker et al., 1987). The microcomputer based input-output (I-O) model employed in this study is the IMPLAN (IMPact analysis for PLANning) system developed by the U.S. Forest Service (Palmer et al., 1985). The IMPLAN model was selected for the following reasons: 1) the I-O results are easier to compare with the more recent regional studies on commercial fisheries (i.e. Bundy, 1988, and Radtke and Jensen, 1987); 2) the cost of using the model was significantly lower than others; 3) since a portable microcomputer version of the model will be available by 1989 (E. Siverts, U.S. Forest Service, personal communication, 1988), experience in using the model for application in future I-O analysis (e.g., economic impact of aquaculture, etc.) was considered desirable.

Like other systems, IMPLAN is used to generate regional "non-survey" input-output models (Alward and Palmer, 1983).

The present version is a 528 industry sector model based on the 1977 U.S. input-output model and the 1982 census. Regions as large as the entire United States or as small as a county within a state can be defined using this system. The IMPLAN system consists of two primary components: 1) a data file of regional economic statistics which provides gross estimates of final demand and final payments and 2) a data reduction procedure used to derive the interindustrial transactions of the production account and to estimate trade flows within the region (Alward and Palmer, 1983).

The validity of this study is based on the usual assumptions of the input-output analysis which are incorporated by the IMPLAN system. These assumptions for the present study include: 1) inputs used in the production of shrimp are used in fixed proportions (that is, all inputs change proportionately in response to a change of the output of a sector of the economy), 2) relative prices, costs, and physical structures of the industries do not change, 3) within the accounting period, technologies are expected to remain the same and 4) the way products are mixed remains unchanged.

The different program modules of the IMPLAN produce columns of reports for the analysis of changes in all industries. These reports include total industry output (TIO), total employment, value added, employee compensation (i.e., all payments--wages, salaries, etc., paid to the labor factor of production for services) and Type I and Type III multipliers which are displayed along with the direct, indirect, and induced components for the various categories of reports just enumerated.

IMPLAN Type I multiplier, also called a simple multiplier (Miller and Blair, 1985), traces out the relationship between direct and indirect effects based on one unit of direct effect resulting from a unit change in final demand for any specified sector (di-

rect effect plus indirect effect are divided by the direct effect). Total (Miller and Blair, 1985) or IMPLAN Type III multiplier shows the relationship between the sum of the direct, indirect and induced effects divided by the direct effect resulting from a change in final demand (for example, the effects of business owners, employees and dependents spending their income in a given region). It assumes a population change in the impact area due to direct and indirect impacts and that resulting household spending will change by the average per capita expenditures rather than directly proportional to their income (Palmer et al., 1985).

For the sake of brevity, the 528 national industry sector IMPLAN model was aggregated to a 30 sector model for South Carolina and its subregions. In this aggregation scheme, those sectors that are significantly related to the commercial shrimp fishery and packing (e.g., fuel, ice manufacturing, etc.) remained as separate IMPLAN sectors.

Geographical Areas of Study

For the purposes of this study, South Carolina is divided into five regions--the state as a whole and four substate coastal regions designated as Northern, Central, Southern and the Coastal Zone (Fig. 2). The Northern region is comprised of Horry and Georgetown counties; the Central region is made up of Berkeley, Dorchester, Charleston and Colleton counties; the Southern region consists of Beaufort and Jasper counties. These three substate regions are equivalent to the statistical districts historically used by the U.S. Department of Commerce in reporting commercial landings. The Coastal region is a combination of the three substate regions.

Data Collection

Data on commercial shrimp fishing costs and returns in this study were gathered through a mail survey of 866 (those with no forwarding address are not in-

cluded in this count) licensed shrimp fishermen (FY 1987-88). Selected telephone and in-person interviews were done to ensure that aggregate estimates of fuel and other expenses were reasonable. The survey produced a 16 percent response rate from an estimated population of 648 commercial shrimpers between April and June, 1988 (see Appendix A for the survey instrument) and 84 (13%) usable responses¹.

Based upon interview data and other data sources (e.g., feasibility studies), profiles of expenditures by packers were developed and extrapolated into aggregate expenditures by statistical district using ex-vessel landing data. Aggregate sales by packers in each district were based upon estimated profit margin plus ex-vessel values. Shrimper purchases were weighted based on simple averages for two size group boats² (i.e., LOA 54 ft. or less and LOA greater than 54 Ft.). Trip ticket data (i.e., catch, value and effort data) which represent about 79 percent of all reported data on shrimp landings (A. Applegate, DMR, personal communications, 1988) and vessel size groups were used as weights for a given district to estimate fuel and other purchases. The packer data were not drawn from statistical samples, but were based upon the "best estimates" by people involved in shrimp packing and associated supply sectors. In addition, expenditure averages for certain inputs in the trawler survey had relatively high standard deviations³; consequently, other secondary data were reviewed when estimating "average" costs used in extrapolating aggregate purchases for a given substate region.

The aggregated non-shrimp and/or non-shrimp-related sector transactions and output came from the IMPLAN data base. The Bureau of Labor Statistics (BLS) industry deflators were used to deflate the shrimp data from 1987 to 1982 dollars as recommended when using IMPLAN (Palmer et al., 1985). In the state, as well as the four substate regions, the economic impact values generated by IMPLAN were then re-inflated to the 1987 dollars using BLS data for each output sector.

RESULTS AND DISCUSSION

Multipliers

The Type I and Type III multipliers are presented in Table 3. The largest multipliers, as expected, were generated by IMPLAN at the state level (Table 3). It is assumed that the magnitude of Central region multipliers was influenced by the size of the four county region and associated concentration of local sectors providing more inputs to the shrimp industry compared to other substate regions in this study.

State-Level Impact

An estimated total of \$31.4 million in South Carolina gross output sales is associated with \$16.2 million in final demand sales by the shrimp industry in 1987 (Table 4). In turn, this is associated with an estimated \$ 16.3 million of total income, \$17.7 million in state value added, and 1,672 in employment during 1987.

The greatest amount of total output generated, \$11.9 million, is the estimated ex-vessel value of the shrimp and by-catch harvested (see Appendix B). The second

¹ Based upon past surveys using in-person interviews, the "quality" (e.g., apparent accuracy of responses, unsolicited comments, etc.) of the mail survey did not appear to be inferior compared to previous surveys using only in-person interviews. Moreover, the mail survey is apparently more cost-effective per response compared to past in-person interviews.

² Employment on vessels was estimated using only diesel-powered data (see Table 3), consequently direct and total employment in the fishery may be underestimated.

³ This may be attributable to only using two size groups of vessels.

largest output, \$5 million, came from the Service Industries sector; and the third largest was, \$1.8 million, the Other Retail Trade sector.

Clearly, a comparison of the various effects shows that the direct effect contributed more to total effect than the indirect and induced effects. For example, total gross output (sales) was \$16.2 million for direct effect \$2.8 million for indirect effect, and \$12.3 million for induced effect (Table 4). Direct effect resulted in 1,410 jobs, indirect effect 43 jobs, and induced effect 219 jobs (Table 4).

Substate Regional Impacts

Table 4 summarizes the economic impacts in three substate regions--Northern, Central and Southern. For example, direct purchases by packers plus wages, salaries and property income associated with the purchases by packers in Southern region generated \$7.29 million in total output (sales) and 501 jobs. The same output stimulated \$4.1 million in total income and \$4.4 million in value added in the Southern region.

Comparing the three substate regions, the Central region had the largest total impact (Table 4). This is probably attributable to two factors: 1) the commercial shrimp fishery in terms of ex-vessel dollars is the highest in the Central region (see Table 1) and 2) the Central region is less dependent on "imported" goods and services for the shrimp industry compared to the other substate regions. The output multiplier indicates that the Central region has more industries that cater to the needs of packers and absorb the ripple effect of the activities in the shrimping sector, thus reducing leakages. The relatively high aggregate ex-vessel value of the shrimp fishery in the region may also be associated with the size of the trawling area and/or the accessibility of the various trawling areas.

The difference between the state-level

impact and the Coastal Zone impact is insignificant. This is expected because most of the industries that supply goods and services for the packer sector are located within the coastal counties.

Substitutability and Assumptions

The exclusion of the secondary wholesale, retail and restaurant sectors and small amount of shrimp processing in this analysis probably underestimates the impact of the shrimping industry in South Carolina. We base this exclusion on the following: 1) First, the seasonality of South Carolina shrimp landings tends to constrain buying for in-state processing; 2) South Carolina has a relatively low share (volume) of the U.S. shrimp supply - - less than 1% in 1987; and, 3) South Carolina has a relatively high percentage of shrimp purchased from non-South Carolina sources (W. Lacey, DMR, personal communication, 1988) by restaurants, retail stores and wholesalers in South Carolina, including some firms which also serve as packers. Given this apparent substitutability of non-South Carolina shrimp at the retail and wholesale levels, the exclusion of these sectors is warranted in this I-O analysis. Also, methodologically, the packers also represent the "last industry" where the output can be readily traced (Palmer and Siverts, 1985).

In contrast, estimating the impact of the shrimp industry at the harvester level would seriously underestimate the industry's impact. The output of the South Carolina shrimp fishery (harvesters) is critical to local shrimp packers because many of them would be unable to utilize a substitute source (i.e., non-South Carolina shrimp).

Implications for the Coastal Economy

In addition to demonstrating the South Carolina shrimp industry linkage with the coastal economy, these results also document and quantify the interdependency of the harvesting and packing sector. Some have argued that a major decline in South Carolina's shrimp landings due to perhaps

pollution and/or regulatory actions would only temporarily interrupt the supply of marine shrimp available to South Carolina consumers because non-South Carolina sources would quickly replace local supplies. Regardless of such an effect on consumers, the negative short-term economic impact, if not long-term, on South Carolina coastal communities like Georgetown, McClennanville, Mt. Pleasant, Edisto Beach and Frogmore are likely to be significant, given the findings in this study. Moreover, these impacts would not only be associated with decreased purchases by the commercial fishing sector but also by the packers (dealers) serving South Carolina's shrimp fleet.

Recommendations for Future Research

The shrimp fishery constitutes the major portion of ex-vessel sales from South Carolina commercial fisheries. However, other fisheries in the state, like the oyster and blue crab fisheries, are also significant either due to in-state wholesale activities and/or value-added processing. Consequently, a comprehensive study that incorporates other seafood industries (e.g., blue crab, oyster, finfish) would provide a more complete view of South Carolina commercial fisheries for both policy makers and others.

In addition, the recent expansion of aquaculture output (Whetstone, 1987) in South Carolina, an industry partially dependent upon the marketing infrastructure of the seafood industry, would also make the aquaculture industry a desirable candidate for I-O analysis. Some preliminary analysis of aquaculture's impact has been performed using IMPLAN sector No. 26 (Agricultural, Forestry, and Fishery Services) multipliers at the state level (Rhodes and Pomeroy, 1988), but a more productive and accurate approach may require the insertion of a new sector in the appropriate counties. The IMPLAN model's data base can be modified to accommodate the

addition of a new sector (Palmer and Siverts, 1985).

SUMMARY AND CONCLUSIONS

The primary concern of this study is the determination of the economic activity generated through production by the commercial shrimp industry in South Carolina generally and the coastal counties in particular. For purposes of clarity, South Carolina was divided into five regions: 1) the state as a whole, 2) Northern substate region, 3) Central substate region, 4) Southern substate region and 5) Coastal region. The Northern region is made up of Horry and Georgetown counties; the Central region is made up of Berkeley, Dorchester, Charleston and Colleton counties; the Southern region consists of Beaufort and Jasper counties; the three substate regions were combined as a single region and designated as Coastal region. The statewide and regional impacts from shrimp production were estimated using the regional input-output framework.

Total purchases stimulated total economic output worth \$31.4 million in South Carolina. Most of the impact, \$29.7 million, was generated in the Coastal region. The total number of jobs created in producing a \$31.4 million worth of output in the state was an estimated 1,672. Likewise, 203 jobs were created in the Northern region, 911 in the Central region, 501 in the Southern region. The employment effects of the commercial shrimp industry are concentrated mostly in the coastal counties where there are more significant supporting industries in terms of direct, indirect and induced impacts. The most significant industries that are affected by the commercial shrimp industry are service industries, retail trade, wholesale trade, fresh, frozen packaged fish (this includes de-heading and packing shrimp) banking and finance, food processing and utilities. Additional research is needed on the economic impact of

other commercial fisheries (e.g., blue crabs) and aquaculture on South Carolina.

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Figure 1. Estimated direct employment in the South Carolina commercial shrimp trawler fishery, 1987.

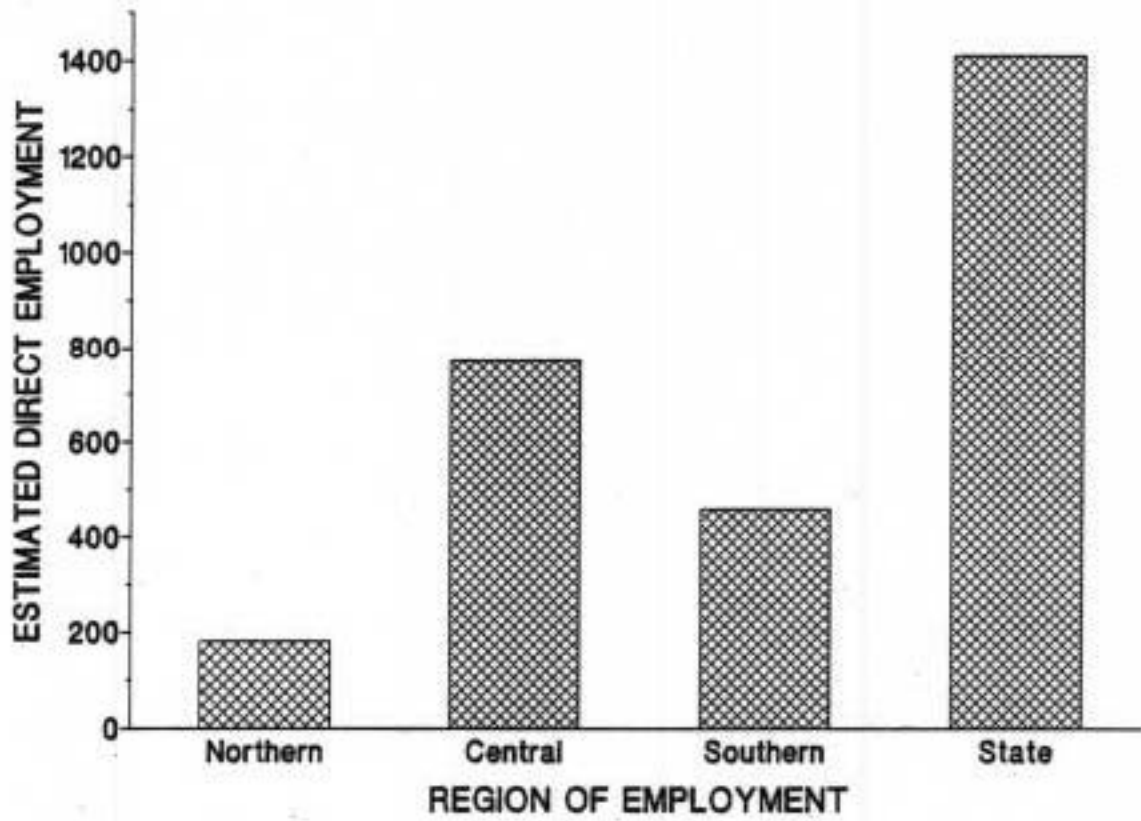


Figure 2. The three coastal substrate regions based upon county groups.

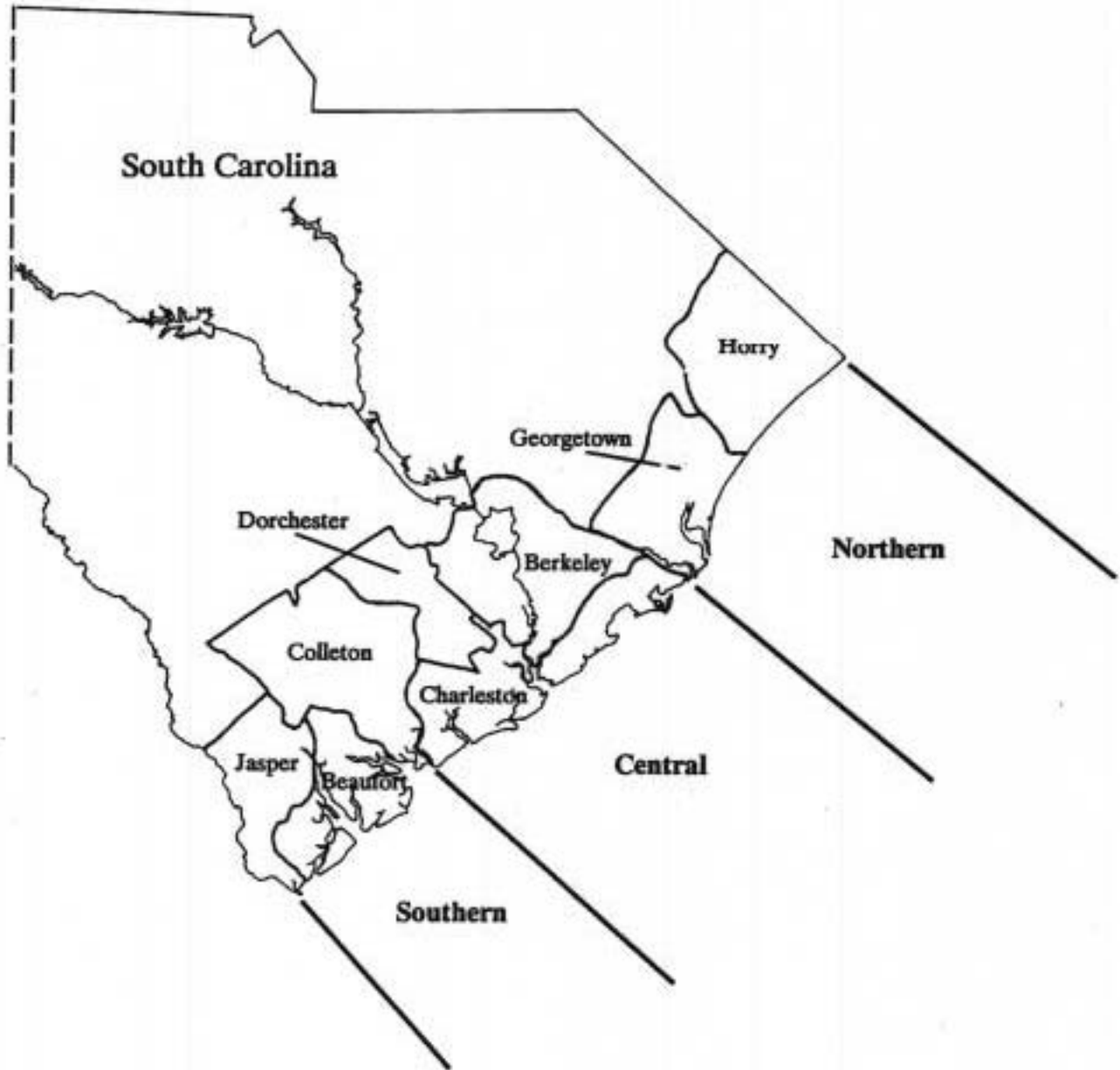


Table 1. Annual commercial fishery landings for South Carolina, 1987. (Source: Applegate, 1988)

	Pounds	Exvessel Value	Percent of Exvessel*
	(In Thousands)		
Shrimp, Heads-off	3,675	\$11,939	53.6%
Blue Crabs (hard & soft)	5,413	\$2,141	9.6%
Hard Clams (lbs of meat)	186	\$943	4.2%
Oysters (U.S. bushels)	133	\$1,026	4.6%
Other Shellfish	667	\$1,088	4.9%
Finfish	4,138	\$5,150	23.1%
Total:	NA	\$22,287	100.0%

For given group, the percent of total exvessel value.

Table 2. Simplified Hypothetical Transactions for Input-Output Models.

Producing Sector	Purchasing Sectors				Total Output
	Agriculture	Manufacturing	Services	Final Demand	
Agriculture	12	8	4	20	44
Manufacturing	6	6	5	28	45
Services	8	4	3	37	52
Primary Inputs	18	27	40	0	85
Total Outlay	44	45	52	85	226

Source: Adapted from Palmer et al. (1985)

Table 3. Estimated economic impact multipliers based upon aggregate sales by South Carolina shrimp packers (1987 dollars) for selected regions.

	FISHERIES DISTRICT				
	Northern	Central	Southern	Coastal	State
OUTPUT (SALES) MULTIPLIERS:					
Direct	1.000	1.000	1.000	1.000	1.000
Indirect	0.101	0.223	0.095	0.201	0.176
Induced ¹	0.583	0.655	0.406	0.635	0.763
TOTALS	1.684	1.878	1.501	1.836	1.938
COEFFICIENTS:					
Direct	0.543	0.549	0.551	0.548	0.548
Indirect	0.050	0.080	0.052	0.077	0.079
Induced ¹	0.303	0.335	0.234	0.325	0.381
TOTALS	0.896	0.964	0.837	0.950	1.009
VALUE ADDED COEFFICIENTS:					
Direct	0.579	0.584	0.586	0.583	0.583
Indirect	0.055	0.088	0.057	0.084	0.086
Induced ¹	0.346	0.379	0.271	0.370	0.428
TOTALS	0.979	1.051	0.914	1.037	1.097
COEFFICIENTS:²					
Direct	116.333	78.755	94.208	87.079	87.085
Indirect	1.996	2.536	1.597	2.488	2.626
Induced ¹	12.1171	1.835	7.229	11.467	13.540
TOTALS	130.445	93.127	103.035	101.035	103.251

¹ Type III IMPLAN multiplier.

² Employment (i.e. full-time & seasonal) per million dollars of sales. Vessel employment is based only on crews working on diesel-powered vessels, consequently direct & total employment multipliers maybe underestimated.

Table 4. Estimated economic impact of South Carolina's shrimp industry based upon aggregate sales by shrimp packers (dealers) for selected regions, 1987.

	FISHERIES DISTRICT				
	Northern	Central	Southern	Coastal	State
OUTPUT (SALES) IMPACT:	(1987 DOLLARS IN MILLIONS)				
Direct	\$1.56	\$9.79	\$4.86	\$16.19	\$16.19
Indirect	\$0.16	\$2.18	\$0.46	\$3.25	\$2.85
Induced ¹	\$0.91	\$6.41	\$1.97	\$10.28	\$12.35
TOTALS	\$2.63	\$18.38	\$7.29	\$29.72	\$31.39
TOTAL INCOME IMPACT:	(1987 DOLLARS IN MILLIONS)				
Direct	\$0.85	\$5.37	\$2.68	\$8.88	\$8.88
Indirect	\$0.08	\$0.79	\$0.25	\$1.25	\$1.29
Induced ¹	\$0.47	\$3.28	\$1.14	\$5.27	\$6.17
TOTAL:	\$1.40	\$9.44	\$4.07	\$15.39	\$16.33
VALUE ADDED IMPACT:	(1987 DOLLARS IN MILLIONS)				
Direct	\$0.90	\$5.71	\$2.85	\$9.44	\$9.44
Indirect	\$0.09	\$0.86	\$0.28	\$1.36	\$1.39
Induced ¹	\$0.54	\$3.71	\$1.32	\$5.99	\$6.93
TOTAL:	\$1.53	\$10.28	\$4.44	\$16.79	\$17.75
EMPLOYMENT IMPACT:	(TOTAL EMPLOYMENT)				
Direct ²	181	771	458	1,410	1,410
Indirect	3	25	8	40	43
Induced ¹	19	116	35	186	219
TOTAL:	203	911	501	1,636	1,672

¹ Type III IMPLAN multiplier.

² Vessel employment is based only on crews working on diesel-powered vessels.

APPENDIX A

REGION: SOUTH CAROLINA SECTOR: SHRIMP PICKERS

ECONOMIC IMPACT IN MILLIONS OF DOLLARS (1987) DIRECT CHANGE IN STANDARD T60-RELATED FLOWS

IMPLAN NUMBER	SECTOR DESCRIPTION	FINAL DEMAND (MM\$)	IMPACT T60 (MM\$)	EMPLOYEE INCOME (MM\$)	PROPERTY INCOME (MM\$)	TOTAL INCOME (MM\$)	VALUE ADDED (MM\$)	EMPLOYMENT (NUMBER OF JOBS)
1	866 Livestock	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	866 Agricultural Crops	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	866 Forestry & Nur. Prod.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	COMMERCIAL FISHING	11.690	11.690	2.906	4.015	6.922	7.182	793.000
35	866 Mining, Minerals, etc.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
66	866 New Construction	0.000	0.000	0.000	0.000	0.000	0.000	0.000
73	866 Building Maintenance	0.126	0.126	0.054	0.004	0.058	0.060	1.810
77	866 Metal Products & Mac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
82	866 Food Proc. (w/o Sfd.)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	FRESH OR FROZEN SEAFOOD	1.171	1.171	0.140	0.063	0.204	0.204	524.000
124	MANUFACTURED ICE	0.431	0.431	0.226	0.046	0.272	0.297	9.640
128	866 Tobacco Products	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	866 Textiles	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160	866 Logging & Lumber	0.000	0.000	0.000	0.000	0.000	0.000	0.000
178	866 Plastic, Glass, etc.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	866 Pulp & Paper Mills	0.000	0.000	0.000	0.000	0.000	0.000	0.000
235	866 Petroleum Products	0.000	0.000	0.000	0.000	0.000	0.000	0.000
392	866 Communications & Ele.	0.120	0.120	0.047	0.029	0.075	0.081	1.950
401	866 Vehicles, Instrument	0.000	0.000	0.000	0.000	0.000	0.000	0.000
408	866 Boat Bldg. & Repairs	0.000	0.000	0.000	0.000	0.000	0.000	0.000
446	866 Transportation	0.000	0.000	0.000	0.000	0.000	0.000	0.000
456	866 Utilities	0.156	0.156	0.019	0.044	0.064	0.071	0.700
460	866 Recreation Trade	0.000	0.000	0.000	0.000	0.000	0.000	0.000
461	OTHER AMBLEABLE TRADE	1.613	1.613	0.663	0.210	0.873	1.074	54.637
463	OTHER RETAIL TRADE	0.342	0.342	0.159	0.038	0.197	0.248	13.310
464	866 Banking and Finance	0.167	0.167	0.080	0.019	0.099	0.104	3.640
467	866 Insurance	0.090	0.090	0.030	0.003	0.033	0.037	1.300
469	866 Service Industries	0.072	0.072	0.018	0.023	0.040	0.045	1.210
486	866 Professional Service	0.054	0.054	0.023	0.013	0.036	0.036	0.770
523	866 Other Industries	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		16.231	16.231	4.367	4.508	8.875	9.443	1405.987

SECTOR: SHRIMP PICKERS

INDIRECT CHANGE IN STANDARD T60-RELATED FLOWS

IMPLAN NUMBER	SECTOR DESCRIPTION	FINAL DEMAND (MM\$)	IMPACT T60 (MM\$)	EMPLOYEE INCOME (MM\$)	PROPERTY INCOME (MM\$)	TOTAL INCOME (MM\$)	VALUE ADDED (MM\$)	EMPLOYMENT (NUMBER OF JOBS)
1	866 Livestock	0.000	0.006	0.000	0.000	0.001	0.001	0.070
10	866 Agricultural Crops	0.000	0.002	0.000	0.001	0.001	0.001	0.000
22	866 Forestry & Nur. Prod.	0.000	0.008	0.002	0.002	0.004	0.004	0.270
25	COMMERCIAL FISHING	0.000	0.027	0.007	0.009	0.016	0.016	0.740
35	866 Mining, Minerals, etc.	0.000	0.001	0.000	0.000	0.001	0.001	0.070
66	866 New Construction	0.000	0.000	0.000	0.000	0.000	0.000	0.000
73	866 Building Maintenance	0.000	0.209	0.090	0.007	0.096	0.096	3.000

APPENDIX A (continued)

ECONOMIC IMPACT IN MILLIONS OF DOLLARS (1987)		REGION:	SOUTH CAROLINA	SECTOR:	SHRIMP PICKERS
77	800 Metal Products & Mac.	0.131	0.038	0.010	0.048
82	800 Food Proc. (w/o Sfd.)	0.016	0.002	0.001	0.004
96	FRESH OR FROZEN SEAFOOD	0.001	-0.000	0.000	-0.000
124	MANUFACTURED ICE	0.195	0.102	0.021	0.123
128	800 Tobacco Products	0.000	0.000	0.000	0.000
131	800 Textiles	0.195	0.042	0.009	0.051
160	Logging & Lumber	0.023	0.006	0.002	0.007
178	800 Plastic, Glass, etc.	0.125	0.036	0.010	0.045
187	800 Pulp & Paper Mills	-0.000	-0.000	0.000	-0.000
235	800 Petroleum Products	0.133	0.011	0.011	0.025
392	800 Communications & Ele.	0.083	0.032	0.020	0.052
401	800 Vehicles, Instrument	0.011	0.004	0.001	0.005
408	800 Bldg. & Repairs	0.368	0.168	-0.053	0.116
446	800 Transportation	0.311	0.111	0.034	0.145
456	800 Utilities	0.089	0.011	0.025	0.037
460	800 Recreation Trade	0.010	0.004	0.001	0.016
461	OTHER WHOLESALE TRADE	0.005	0.002	0.001	0.003
463	OTHER RETAIL TRADE	0.057	0.028	0.007	0.045
464	800 Banking and Finance	0.093	0.027	0.007	0.034
467	800 Insurance	0.543	0.133	0.003	0.039
469	800 Service Industries	0.146	0.062	0.035	0.098
496	800 Professional Service	0.000	0.000	0.000	0.000
525	800 Other Industries	0.000	0.000	0.000	0.000
TOTAL		2.847	0.951	0.336	1.216
					1.366
					42,510

ANALYSIS OF CHANGE IN FINAL DEMAND (1987 DOLLARS)
INDUCED CHANGE IN STANDARD TBO-RELATED FLOWS (5 ITERATIONS--FINAL REPORT)

NUMBER	SECTOR DESCRIPTION	IMPACT TBO (MM\$)	EMPLOYEE INCOME (MM\$)	PROPERTY INCOME (MM\$)	TOTAL INCOME (MM\$)	VALUE ADDED EMPLOYMENT (NUMBER OF JOBS)
1	800 Livestock	0.114	0.007	0.007	0.013	0.015
10	800 Agricultural Crops	0.105	0.008	0.044	0.052	0.054
22	800 Forestry & Nur. Prod.	0.034	0.008	0.009	0.017	0.019
25	COMMERCIAL FISHING	0.001	-0.000	-0.000	0.000	0.000
35	800 Mining, Minerals, etc.	0.002	0.001	-0.000	0.001	0.001
66	800 New Construction	0.000	0.000	0.000	0.000	0.000
73	800 Building Maintenance	0.258	0.111	0.008	0.119	0.122
77	800 Metal Products & Mac.	0.170	0.049	0.013	0.232	0.244
82	800 Food Proc. (w/o Sfd.)	0.626	0.124	0.067	0.817	0.864
96	FRESH OR FROZEN SEAFOOD	0.002	-0.000	-0.000	0.000	0.000
124	MANUFACTURED ICE	0.002	0.001	-0.000	0.001	0.001
128	800 Tobacco Products	-0.000	0.000	0.000	0.000	0.000
131	800 Textiles	0.396	0.086	0.018	0.104	0.107
160	Logging & Lumber	0.076	0.027	0.008	0.041	0.046
178	800 Plastic, Glass, etc.	0.393	0.113	0.030	0.143	0.151
187	800 Pulp & Paper Mills	0.001	-0.000	-0.000	0.000	0.000
235	800 Petroleum Products	0.056	0.006	0.006	0.013	0.014
392	800 Communications & Ele.	0.267	0.157	0.096	0.274	0.274
401	800 Vehicles, Instrument	0.043	0.023	0.008	0.031	0.031
408	800 Bldg. & Repairs	0.007	0.003	-0.001	0.002	0.002

APPENDIX A (continued)

	ECONOMIC IMPACT IN MILLIONS OF DOLLARS (1987)		REGION: SOUTH CAROLINA		SECTOR: SHRIMP PACKERS	
446	0.151	0.268	0.075	0.029	0.124	0.132
456	0.415	0.560	0.070	0.159	0.229	0.255
460	0.163	0.179	0.076	0.022	0.078	0.121
461	0.004	0.006	0.002	0.001	0.003	0.004
463	1.452	1.465	0.681	0.163	0.814	1.062
464	0.536	0.638	0.306	0.073	0.379	0.398
467	0.391	0.540	0.180	0.020	0.210	0.224
469	4.772	5.353	1.313	1.697	3.010	3.388
486	0.234	0.371	0.158	0.089	0.247	0.310
525	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	10.007	12.348	3.605	2.568	6.172	6.925

ANALYSIS OF CHANGE IN FINAL DEMAND (1987 DOLLARS)
TOTAL CHANGE IN STANDARD T60-RELATED FLOWS

NUMBER	IMPLAN SECTOR DESCRIPTION	FINAL DEMAND (MM\$)	IMPACT T60 (MM\$)	EMPLOYEE INCOME (MM\$)	PROPERTY INCOME (MM\$)	TOTAL INCOME (MM\$)	VALUE ADDED EMPLOYMENT (NUMBER OF JOBS)
1	866 Livestock	0.036	0.119	0.007	0.007	0.014	0.016
10	866 Agricultural Crops	0.044	0.107	0.009	0.045	0.054	0.055
22	866 Forestry & Nur. Prod.	0.013	0.041	0.010	0.012	0.022	0.023
25	COMMERCIAL FISHING	11.890	11.918	2.918	4.025	6.943	7.198
35	866 Mining, Minerals, etc.	0.000	0.003	0.001	0.001	0.002	0.002
66	866 New Construction	0.000	0.000	0.000	0.000	0.000	0.000
73	866 Building Maintenance	0.126	0.592	0.205	0.019	0.223	0.281
77	866 Metal Products & Mch.	0.107	0.901	0.086	0.028	0.113	0.113
82	866 Food Proc. (w/o Sfd.)	0.676	0.842	0.126	0.068	0.194	0.201
96	FRESH OR FROZEN SEAWOOD	1.172	1.174	0.141	0.064	0.204	0.207
124	MANUFACTURED ICE	0.433	0.628	0.329	0.067	0.397	0.493
128	866 Tobacco Products	0.000	0.000	0.000	0.000	0.000	0.000
131	866 Textiles	0.334	0.591	0.128	0.027	0.155	0.160
160	866 Logging & Lumber	0.076	0.134	0.033	0.010	0.043	0.044
178	866 Plastic, Glass, etc.	0.207	0.518	0.148	0.040	0.188	0.200
187	866 Pulp & Paper Mills	0.000	0.001	0.000	0.000	0.000	0.000
239	866 Petroleum Products	0.056	0.208	0.018	0.017	0.035	0.039
392	866 Communications & Ele.	0.407	0.609	0.236	0.144	0.380	0.412
401	866 Vehicles, Instrument	0.043	0.090	0.026	0.009	0.035	0.037
408	866 Boat Bldg. & Repairs	0.007	0.375	0.172	-0.054	0.118	0.121
446	866 Transportation	0.151	0.578	0.206	0.063	0.269	0.285
456	866 Utilities	0.571	0.805	0.100	0.229	0.329	0.367
460	866 Recreation Trade	0.163	0.189	0.080	0.024	0.104	0.128
463	OTHER RETAIL TRADE	1.617	1.624	0.669	0.211	0.880	1.081
464	866 Banking and Finance	1.794	1.867	0.868	0.207	1.075	1.354
467	866 Insurance	0.703	0.862	0.413	0.099	0.512	0.537
469	866 Service Industries	0.481	0.722	0.241	0.027	0.268	0.300
486	866 Professional Service	4.844	5.967	1.464	1.892	3.356	3.778
525	866 Other Industries	0.288	0.571	0.243	0.136	0.379	0.410
		0.000	0.000	0.000	0.000	0.000	0.000
TOTAL		26.238	31.426	8.922	7.411	16.333	17.753
							1667.777

APPENDIX B

SHRIMP INDUSTRY ECONOMIC IMPACT SURVEY, 1987 Commercial Trawler Survey

Please answer the following questions based upon your experience in 1987. Since we are not asking you to identify your trawler, all of the information will remain anonymous. Rough estimates are acceptable for all questions. If you have problems filling out the questionnaire or need more questionnaires, please call Ray Rhodes, 795-6350. Thank you.

1. Please describe each vessel you operated &/or owned in 1987: (If you owned &/or operated more than one vessel in 1987, please fill out a separate questionnaire for each vessel)
Total Length: _____ ft. Gross Tonnage: _____ Horsepower: _____
Fuel Used: Diesel _____, Gasoline _____. Year built: _____
Hull Material: (Check one) Wood _____, Fiberglass _____, Steel _____
Type & Size of Nets Usually Used: _____
2. At what dealer or port did you unload most of your 1987 shrimp catch?
Name of Dealer: _____, County: _____
3. If you wanted to sell your vessel right now, how much would you expect to get for your vessel? \$ _____
4. If you own the vessel, what year did you purchase it in and what did you pay for the vessel (include cost to get the vessel into operating condition) \$ _____ & Year Purchased _____.
5. In 1987, did you or the operator of your vessel (boat) catch shrimp to sell? Yes __, No __.
6. In 1987, did you catch shrimp to sell using gear (e.g. cast net) other than shrimp trawls? Yes __, No __. If yes, please indicate the gear used and total pounds sold: _____

Crew & Ownership: (Please respond relative to the 1987 shrimp season.)

7. Did you operate a vessel you owned (i.e. the captain owns & operates the vessel)? Yes __, No __. If no, what state does the owner(s) live in? _____
8. Were you a captain on a trawler you did not own? Yes __, No __
9. What percent of your shrimping income (if you were an owner-operator include your boat share) was spent in S.C. during 1987? _____ %
10. Approximately what percentage of your 1987 total household income was derived from shrimp trawling? _____ %
11. How many strikers do you regularly use on your vessel? _____ persons.
How many of your regular strikers live in S.C.? _____.

Effort & Mobility:

12. Estimate the number of days you went shrimping in South Carolina during 1987: _____ days.
13. If any, how many days did you shrimp trawl in other states (e.g., Florida, Georgia, North Carolina, etc.) during 1987? _____ days.
14. If any, what non-shrimping trips (e.g., conchs, crabs, fish, etc.) did you make in 1987? _____ trips. How many days of non-shrimp fishing (e.g., crabs, fish, etc.) during 1987? _____ days.

APPENDIX B (continued)

15. Costs: Please provide your total fishing expenses for 1987. Also, for each item estimate the percent paid to South Carolina companies (e.g. local fuel docks and net makers, etc.). Rough estimates are acceptable for all items.

ITEM	1987 EXPENSES	PERCENT PAID TO S.C. BUSINESSES
Fuel & Oil	\$ _____	_____ %
Ice	\$ _____	_____ %
Engine Maintenance and Repair	\$ _____	_____ %
Trawling Gear (nets & doors) Purchases	\$ _____	_____ %
Trawling Gear Repair	\$ _____	_____ %
Hull Maintenance & Repairs (e.g. railway)	\$ _____	_____ %
Insurance	\$ _____	_____ %
Electronic Equipment & Repairs	\$ _____	_____ %
Interest Payments (exclude principal payment)	\$ _____	_____ %
Marine Hardware & Misc. Supplies	\$ _____	_____ %
Groceries	\$ _____	_____ %
Truck & Car Expenses (shrimp related travel)	\$ _____	_____ %
Packing & Heading Expenses	\$ _____	_____ %
Moorage or Docking Fees (if any)	\$ _____	_____ %
Professional Fees (e.g. lawyers, tax prep)	\$ _____	_____ %
Other Expenses (Specify: _____)	\$ _____	_____ %
Property Taxes Paid to South Carolina	\$ _____	NA
Property Taxes Paid to other States (if any)	\$ _____	NA
Non-South Carolina License Fees (if any)	\$ _____	NA

16. Are you a resident of South Carolina? Yes ____, No ____.

17. What was your total 1987 shrimp production (heads-off) and sales?
 _____ lbs; \$ _____ or Average Price: \$ _____ per lb.

18. Approximately what percent of this 1987 poundage was unloaded in South Carolina? _____ %

19. If any, estimate the total sales of your 1987 non-shrimp by-catch (e.g. flounders, crabs, etc.) in South Carolina: \$ _____

PLEASE RETURN YOUR QUESTIONNAIRE (See Enclosed Envelope) TO: RAY RHODES, S.C. MARINE RESOURCES CTR., P.O. BOX 16190, CHARLESTON, SC 29412