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## Possible effects of the shrimp-baiting fishery on the economic performance of the South Carolina traveling industry and related economic impacts

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UNIVERSITY

**Agricultural &  
Applied Economics**

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**Possible Effects of the Shrimp-Baiting  
Fishery on the Economic Performance  
Of the South Carolina Trawling  
Industry and Related Economic Impacts**

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The South Carolina Shrimp Trawling Industry and Related Economic Impacts**

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**Report to the Marine Resources Division, South Carolina Department of Natural  
Resources, Charleston, South Carolina**

**March 1, 2001**

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## Possible Effects of the Shrimp-Baiting Fishery On the Economic Performance of The South Carolina Shrimp Trawling Industry and Related Economic Impacts

### Executive Summary

#### *Impacts of Reduced Catch on the South Carolina Resident Commercial Shrimp Fleet.*

We find that most full time owner/operators of commercial shrimp trawlers are operating at about breakeven levels of activity. If 1999 catch rates were to persist over the next 5 to 10 years, we expect that both mid-sized (31 to 60 feet) and large vessels (more than 60 feet) will exit the industry while owner/operators of small (less than 31 feet), part-time vessels could increase in small numbers. Reduction in commercial catch associated with shrimp baiting, if any, or other causes would exacerbate the rate of exit of all vessel sizes – though the largest vessels would show the largest percentage declines.

**Table S-1. Expected Change in SC Resident Shrimp Trawler Fleet if Commercial Catch Declines From 1999 Levels: Heads Off Price \$3.83**

Catch	Fleet size	Change in SC Fleet from Actual SC Fleet in 1999				Percentage Change in SC Fleet from Actual SC Fleet in 1999			
		(294)	(116)	(57)	(467)	Small	Medium	Large	Total
Reduction		Small	Medium	Large	Total	Small	Medium	Large	Total
0.0%		56	-2	-11	42	18.9%	-1.6%	-19.5%	11.3%
10.0%		21	-13	-16	-8	7.0%	-11.5%	-27.6%	-2.2%
20.0%		-14	-25	-20	-59	-4.9%	-21.3%	-35.6%	-15.8%
30.0%		-49	-36	-25	-110	-16.8%	-31.2%	-43.7%	-29.3%
40.0%		-84	-48	-29	-161	-28.7%	-41.0%	-51.7%	-42.8%
50.0%		-119	-59	-34	-212	-40.6%	-50.8%	-59.8%	-56.3%

In Table S-1, the 0% reduction reflects 1999 cost and returns conditions. If these conditions persist over the next 5 to 10 years, the fleet would lose about 20% of the large vessels and 2% of the mid-sized vessels but could support about 19% more small vessels. The fleet becomes smaller and more “part-time.” A 20% reduction in catch would drive out 36% of the large vessels, 21% of the mid-sized vessel and about 5% of the small vessels from the 1999 licensed shrimpers that reside in South Carolina.

As shown in Table S-2, if price falls by \$.25 per pound to \$3.58, the size of

**Table S-2. Expected Change in SC Resident Shrimp Trawler Fleet if Commercial Catch Declines From 1999 Levels: Heads Off Price \$3.58**

Catch	Fleet size	Change in SC Fleet from Actual SC Fleet in 1999				Percentage Change in SC Fleet from Actual SC Fleet in 1999			
		(294)	(116)	(57)	(467)	Small	Medium	Large	Total
Reduction		Small	Medium	Large	Total	Small	Medium	Large	Total
0.0%		26	-12	-15	-1	8.7%	-10.2%	-26.6%	-0.4%
10.0%		-6	-22	-19	-48	-2.1%	-19.2%	-33.9%	-12.7%
20.0%		-38	-33	-24	-94	-13.0%	-28.2%	-41.3%	-25.1%
30.0%		-70	-43	-28	-141	-23.9%	-37.1%	-48.6%	-37.4%
40.0%		-102	-53	-32	-188	-34.8%	-46.1%	-55.9%	-49.8%
50.0%		-134	-64	-36	-234	-45.6%	-55.1%	-63.3%	-62.1%

the shrimp fleet declines more rapidly. In this case, a 20% reduction in catch, for example, results in a 13% loss in small vessels, a 28% loss in mid-sized vessels and a 41% reduction in large vessels.

*Impacts of Reduced Catch on the South Carolina Economy.*

**Table S-3. Expected Loss in Sales, Income, Employment and Taxes if Commercial Catch Declines From 1999 Levels: Heads Off Price**

**\$3.83**

Catch Reduction	State of South Carolina Losses in:			
	Sales \$ million	Income \$ million	Employment number	Taxes \$ million
0.0%	-\$2.25	-\$1.73	-56	-\$0.11
10.0%	-\$4.82	-\$3.71	-119	-\$0.24
20.0%	-\$7.22	-\$5.56	-179	-\$0.36
30.0%	-\$9.79	-\$7.64	-243	-\$0.48
40.0%	-\$12.20	-\$9.39	-302	-\$0.60
50.0%	-\$14.76	-\$11.37	-386	-\$0.73

The expected losses to the South Carolina economy are shown in Table S-3. If commercial shrimp costs and returns remains at 1999 levels or the physical catch declines, the range of economic impacts includes the following:

- Annual Sales declines from about \$2.25 million to \$14.76 million
- Annual Income declines from \$1.73 million to \$11.37 million
- Employment falls by 56 to 386 jobs
- State and Local taxes decline from \$110,000 to \$730,000 per year

If the heads-off price declines by \$.25 per pound aggregate impacts increase as shown in Table S-4.

**Table S-4 Expected Loss in Sales, Income, Employment and Taxes if Commercial Catch Declines From 1999 Levels: Heads Off Price**

**\$3.58**

Catch Reduction	State of South Carolina Losses in:			
	Sales \$ million	Income \$ million	Employment number	Taxes \$ million
0.0%	-\$4.47	-\$3.44	-111	-\$0.22
10.0%	-\$6.69	-\$5.15	-166	-\$0.33
20.0%	-\$9.24	-\$7.11	-239	-\$0.45
30.0%	-\$11.46	-\$8.82	-284	-\$0.56
40.0%	-\$13.67	-\$10.53	-339	-\$0.67
50.0%	-\$15.98	-\$12.30	-396	-\$0.79

While the overall economic impacts at the regional and state levels of a declining commercial shrimp trawler fleet are not large relative to the overall size of the regional economies, commercial shrimping is likely to be very important to the vitality of selected communities along the coast that are home ports to large numbers of commercial vessels and the packing and other related businesses.

The most important assumptions in this analysis are: 1. Future prices of shrimp landed in SC will increase at the same rate as the costs of operations and ownership for commercial shrimp trawlers; and 2. Some vessels will exit so that remaining vessels can operate at breakeven levels over the long run. If the abundance of shrimp available to commercial trawlers declines, then the fleet size will contract to lift the per vessel catch to levels needed to maintain long run breakeven revenues. While there is a "resistance to change" by commercial shrimpers, perhaps associated with "monetary conversion costs, nonmonetary factors and personal preferences," if catch rates decline, the opportunity costs of remaining in commercial shrimping will increase for all owner/operators and the economic pressure to exit will increase.

### *Summary*

The South Carolina resident shrimp fleet is under considerable economic pressure from several sources. First, nonresident vessels are taking a larger share of the commercial licenses and tend to have larger vessels shrimping in South Carolina waters. Second, increased shrimp baiting catch may limit the total commercial catch in South Carolina waters. Finally, mid and large commercial vessels are operating on very thin profit margins (or losses) and some will be hard pressed to stay in shrimping even at 1999 levels of commercial catch.

To maintain the long run viability of the SC commercial shrimp trawler fleet with 1999 vessel numbers and size distribution, annual landings by the commercial fleet need to increase. This might be accomplished in several ways. If shrimp baiting were shown to reduce commercial catch, then increased shrimp baiting license fees and/or reductions in limits on the size of the recreational catch would be one avenue for improving the prospects for commercial shrimpers

## **Possible Effects of the Shrimp-Baiting Fishery On the Economic Performance of The South Carolina Shrimp Trawling Industry and Related Economic Impacts<sup>1</sup>**

### **Introduction**

Shrimp-baiting in South Carolina increased substantially during the 1990s. In 1988, there were 5,509 shrimp-baiting permits and total heads-off catch by the shrimp baiters was approximately 700,000 pounds. From 1997 to 1999, an average of 16,293 annual baiting permits were sold. The estimated catch by baiters was about 1,800,000 pounds per year representing 37% of the total fall catch, DeLancey, (2000). This growth in popularity of shrimp baiting has stimulated interest in the potential implications of the shrimp-baiting fishery on the economic performance of the commercial shrimp trawling industry in South Carolina (Low and Waltz (2000).

Two economic issues confront the existing commercial shrimp trawling industry and supporting businesses. First, if the shrimp-baiting fishery reduces the catch rates of the South Carolina trawler fleet during the fall season, how will the profitability of commercial trawlers be affected? Second, if the shrimp-baiting fishery has a significant negative impact on the profitability of commercial trawlers, what are the likely aggregate economic impacts on the commercial fleet and coastal counties in South Carolina?

The objectives of this report are:

1. To estimate the microeconomic performance of representative owner/operators in the South Carolina shrimp trawler industry, under current conditions;
2. To simulate possible effects of the shrimp-baiting fishery on the economic viability of the South Carolina shrimp trawler industry;
3. To estimate the economic impacts of potential reductions in the South Carolina shrimp trawler fleet on the South Carolina coastal economy under scenarios of sustained reductions in commercial landings.

To meet these objectives, this report provides:

- Enterprise budgets for representative commercial shrimp trawlers operating in South Carolina in 1999.
- Internal rates of return on investments in commercial shrimp trawlers.
- Break-even analysis of possible incremental economic effects of sustained reductions in landings on commercial shrimp trawlers in South Carolina.
- Interindustry analyses of the aggregate economic impacts of reductions in the size of the commercial shrimp trawling fleet on the coastal economy of South Carolina in 1999.
- Implications of research findings for South Carolina shrimp fishery management.

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<sup>1</sup> The views in this report are solely the authors and do not necessarily reflect those of the South Carolina Department of Natural Resources or the Marine Resources Division.

## **Related Research**

Previous research on the economic performance of the shrimp trawling industry is limited. Hayenga, et al. (1974) estimate operating budgets and investment analysis for shrimp vessels in the Gulf of Mexico shrimp fishery. Data for this analysis were collected from interviews of captains/operators of nine medium-sized vessels (53-65 feet) and 21 large-sized vessels (66 to 72 feet). The results reported in this report follow the methodology of the Hayenga, Lacewell, and Griffin -- enterprise budgets were developed for representative shrimp vessel operations.

Jones (1977) investigated the association between the characteristics of South Carolina shrimp trawling operations and the profitability of these operations. Jones conducted personal interviews with 42 South Carolina shrimp vessel owners. Results indicate that the principal determinant of profitability was the operator's ability to reduce costs associated with catch.

Keithly et al (1989) analyzed the economic impact of farm-raised shrimp imports on the shrimp trawling industry in the Gulf of Mexico and South Atlantic states. The econometric model developed by Keithly et al found that dockside prices for U.S. shrimpers would increase by 70 percent in the absence of farm-raised shrimp imports.

Ward and Sutinen (1994) modeled entry and exit behaviors of commercial shrimp vessels in the Gulf of Mexico over the 1965 to 1983 period. They find a "resistance to vessels are more willing to enter the fishery when profits rise than they are to exit when profits fall. However, they also find that "capital flows rapidly into and out of the shrimp fishery in response to changes in abundance" of shrimp (Ward and Sutinen (1994: 931). Funk et al. (1998) develop methods for estimating costs and returns trends using information in the National Marine Fisheries Service (NMFS). They illustrate the methods for the Gulf of Mexico shrimp fishery.

The South Atlantic Fishery Management Council (SAFMC, 1999) provided an overview of the South Atlantic and South Carolina shrimp industry in 1999. According to SAFMC, the shrimp fishery was largest in dollar value of all commercial fisheries in the South Atlantic region. The SAFMC study concludes that the profitability of the commercial trawling industry will depend on the variation in prices and costs to shrimp firms, the intensity of shrimp imports, and global economic trends. The SAFMC notes, however, that the most recent profitability study for the shrimp trawling industry was conducted in 1979. Thus, research is needed for each South Atlantic state on the costs, earnings, and profitability of shrimp trawlers.

Low and Waltz (2000) discuss trends in shrimp baiting in South Carolina. They also explore regulatory options for shrimp baiting and its relation to concerns of commercial shrimp trawler owner/operators.

## **Survey Of Owner/Operators of Commercial Shrimp Trawlers in South Carolina**

Cost and revenue data as well as vessel and operator characteristics were obtained using a mail survey of trawler owners licensed by the South Carolina Department of Natural Resources in fiscal year 1999 (June 30, 1998 to July 1, 1999). Clemson University researchers developed the survey instrument with input provided by commercial shrimp trawlers and the Marine Resources Division of the South Carolina

Department of Natural Resources. A pre-test of the survey instrument was provided by a sample of large vessel owners to ensure that the survey was clear and comprehensive.

After pre-testing the survey instrument, Clemson mailed an advance letter to introduce the study to South Carolina licensed commercial vessel owners. The first wave of the surveys was mailed to all individuals on a preliminary list of shrimp vessel owners licensed in South Carolina in 1999. A letter of support from the presidents of the three branches of the South Carolina Shrimpers Association (SCSA) was included with the survey. Clemson University project staff met with the SCSA organizations on numerous occasions to explain the study and to answer questions that potential participants might have regarding the survey instrument. Confidentiality of survey responses was emphasized. Clemson University mailed a second wave of surveys to non-respondents four weeks after the first mailing. After the second wave was mailed, Clemson University researchers attended the annual statewide SCSA meeting in Charleston, South Carolina to emphasize the importance of the study to operators/owners of commercial trawlers.

### *Response to the Survey*

Population sizes, response rates and sample sizes for three vessel size categories (less than 31 feet in length, 31 to 60 feet, and over 60 feet) are presented in Table 1. In summary, 821 shrimp vessel owners were licensed in South Carolina in 1999 according to preliminary data files supplied by SCDNR.<sup>2</sup> The population of shrimp vessel owners was reduced to 706 after excluding 65 addresses of multiple license owners and 50 bad mail addresses

**Table 1. Response Rates.**

Vessel Size	1999		Sample		Usable Sample		Response rate	
	Population							
	N	%	n	%	n	%	All	Usable
< 31'	271	38.4%	63	46.7%	31	31.3%	23.2%	11.4%
31 to 60	247	35.0%	40	29.6%	36	36.4%	16.2%	14.6%
Over 60'	188	26.6%	32	23.7%	32	32.3%	17.0%	17.0%
Total	706	100.0%	135	100.0%	99	100.0%	19.1%	14.0%

Bad mail addresses: 50, Duplicate addresses, 65, Total Licenses: 821

Following the return of the mail surveys, Clemson researchers conducted telephone interviews of a random sample of non-respondents to test for non-response bias in each of the vessel length categories. Telephone interviews found that respondents and non-respondents were not significantly different with respect to vessel length, number of crew, age of the vessel, and days shrimped per week. However, for the largest boats (61 feet and longer), the percent of household income from shrimping was larger for nonrespondents (87.8%) than for those returning the survey (72.0%). Accordingly, the sample data are representative of the physical characteristics of the trawler fleet and

<sup>2</sup> A first update of this license file indicated a total of 864 licenses sold. Expanded population characteristics are displayed in Table 15 of the text. A second revision of the license file indicated a total of 884 licenses sold as shown in Table 2.

shrimping activity; however, the population of full time commercial shrimpers may be more dependent on shrimping than indicated by the sample data.

*Trends in the Number of Licensed Shrimp Trawlers*

Trends in commercial licenses issued by the South Carolina Department of Natural Resources are summarized in Table 2. In both fiscal years 1989 and 1999, 884 licenses were sold to commercial shrimp trawlers. However, the percentage of licenses sold to SC residents declined from 71.3% of all licenses in 1989 to 59.6% in 1999. As shown in Figure 1, while the number of SC resident trawlers has declined at a slow pace over the 1990s – shedding about 100 SC vessels from 1989 to 1999 -- the number of nonresident trawlers has increased steadily since 1996 adding about 100 vessels to the commercial shrimp trawler fleet fishing in South Carolina during the 1990s.

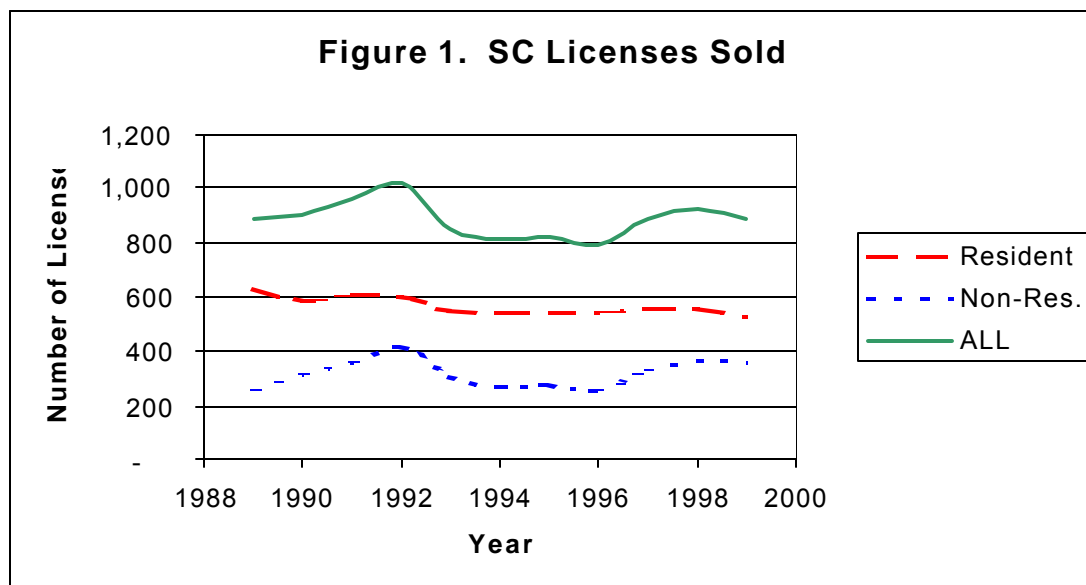
**Table 2 SC Trawler Licenses Sold**

Fiscal year	Number:		ALL	Shares:	
	Resident	Non-Res.		Resident	Non Res
1989	630	254	884	71.3%	28.7%
1990	586	311	897	65.3%	34.7%
1991	604	355	959	63.0%	37.0%
1992	599	417	1,016	59.0%	41.0%
1993	548	304	852	64.3%	35.7%
1994	540	269	809	66.7%	33.3%
1995	544	275	819	66.4%	33.6%
1996	540	253	793	68.1%	31.9%
1997	558	329	887	62.9%	37.1%
1998	554	368	922	60.1%	39.9%
1999	527	357	884	59.6%	40.4%

SC Trawler Licenses sold by Fiscal Year.

Example: FY 1989 is July 1, 1988 thru June 30, 1989

Source: Marine Resources Division, SCDNR, Charleston SC.



### *Vessel Size and State of Ownership*

The size distribution of sample vessels within the three main size groups is shown in Table 3 and by the owner's state of residence in Table 4. By size of vessel, 307 vessels were less than 31 feet in length, 289 were between 31 and 60 feet and the remaining 225 were greater than 60 feet in length. Using the preliminary data file of 821 licenses provided by SCDNR to estimate ownership by size group, South Carolina resident owners made up 62% (511) of the shrimp trawler fleet followed by NC with 22% (181) of the fleet, Georgia residents with 13% (109) and Florida residents with about 2% of the owners of commercial shrimp vessels.

While South Carolina owners made up 62% of all vessels in this preliminary data file, South Carolina had only 34% (77) of the large vessels. NC had nearly 37% (83) of the large vessels followed by Georgia with 21% (48) and Florida with about 7% (15) of the large vessels. In contrast, South Carolina owners represented about 93% (284) of the small vessels. A small majority (about 52% or 150) of the mid-sized vessels were owned by South Carolina residents followed by NC with 31% (89) and Georgia with 16% (47) of all mid-sized vessels.

Both the time trends in Table 2 and the size and state distribution of owners in Tables 3 and 4 suggest that South Carolina resident commercial shrimp trawlers face stiff competition from out-of-state vessels at the high end of the industry. Large out-of-state vessels outnumber South Carolina vessels by a margin of 2 to 1 and there is almost one out-of-state mid-sized vessel for every South Carolina mid-size vessel. Over the 1990s for every added license sold to a nonresident, there was a corresponding loss of one SC resident commercial shrimp trawler.

**Table 3. Distribution of Sample Vessel Length by Size Groups**

BOATSIZE	SAMPLE VESSEL MAXIMUM LENGTH (FEET), 1999.								
	15	30	40	50	60	70	80	100	
Less Than 31	25	35	0	0	0	0	0	0	
31 to 60 ft.	0	0	12	13	15	0	0	0	
More Than 60	0	0	0	0	0	20	10	2	
<b>Total</b>	<b>25</b>	<b>35</b>	<b>12</b>	<b>13</b>	<b>15</b>	<b>20</b>	<b>10</b>	<b>2</b>	



**Table 4. Vessel Owners By State And Size, FY 1998-99.**

SIZE	FL	GA	NC	SC	TN	TX	VA & NY	Total
	0	14	9	284	0	0	0	307
LESS THAN 31 FT	0.00	1.71	1.10	34.59	0.00	0.00	0.0	37.39%
	0.00	4.56	2.93	92.51	0.00	0.00	0.00	
	0.00	12.84	4.97	55.58	0.00	0.00	0.00	
	1	47	89	150	1	0	1	289
31 FT TO 60 FT	0.12	5.72	10.84	18.27	0.12	0.00	0.12	35.20%
	0.35	16.26	30.80	51.90	0.35	0.00	0.35	
	6.25	43.12	49.17	29.35	100.00	0.00	50.0	
	15	48	83	77	0	1	1	225
MORE THAN 60 FT	1.83	5.85	10.11	9.38	0.00	0.12	0.12	27.41%
	6.67	21.33	36.89	34.22	0.00	0.44	0.44	
	93.75	44.04	45.86	15.07	0.00	100.00	50.00	
Total	16	109	181	511	1	1	2	821
%	1.95	13.28	22.05	62.24	0.12	0.12	0.24	100.00

In each cell, the top number is the number of vessels; the second number is the percentage of all vessels represented by that cell; the third number is the row (size group) percentage; and the fourth number is the column (state) percentage. For example, there were 284 licensed small vessels with a South Carolina address representing 34.59% of all licenses, 92.51% of all small vessels and 55.58% of all vessels licensed to a resident of South Carolina.

### *Vessel and Crew Characteristics*

Average vessel and crew characteristics from the sample vessels are provided in Tables 5 and 6 (refer to Appendix A for additional descriptive statistics). The average age of shrimp vessels licensed in South Carolina is 15 to 25 years although current owners typically purchased the vessel from 6 to 13 years ago (Table 5). Vessel purchase price and current market value vary significantly by vessel size. The average 1999 market value increased from \$9,416 to \$62,964 to \$125,234 for small, medium, and large vessels. Shrimping activity also varied significantly by boat size. Small vessels (15 to 30 feet in length) engaged in shrimp harvesting three days per week and only 47 days per year. Medium (31 to 60 feet) and large (61 feet or more) vessels, on the other hand, generally worked full time (five to six days per week and 150 to 200 days per year).

**Table 5. Sample Vessel Characteristics, 1999.**

Vessel Characteristics	15 to 30 ft.	31 to 60 ft.	61 to 100 ft.
	Mean (Standard Error)	Mean (Standard Error)	Mean (Standard Error)
	No. of Observ	No. of Observ	No. of Observ
Year Built	1984 (1.6) [33]	1976 (2.2) [35]	1974 (1.2) [32]
Year Purchased	1993 (0.9) [30]	1992 (1.0) [31]	1986 (1.4) [31]
Purchase Price	\$8,006 (1,156) [31]	\$60,714 (10,046) [35]	\$131,156 (13,935) [32]
Current Market Value (\$)	\$9,416 (1,495) [32]	\$62,964 (8,442) [36]	\$125,234 (12,016) [32]
Owner and operator of Vessel	97% (0.03) [34]	100% (0.00) [37]	100% (0.00) [32]
Days Shrimped in 1999	47 days (11.6) [26]	153 days (11.6) [26]	198 days (10.0) [28]
Days Shrimping per Week	3 days (0.3) [24]	5 days (0.2) [34]	6 days (0.2) [29]

Captain and crew characteristics by vessel size reflect differences between part-time operations of the small vessels and the generally full-time operations of the medium-sized and large vessels (Table 6). Of particular interest is the percentage of household income from shrimping by vessel size. For medium and large boats, the average shares of household income from shrimp are 63% and 72%, respectively. Thus, changes in shrimp catch can have a significant impact on the family incomes of captains of larger vessels. For smaller vessels, however, shrimping contributes, on average, only 17% of household income

**Table 6. Captain and Crew Characteristics, 1999.**

Selected Fishermen's Characteristics	15 to 30 ft.	31 to 60 ft.	61 to 100 ft.
	Mean ( <i>Standard Error</i> ) No. of Observ	Mean ( <i>Standard Error</i> ) No. of Observ	Mean ( <i>Standard Error</i> ) No. of Observ
Years of Captain's Experience	12 (1.7) [27]	20 (1.9) [33]	27 (2.4) [30]
Number of Crewmembers Including Captain	2 (0.2) [29]	2 (0.1) [36]	3 (0.1) [32]
Number of Family Members in Crew	1 (0.2) [25]	2 (1.4) [32]	1 (0.3) [27]
% Striker's Share <sup>1</sup>	15% (4.5) [18]	24% (2.6) [29]	27% (2.9) [30]
% Household Income from Shrimping	17% (5.3) [22]	63% (6.4) [32]	72% (6.1) [30]

<sup>1</sup>Total share of all strikers in crew before expense deductions

### **Profitability of Representative Commercial Shrimp Trawlers in South Carolina**

The profitability of current commercial trawlers is examined from two perspectives. First, operating budgets of representative trawler owner/operators are analyzed to establish current net returns and breakeven rates of shrimp catch and prices for shrimp. Second, the rates of return on investments by representative owners of commercial shrimp trawlers are estimated. Budgets and rate of return are estimated for each of the three sizes of vessel groups. As noted above, there is substantial variation in costs and revenues within each of these size groups. Individual vessel operating budgets and cash flows may be used by owners/operators when planning for the upcoming budget year, assessing the potential profitability effects from reduced catch rates associated with shrimp baiting, or when considering purchase of a new vessel.

### *Operating Budget Analysis—the Current Situation*

The profitability of commercial shrimp trawlers in South Carolina is examined using representative annual operating budgets for trawler owner/operators (the enterprises) licensed to shrimp in South Carolina during 1999. Since these operating budgets reflect the costs and revenues of trawlers in 1999, budget estimates will vary in years where catch rates, shrimp prices, or costs of key inputs like fuel differ substantially from their 1999 levels. The impacts on vessel profitability from variations in catch rates are examined using break-even analysis in the next section.

It is important to emphasize that these operating budgets capture three major facets of the enterprise that will determine profitability: revenues, operating costs (ice, fuel, crew shares, repairs, packing fees, etc.) and ownership costs (insurance, interest on investment, property taxes, and depreciation of capital assets). The annual operating budget can be used to estimate revenues needed for the commercial trawler to stay in business over the long term rather than just to manage cash flow over a given year without regard for the need to replace capital items. Operating budgets can also be used by the trawler owner/operator to evaluate the opportunity costs of staying in the shrimp trawling business rather than selling or leasing their vessel and equipment.

The enterprise operating budgets for each size vessel are presented in Table 7. These data represent an historical accounting of trawler costs and revenues that reflect the situation of the average trawler in each size group.<sup>3</sup> Using the 1999 season average gross price of \$3.83 per pound (heads-off)<sup>4</sup>, the average vessel catch increases from 2,788 pounds for the small vessels to 18,618 for mid-sized vessels to 42,487 for large vessels. The average revenue for each size vessel increases accordingly from \$10,678 to \$71,306 to \$162,725.

As expected, some operating and ownership costs also rise with vessel length. For large vessels (over 60 feet in length), the largest *operating costs* were crew (\$37,549) and captain (\$27,949) labor shares followed by repair and maintenance (\$16,656), fuel (\$14,035), hardware and supplies (\$12,676) and packing fees (\$10,622). All operating costs totaled \$142,659 for the large vessels leaving income above operating costs of \$20,066. *Ownership costs* were led by insurance (about \$9,400), interest on investment (\$7,726) and depreciation (\$4,253). The total cost of operating and owning a large vessel averaged \$166,067. Comparing total cost with total revenues indicates that the average large vessel owner had a negative net annual return in 1999 of \$3,342.

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<sup>3</sup> Vessel efficiencies are proxied here by length of vessel although other vessel characteristics like engine horsepower, propeller size, etc, might be equally as important in determining fishing efficiency (See Hayenga et al. (1974).

<sup>4</sup>The season average gross price of \$3.83 is a \$3.58 heads off price per pound + \$0.25 packing and heading costs per pound. Heads-off price data are from unpublished reports by the South Carolina Department of Natural Resources, 2000. See Appendix B for price and landings trends in South Carolina.

**TABLE 7. Average Annual Reported Vessel Cost and Revenues by South Carolina  
Licensed Shrimp Trawlers, 1999**

	(Vessel size)			
	15 to 30 feet	31 to 60 feet	61 to 100 feet	
<b>Total Revenue</b>	<b>\$10,678.19</b>	<b>\$71,306.66</b>	<b>\$162,725.80</b>	
Operating Costs				
Ice	\$168.93	\$1,766.92	\$6,342.14	
Fuel	\$980.00	\$7,116.45	\$14,035.80	
Groceries	\$98.61	\$1,386.31	\$2,602.56	
Misc. Hardware & Supplies	\$355.54	\$4,770.72	\$12,676.16	
Utilities	\$142.86	\$64.84	\$1,462.68	
Car & Truck Expenses	\$713.62	\$1,255.66	\$2,832.75	
Electronics repair	\$106.21	\$654.09	\$1,611.24	
Hull & Engine repair	\$479.31	\$2,590.68	\$7,350.90	
Gear repair	\$190.36	\$1,883.44	\$7,694.64	
Total Repair & Maintenance	\$775.88	\$5,128.21	\$16,656.78	
Doors	\$87.50	\$913.68	\$1,626.51	
BRD's	\$13.39	\$113.28	\$173.23	
TED's	\$50.00	\$424.48	\$972.53	
Nets	\$278.15	\$2,124.29	\$4,708.69	
Total Equipment Replacement Costs	\$429.04	\$3,575.73	\$7,480.96	
Miscellaneous Costs	\$80.77	\$1,227.96	\$1,837.98	
Interest on operating loans	\$42.00	\$253.24	\$611.12	
<b>Operating costs (exc shr,packing) Subtotal</b>	<b>\$3,787.25</b>	<b>\$26,546.04</b>	<b>\$66,538.93</b>	
Packing (\$.25 per pound)	\$697.01	\$4,654.48	\$10,621.79	
Shares	<b>Captain</b> \$1,886.13	\$12,207.40	\$27,949.06	
	<b>Crew</b> \$1,414.60	\$14,410.83	\$37,549.56	
<b>All Operating Costs Subtotal</b>	<b>\$7,784.99</b>	<b>\$57,818.75</b>	<b>\$142,659.35</b>	
<b>Income above Operating Costs</b>	<b>\$2,893.20</b>	<b>\$13,487.91</b>	<b>\$20,066.45</b>	
<b>Ownership Costs</b>				
License/Regulatory Fees	\$138.08	\$282.90	\$882.19	
Interest on Investment	\$550.03	\$3,714.09	\$7,726.94	
Depreciation reported	\$129.60	\$1,191.07	\$4,253.43	
Hull Insurance	\$86.75	\$1,701.62	\$5,093.32	
Other Insurance	\$0.00	\$101.94	\$224.83	
Job-Related Insurance	\$61.54	\$701.42	\$4,099.13	
Property Tax	\$78.58	\$238.65	\$478.87	
Professional Fees	\$15.96	\$375.77	\$649.47	
	<b>Subtotal</b>	<b>\$1,060.54</b>	<b>\$8,307.46</b>	
<b>Total Costs</b>	<b>\$8,845.53</b>	<b>\$66,126.21</b>	<b>\$166,067.53</b>	
<b>Net Annual Returns</b>	<b>\$1,832.66</b>	<b>\$5,180.45</b>	<b>-\$3,341.73</b>	
<b>Pounds at Heads off Price/pound:</b>	<b>\$3.83</b>	<b>2,788</b>	<b>18,618</b>	<b>42,487</b>
Crew Share after deductions (ice, fuel, groceries)		13%	20%	23%
Captain Share after deductions		18%	17%	17%

Looking next at the mid-sized vessels, those less than 60 feet but larger than 30 feet, total revenues of \$71,306 were offset by \$57,819 in operating costs and \$8,307 in ownership costs. This left net annual revenues of \$5,180 to the owner of the mid-sized vessel. Small vessels earned \$10,678 in revenues, which were offset by \$7,785 in total costs leaving annual returns of \$1,833.

At this juncture, it is important to emphasize several facets of these enterprise budget results. First, the net returns are the payoff to the owner for the investment side of shrimp trawling. Most South Carolina commercial shrimpers are both owners and operators (captains). Accordingly, the household income received by an owner/operator of a shrimp trawler includes both the labor income (captain's share), possibly part of the crew share if family members are also crewmembers, and the net returns to the owner portrayed in Table 7.

Second, owner/operators of small vessels (those less than 31 feet) do not generate enough household income (roughly captain's share + net returns = \$3,719) to sustain a household over a year. Third, while mid-sized vessel owner/operators are able to generate, on-average, a positive net revenue of \$5,180 and a captain share of \$12,207, it would appear that some family crew time is needed to allow the smaller vessels in this range (less than 60 feet and more than 30 feet) to supply enough income to support a household. Larger vessels in this group (between 50 and 60 feet) have revenues that average about \$20,000 higher than the mean for the mid-sized group and are accordingly more likely to be fully reliant on shrimping for most of their household income.

Fourth, South Carolina owner/operators of large vessels, on average, are losing money on their investment if one considers the opportunity or 'holding' cost of the capital tied up in their vessel. However, the labor income of the captain conservatively estimated at about \$28,000 would seem adequate to sustain a household and be competitive with alternative employment opportunities in the area. These are full time operators and some large vessels gross considerably more than the sample mean of \$162,725.

In sum, conventional wisdom holds that a full-time shrimp owner/operator needs to gross about a \$1000 per day during a 150-day season to stay in business. This translates into a daily catch of about 300 pounds (heads-off) at about \$3.50 heads-off price per pound. The sample data indicate that the average large vessel is about at that point with annual catch of about 43,000 pounds and revenues of \$162,000. Analysis of the sample data indicates that about 25% of all vessel owners have revenues above \$150,000. While none of the small vessels had revenues of \$150,000 or more, half of the large vessels had revenues in excess of \$150,000. Only 10 % of the mid-sized vessels had revenues exceeding \$150,000. By this accounting, of the 511 South Carolina resident commercial shrimp trawlers, only 39 of the large vessel owner/operators and 15 of the mid-sized vessel owner/operators are able to sustain a household as a full-time commercial shrimp trawler captain. The remaining 90% of the commercial trawlers must rely on other fishing income, income from family members serving as crew on the shrimp boats, and/or off-season employment outside the fishery to sustain a household.

### *Investment Analysis*

While commercial shrimp trawling may not be a viable *sole* source of household income for most South Carolina commercial trawler owner/operators, investment in a shrimp vessel may be a good investment of capital compared to alternative investment options. Since owners of small, mid-sized, and large vessels have different amounts of capital invested in their vessel, the relative returns to these investments requires computation of the rates of return on invested capital. If these rates of return fall below those available in alternative investments, then owner/operators of shrimp vessels will be more likely to sell their vessels and exit the industry.

To estimate the rate of return to the trawler owner on the investment in a vessel and its related equipment, cash flow budgets are estimated on an annual basis over the life of the vessel. *Rate of return analysis* also can be used to evaluate new investments in a trawler and related equipment. In this case, cash flow is simply annual revenue less annual operating costs, annual payments for fees, insurance, and principal and interest on loans used to finance the purchase of the vessel, if any. In the South Carolina case, cash flows over the life of the vessel (20 years) are estimated with all equity financing since it is assumed that the average owner/operator in the current fleet owns his vessel outright.<sup>5</sup>

Annual cash flows to the owner are shown in Table 8. Income above operating costs increases steadily from \$2,914 for small vessels to \$13,488 for mid-sized vessels and to \$20,066 for large vessels. However, disproportional payments for insurance associated with larger crews on large vessels reduces the advantages of the larger vessels in cash flow estimates with mid-sized vessels yielding \$10,086 per year to the vessel investment while large vessel cash flow is \$8,639.

In Table 9, the present value of the cash flows over the 20-year period are estimated and compared to the vessel owner investment to find the internal rate of return (IRR) to the investor. Owners of small vessels have equity of about \$10,000 in their trawler according to sample estimates of current market value of the vessel. At present, this investment is expected to yield about a 26% rate of return on the capital.

Mid-size vessels with equity investments of \$67,253 are expected to yield a return of about 14% per year if current cash flows persist over the next 20 years. Surprisingly, large vessels are expected to yield only about 3% on the investment if catch rates and associated cash flows continue at 1999 levels for the next 20 years.

It should be emphasized that the returns estimated are for owner/operators in contrast to an outside investor/owner looking for a return on capital invested in vessel and equipment. As traditional investment analysis dictates, the owner/operator should consider labor time as a captain (or the wages forgone in the next best employment opportunity) as an expense that reduces cash flow from the investment.

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<sup>5</sup> For an individual vessel, the cash flow analysis can be examined from a wide range of external financing options – 6 year loan with a 20% down payment, for example. In this case, the cash flows will be reduced for each of the first six years of operation by the amount of the loan principal and interest. However the present value of the 20 year net returns stream is then compared to the 20% down payment (equity investment) at alternative discount rates to find the internal rate of return on the investment.

**Table 8. Average Annual CASH FLOW: South Carolina Licensed Shrimpers, 1999**

	(Vessel size)		
	15 to 30 feet	31 to 60 feet	61 to 100 feet
<b>Total Revenue from Production</b>	<b>\$10,678.19</b>	<b>\$71,306.66</b>	<b>\$162,725.80</b>
<b>Operating Costs</b>			
Ice	\$168.93	\$1,766.92	\$6,342.14
Fuel	\$980.00	\$7,116.45	\$14,035.80
Groceries	\$98.61	\$1,386.31	\$2,602.56
Misc. Hardware & Supplies	\$355.54	\$4,770.72	\$12,676.16
Utilities	\$142.86	\$64.84	\$1,462.68
Car & Truck Expenses	\$713.62	\$1,255.66	\$2,832.75
Electronics repair	\$106.21	\$654.09	\$1,611.24
Hull & Engine repair	\$479.31	\$2,590.68	\$7,350.90
Gear repair	\$190.36	\$1,883.44	\$7,694.64
<b>Total Repair &amp; Maintenance</b>	<b>\$775.88</b>	<b>\$5,128.21</b>	<b>\$16,656.78</b>
Doors	\$87.50	\$913.68	\$1,626.51
BRD's	\$13.39	\$113.28	\$173.23
TED's	\$50.00	\$424.48	\$972.53
Nets	\$278.15	\$2,124.29	\$4,708.69
<b>Total Equipment Replacement Costs</b>	<b>\$429.04</b>	<b>\$3,575.73</b>	<b>\$7,480.96</b>
Interest on Operating Loans	\$42.00	\$253.24	\$611.12
Miscellaneous Costs	<b>\$80.77</b>	<b>\$1,227.96</b>	<b>\$1,837.98</b>
<b>Operating costs</b>	<b>Subtotal</b>	<b>\$3,787.25</b>	<b>\$26,546.04</b>
Packing (\$.25 per pound)	\$697.01	\$4,654.48	\$10,621.79
Shares	<b>Captain</b>	\$1,886.13	\$12,207.39
	<b>Crew</b>	\$1,393.85	\$14,410.83
<b>All Operating Costs</b>	<b>Subtotal</b>	<b>\$7,764.24</b>	<b>\$57,818.75</b>
		<b>\$142,659.35</b>	
<b>Income above Operating Costs</b>	<b>\$2,913.95</b>	<b>\$13,487.91</b>	<b>\$20,066.45</b>
<b>Ownership Costs</b>			
License/Regulatory Fees	\$138.08	\$282.90	\$882.19
Hull Insurance	\$86.75	\$1,701.62	\$5,093.32
Other Insurance	\$0.00	\$101.94	\$224.83
Job-Related Insurance	\$61.54	\$701.42	\$4,099.13
Property Tax	\$78.58	\$238.65	\$478.87
Professional Fees	\$15.96	\$375.77	\$649.47
	<b>Subtotal</b>	<b>\$380.91</b>	<b>\$3,402.30</b>
		<b>\$11,427.81</b>	
<b>Total Costs</b>	<b>\$8,145.15</b>	<b>\$61,221.05</b>	<b>\$154,087.16</b>
<b>OWNER ANNUAL NET RETURNS:</b>	<b>\$2,533.04</b>	<b>\$10,085.61</b>	<b>\$8,638.64</b>
<b>Pounds at Heads off Price/pound:</b>	<b>\$3.83</b>	<b>2,788</b>	<b>18,618</b>
		<b>42,487</b>	



**Table 9. Average Net Present Values of Cash Flows & Internal Rates of Return Before Income Taxes to South Carolina Licensed Trawler Owners, by Vessel Length, 1999<sup>a</sup>**

Less than 31 ft	<u>Net Present Values</u>			Internal rate of return
	Between 31 to 60 ft	More than 60 ft		
\$8,995.92	\$35,858.12	\$30,824.66	28	
\$9,666.22	\$38,541.71	\$33,164.35	26	
\$10,438.35	\$41,636.57	\$35,872.57	24	
\$11,335.27	\$45,236.61	\$39,036.66	22	
\$12,386.67	\$49,463.55	\$42,770.82	20	
\$13,631.26	\$54,476.76	\$47,226.09	18	
\$15,120.10	\$60,487.17	\$52,604.51	16	
\$16,921.23	\$67,777.03	\$59,179.37	14	
\$19,126.39	\$76,728.31	\$67,324.78	12	
\$21,860.56	\$87,863.87	\$77,558.90	10	
\$25,296.07	\$99,022.05	\$84,815.49	8	
\$29,673.33	\$115,681.20	\$99,084.57	6	
\$35,331.69	\$143,205.48	\$129,724.05	4	
\$42,756.05	\$173,966.13	\$159,423.87	2	

<sup>a</sup> Assumes a 20 year life of vessel with salvage value of 20% of current value. Also assumes an average 1999 vessel cost of \$9,935 for small vessels; \$67,253 for medium-sized; and \$134,996 for large vessels. Vessel costs include estimated mean equipment costs.

Alternatively, the combined captain's share and net returns above other operating and ownership costs (net of depreciation and interest on investment) can be used as the household income from owning and operating a shrimp trawler. Estimated household incomes (captain's share + cash flow) are displayed in Table 10.

From the perspective of the owner/operator of the shrimp trawler, household income from shrimping activities increases from about \$4,419 for small vessels to \$22,293 for mid-sized vessels and to \$36,588 for large vessels. These are averages for the vessel size groups and there is substantial variation within each group. Additions to household income earned in other uses of the vessel for fishing or earnings by family members from crew share are possible.

In the next section, the impacts of potential reductions in catch from increased bait shrimping or other causes (e.g., hard freezes, drought or regulatory closures) on commercial shrimp trawler owner/operator enterprise budgets, cash flow and household incomes are estimated. Consequences for the size of the South Carolina trawler fleet are then summarized.

**Table 10. Household Income to South Carolina Shrimp Trawler Owner/Operators, 1999**

	(Vessel size)			
	15 to 30 feet	31 to 60 feet	61 to 100 feet	
<b>Total Revenue from Production</b>	<b>\$10,678.19</b>	<b>\$71,306.66</b>	<b>\$162,725.8</b>	
Operating Costs				
Operating costs (exc shares)	Subtotal	\$3,787.25	\$26,546.04	\$66,538.9
Packing (\$.25 per pound)		\$697.01	\$4,654.48	\$10,621.7
Shares	Crew	\$1,393.85	\$14,410.83	\$37,549.5
<b>All Operating Costs</b>	<b>Subtotal</b>	<b>\$5,878.11</b>	<b>\$45,611.35</b>	<b>\$114,710.2</b>
<b>Income above Operating Costs</b>		<b>\$4,800.08</b>	<b>\$25,695.31</b>	<b>\$48,015.5</b>
Ownership Costs				
License/Regulatory Fees		\$138.08	\$282.90	\$882.1
Hull Insurance		\$86.75	\$1,701.62	\$5,093.3
Other Insurance		\$0.00	\$101.94	\$224.8
Job-Related Insurance		\$61.54	\$701.42	\$4,099.1
Property Tax		\$78.58	\$238.65	\$478.8
Professional Fees		\$15.96	\$375.77	\$649.4
	<b>Subtotal</b>	<b>\$380.91</b>	<b>\$3,402.30</b>	<b>\$11,427.8</b>
<b>Total Costs</b>		<b>\$6,259.02</b>	<b>\$49,013.65</b>	<b>\$126,138.1</b>
<b>CAPTAIN / OWNER ANNUAL NET RETURNS: INCLUDING CAPTAIN SHARE</b>		<b>\$4,419.17</b>	<b>\$22,293.01</b>	<b>\$36,587.7</b>

\*See Table 8 of this report

### Effects of Reduced Landings on the Economic Viability of Commercial Shrimp Trawlers

Consequences of reduced catches on the profitability of shrimp trawlers are simulated in two ways. First, a breakeven analysis for the three vessel sizes is made. Second, the effects of reduced catch from shrimp baiting or other causes on cash flow to the vessel owner/operator are estimated. The cash flow estimates are used to estimate the impact of catch reductions on: (1) the rate of return to the vessel owner/operator in the investment of capital and (2) income accruing to the owner/operator household.

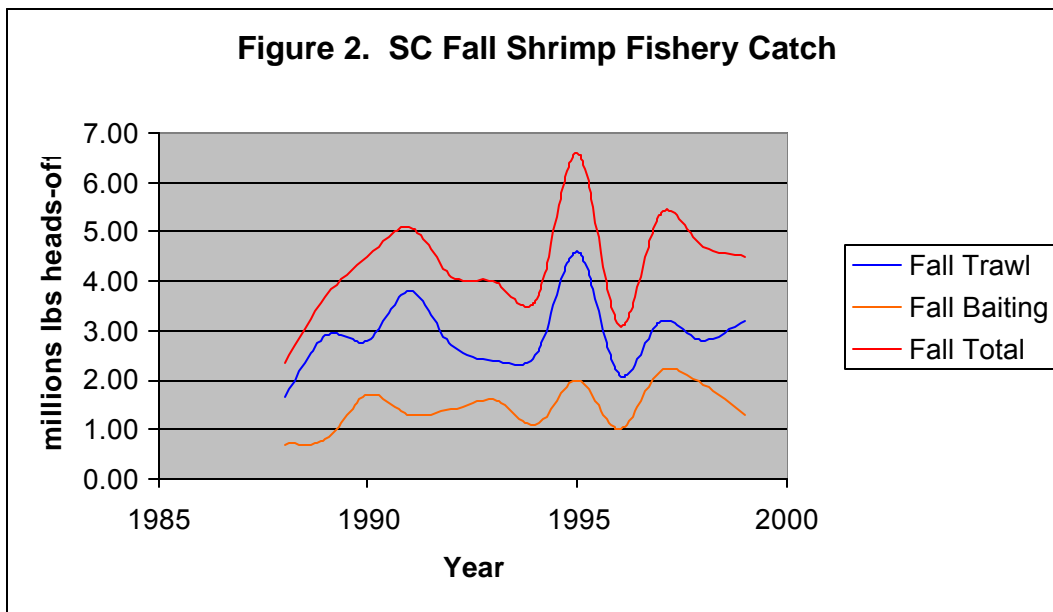
Simulations of possible effects of sustained reductions in commercial landings on the trawler fleet's performance are based on assumed reductions of annual catch by commercial trawlers from its 1999 level. Historical catch data are displayed in Table 11 and Figure 2. About two-thirds of the commercial catch is in the fall season. In some years the commercial and bait catch move in the same direction – in others they diverge.

**Table 11. Fall Trawler and Total Trawler Catch**

YEAR	Baiting PERMITS	Fall				Annual Trawl Mil lbs HO	Total	Trawl Fall Catch as % of Total Trawl Catch
		TRAWL Mil lbs HO	BAIT Mil lbs HO	Fall Total Mil lbs HO % baiter				
1988	5,509	1.64	0.70	2.34	29.9	2.77	3.47	59.2%
1989	6,644	2.90	0.80	3.70	21.6	4.66	5.46	62.2%
1990	9,703	2.80	1.70	4.50	37.8	3.72	5.42	75.3%
1991	12,005	3.80	1.30	5.10	25.5	5.92	7.22	64.1%
1992	11,571	2.70	1.40	4.10	34.1	4.26	5.66	63.3%
1993	12,984	2.40	1.60	4.00	40.0	5.29	6.89	45.4%
1994	13,366	2.50	1.10	3.60	30.6	3.48	4.58	71.9%
1995	13,919	4.60	2.00	6.60	30.3	6.86	8.86	67.1%
1996	14,156	2.10	1.00	3.10	32.3	3.44	4.44	61.0%
1997	15,488	3.20	2.20	5.40	40.7	4.26	6.46	75.2%
1998	17,497	2.80	1.90	4.70	40.4	4.07	5.97	68.7%
1999	15,895	3.20	1.30	4.50	28.9	4.40	5.70	72.7%
12 year total		34.64				53.14		65.2%

Note 1999 data are preliminary

Source: DeLancey, SC DNR, 2000 unpublished data.



Five simulations are performed in increments of 10% point reductions ranging from 10% to 50% of the 1999 baseline catch. *It is important to note that each scenario assumes a persistent annual reduction from the 1999 baseline.* For example under the 20% reduction scenario, it is assumed that the annual catch of the commercial fleet stays at 80% of its 1999 level over the life of a vessel (20 years). These “what-if” reductions in commercial catch may be attributed to the expected expansion in shrimp baiting permits.

### *Breakeven Analysis*

In the simulations provided below, the impacts of reductions in catch (given a constant price over the period) translate into direct reductions to trawler owner/operator revenues with reductions in some operating costs (crew share and packing fees that are proportional to revenues and pounds of shrimp landed). Other operating costs vary little with catch rate (fuel, ice, repair and maintenance), and fixed ownership costs remain constant as the catch rate and revenues decline. As Hayenga et al. (1974: 4) note, most variable operating costs for commercial shrimp vessels are incurred before the vessel sails so they vary little with the amount of shrimp landed. A key exception in our analysis is that crew and captain “shares” and packing fees vary proportionally with the catch. The key issue in breakeven analysis is how far catch and revenues can fall from their 1999 levels before the representative shrimp trawler just covers all costs (with a net return of 0). In this analysis, the captain, as owner/operator, with a net return of zero will simply cover all costs and receive a labor share.

As shown in Table 12, the captain of a small vessel will break-even and receive labor income of \$1259 even if catch falls by 29.4% *from average reported revenues in Table 8*. Similarly, medium size vessel owner/operators that are willing to shrimp for annual incomes of \$10,129 can cover all costs even if catch falls by 14.6 % *from reported averages in Table 8* with a constant price—the price taker assumption for the South Carolina market. However, large vessel owner/operators, who are willing to shrimp for annual incomes of \$29,383, need to increase their catch by 4.4 % to break-even.

The mean catch levels reported in Table 8, however, are higher than can be supported by the actual aggregate catch recorded by SCDNR for 1999. As we discuss in the Macro Impacts section of this report (starting on page 25), mean reported catch for each vessel size is adjusted so that estimated catch equals the benchmark aggregate catch of 5.12 million pounds (heads-off) in 1999. This benchmarking (explained in the discussion of Table 17) results in lower per vessel catch allotments. Breakeven catch exceeds these adjusted catch estimates for mid and large vessels which results in the exit of some vessels even at 1999 levels of aggregate shrimp landings. Small vessels have a reduction in the excess of estimated catch over breakeven amounts – reducing the number of small vessels that can enter the fleet.

**Table 12. Break Even Analysis Based on annual Average Reported Shrimp Trawler Costs and Revenues, 1999**

	(Vessel Size)		
	15 to 30 feet	31 to 60 feet	61 to 100 ft
<b>Total Revenue from Production</b>	<b>\$7,543.96</b>	<b>\$60,917.20</b>	<b>\$169,896.49</b>
<b>Operating Costs</b>			
Ice	\$168.93	\$1,766.92	\$6,342.14
Fuel	\$980.00	\$7,116.45	\$14,035.80
Groceries	\$98.61	\$1,386.31	\$2,602.56
Misc. Hardware & Supplies	\$355.54	\$4,770.72	\$12,676.16
Utilities	\$142.86	\$64.84	\$1,462.68
Car & Truck Expenses	\$713.62	\$1,255.66	\$2,832.75
Electronics repair	\$106.21	\$654.09	\$1,611.24
Hull & Engine repair	\$479.31	\$2,590.68	\$7,350.90
Gear repair	\$190.36	\$1,883.44	\$7,694.64
Total Repair & Maintenance	\$775.88	\$5,128.21	\$16,656.78
Doors	\$87.50	\$913.68	\$1,626.51
BRD's	\$13.39	\$113.28	\$173.23
TED's	\$50.00	\$424.48	\$972.53
Nets	\$278.15	\$2,124.29	\$4,708.69
Total Equipment Replacement Costs	\$429.04	\$3,575.73	\$7,480.96
Miscellaneous Costs	\$80.77	\$1,227.96	\$1,837.98
Interest on operating loans	\$42.00	\$253.24	\$611.12
Operating costs (exc shares)	\$3,787.25	\$26,546.04	\$66,538.93
Packing(\$ .25 per pound)	\$492.43	\$3,976.32	\$11,089.85
<b>Shares</b>	<b>\$1,259.28</b>	<b>\$10,129.50</b>	<b>\$29,383.20</b>
<b>Captain</b>			
Crew	\$944.46	\$11,957.88	\$39,476.33
<b>All Operating Costs</b>	<b>\$6,483.42</b>	<b>\$52,609.74</b>	<b>\$146,488.31</b>
<b>Income above Operating Costs</b>	<b>\$1,060.54</b>	<b>\$8,307.46</b>	<b>\$23,408.18</b>
<b>Ownership Costs</b>			
License/Regulatory Fees	\$138.08	\$282.90	\$882.19
Interest on Investment	\$550.03	\$3,714.09	\$7,726.94
Depreciation reported	\$129.60	\$1,191.07	\$4,253.43
Hull Insurance	\$86.75	\$1,701.62	\$5,093.32
Other Insurance	\$0.00	\$101.94	\$224.83
Job-Related Insurance	\$61.54	\$701.42	\$4,099.13
Property Tax	\$78.58	\$238.65	\$478.87
Professional Fees	\$15.96	\$375.77	\$649.47
Sub total ownership costs:	<b>\$1,060.54</b>	<b>\$8,307.46</b>	<b>\$23,408.18</b>
<b>Total Costs</b>	<b>\$7,543.96</b>	<b>\$60,917.20</b>	<b>\$169,896.49</b>
<b>Net Annual Returns</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$0.00</b>
<b>Breakeven Pounds (Price = \$3.83 HO)</b>	<b>1,970</b>	<b>15,905</b>	<b>44,359</b>
<b>Catch CHANGE for breakeven</b>	<b>-29.4%</b>	<b>-14.6%</b>	<b>4.4%</b>

*Rate of Return if Commercial Landings Decline*

A second perspective on the impacts of reduced catch by commercial trawlers looks at the changes in cash flow, internal rate of return, and household incomes. In Table 13, the expected cash flows and rates of return are computed for the six cases: continuation of the 1999 baseline (no reduction), and reductions in catch and revenues of 10%, 20%, 30%, 40% and 50%. This analysis assumes that the South Carolina trawler operator is a price taker and that national supply (other domestic and imports) will not be substantially affected by reduced commercial catch in South Carolina.

**Table 13. Projected Impacts on Annual Average Cash Flow on South Carolina Licensed Trawler Owners from Reduced Catch**

Impacts on Cash Flow from Reduced Catch	(Vessel Size)		
	15 to 30 feet	31 to 60 feet	61 to 100 feet
Total Revenue from Production: <b>Baseline 1999</b>	\$10,678	\$71,307	\$162,726
Total Costs	\$8,145	\$61,221	\$154,087
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$2,533</b>	<b>\$10,086</b>	<b>\$8,639</b>
<i>Internal rate of return</i>	26%	14%	3%
Total Revenue from Production <b>10% reduction</b>	\$9,610	\$64,176	\$146,453
Total Costs	\$7,704	\$57,646	\$145,398
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$1,906</b>	<b>\$6,530</b>	<b>\$1,055</b>
<i>Internal rate of return</i>	19%	7%	negative
Total Revenue from Production <b>20% reduction</b>	\$8,543	\$57,045	\$130,181
Total Costs	\$7,263	\$54,071	\$136,709
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$1,280</b>	<b>\$2,975</b>	<b>-\$6,528</b>
<i>Internal rate of return</i>	12%	1%	negative
Total Revenue from Production <b>30% reduction</b>	\$7,475	\$49,915	\$113,908
Total Costs	\$6,822	\$50,496	\$128,020
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$653</b>	<b>-\$581</b>	<b>-\$14,112</b>
<i>Internal rate of return</i>	4%	negative	negative
Total Revenue from Production <b>40% reduction</b>	\$6,407	\$42,784	\$97,635
Total Costs	\$6,381	\$46,921	\$119,331
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$26</b>	<b>-\$4,137</b>	<b>-\$21,695</b>
<i>Internal rate of return</i>	negative	negative	negative
Total Revenue from Production <b>50% reduction</b>	\$5,339	\$35,653	\$81,363
Total Costs	\$5,940	\$43,345	\$110,641
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>-\$601</b>	<b>-\$7,692</b>	<b>-\$29,279</b>
<i>Internal rate of return</i>	negative	negative	negative

There are dramatic impacts from reduced catch and revenues. First, owners of all vessels experience reductions in cash flows and rates of return on capital invested in

vessels from even a 10% sustained reduction in revenues.<sup>6</sup> From a return on investment perspective, large vessel owners seem to have two principal choices if confronted with catch reductions. First, they could exit the industry in large numbers with even a 10% permanent decline in catch in the South Carolina fishery from 1999 levels. Second, they might relocate residence and/or fish in a wider area to make up for lost catch in the South Carolina fishing areas. This would mean added costs from relocation expenses and/or added costs in landing 1999 levels of shrimp.

Owners of mid-sized vessels find the return to investment in their vessel fall from 14% in 1999 to 7% with a sustained 10% reduction in catch. A 20% reduction in catch for mid-sized vessels yields only a 1% return on investment. Beyond a 20% decline, returns are negative. Since the mid-size owner/operators are earning only about half the captain's share of larger vessel owners, shrimping for this group could only be a part-time job if catch rates fell by 20%. However, owners of small vessels do surprisingly well even if catch falls by 20% since they have relatively small amounts of capital invested in their vessels. Small vessel owners will find that their rates of return fall from 26% under 1999 conditions to 19% with a 10% cut in catch and to 12% with a 20% reduction in catch. Still, these are part-time shrimpers as the cash flow from shrimping was only about \$2,500 per year in 1999.

The household income perspective (cash flow + captain's share) is summarized in Table 14. A 10% catch reduction would reduce annual income from shrimping for large vessel owners from \$36,587 in 1999 to \$25,749 and would reduce it to \$14,911 with a 20% catch reduction. Owners of mid-sized vessels would find their incomes from shrimping falling from \$22,293 in 1999 to \$17,311 with a 10% catch reduction and to \$12,330 with a 20% catch reduction. Catch reductions of 30% or more would appear to drive even the most dedicated shrimp vessel owner/operator out of the industry.

In the next section, we describe changes in fleet size and the impacts on the coastal economy of South Carolina if shrimp catch declines. As vessels exit the fleet, the remaining vessels will be able to increase catch. Below we allow vessels to exit until the reduced aggregate catch is adequate to support each vessel size at their breakeven catch levels portrayed in Table 12. Breakeven revenues are **\$7,543, \$60,917, and \$169,896** for small, medium and large vessels, respectively. Given a fixed average 1999 gross price of **\$3.83** per pound these revenues streams are equivalent to annual catches per year of **1,970, 15,905 and 44,359** (in pounds of head-off shrimp) for small, medium and large vessels, respectively

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<sup>6</sup> These simulations assume a permanent reduction in catch and revenues over the 20-year life of the vessel. It is the impact of sustained reductions in catch and cash flow that produce the effects on permanent cash flow and rate of return shown in the text.

**Table 14. Impacts on Household Income of South Carolina Shrimp Trawler Owner/Operators  
From Reduced Catch, 1999**

	(Vessel size)		
	15 to 30 feet	31 to 60 feet	61 to 100 feet
<b>Total Revenue from Production: Baseline 1999</b>	\$10,678.19	\$71,306.66	\$162,725.80
<b>Total Costs</b>	\$6,259.02	\$49,013.65	\$126,138.10
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$4,419.17</b>	<b>\$22,293.01</b>	<b>\$36,587.70</b>
<b>Total Revenue from Production: 10% REDUCTION</b>	\$9,610.37	\$64,175.99	\$146,453.22
<b>Total Costs</b>	\$6,031.50	\$46,864.65	\$120,703.47
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$3,578.88</b>	<b>\$17,311.34</b>	<b>\$25,749.75</b>
<b>Percent Change From Baseline</b>	<b>-19.0%</b>	<b>-22.3%</b>	<b>-29.6%</b>
<b>Total Revenue from Production: 20% REDUCTION</b>	\$8,542.55	\$57,045.33	\$130,180.64
<b>Total Costs</b>	\$5,803.97	\$44,715.65	\$115,268.85
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$2,738.58</b>	<b>\$12,329.68</b>	<b>\$14,911.79</b>
<b>Percent Change From Baseline</b>	<b>-38.0%</b>	<b>-44.7%</b>	<b>-59.2%</b>
<b>Total Revenue from Production: 30% REDUCTION</b>	\$7,474.73	\$49,914.66	\$113,908.06
<b>Total Costs</b>	\$5,576.45	\$42,566.65	\$109,834.23
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$1,898.29</b>	<b>\$7,348.01</b>	<b>\$4,073.83</b>
<b>Percent Change From Baseline</b>	<b>-57.0%</b>	<b>-67.0%</b>	<b>-88.9%</b>
<b>Total Revenue from Production: 40% REDUCTION</b>	\$6,406.91	\$42,784.00	\$97,635.48
<b>Total Costs</b>	\$5,348.92	\$40,417.66	\$104,399.61
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$1,057.99</b>	<b>\$2,366.34</b>	<b>-\$6,764.13</b>
<b>Percent Change From Baseline</b>	<b>-76.1%</b>	<b>-89.4%</b>	<b>-118.5%</b>
<b>Total Revenue from Production: 50% REDUCTION</b>	\$5,339.10	\$35,653.33	\$81,362.90
<b>Total Costs</b>	\$5,121.40	\$38,268.66	\$98,964.99
<b>CAPTAIN / OWNER ANNUAL NET RETURNS:</b>	<b>\$217.70</b>	<b>-\$2,615.33</b>	<b>-\$17,602.09</b>
<b>Percent Change From Baseline</b>	<b>-95.1%</b>	<b>-111.7%</b>	<b>-148.1%</b>

### **Macro Impacts On the Commercial Shrimp Vessel Fleet and Coastal Economy in South Carolina**

Estimates of the macro-economic impacts (income, sales and employment) on South Carolina coastal counties are based on 1999 conditions and scenarios related to the possible incremental effects of the shrimp-baiting fishery. The coastal area locations of commercially licensed vessels that were owned by South Carolina residents in 1999 are displayed in Table 15. The Southern region (Beaufort, Colleton, and Jasper counties) is home to the most vessels (208) and so is most likely to be affected by declines in commercial shrimping. The Central region (Berkeley, Charleston, and Dorchester counties), while home to fewer vessels, has more large vessels (37) and nearly as many mid-sized vessels (64) as the Southern region. In contrast to the Central and Southern regions, the Northern region (Horry and Georgetown counties) is dominated by small



**Table 15. Residency regions of South Carolina trawler owners by vessel length, FY 1998-99**

<b>Part A. Vessel Size Groups*</b>				
<b>Residency Region</b>	<b>&lt;31</b>	<b>31 to 60</b>	<b>60+ Totals</b>	
Northern, SC	106	15	14	135
	78.5%	11.1%	10.4%	100.0%
Central, SC	29	64	37	130
	22.3%	49.2%	28.5%	100.0%
Southern, SC	114	68	26	208
	54.8%	32.7%	12.5%	100.0%
<b>SC Coastal Totals:</b>	<b>249</b>	<b>147</b>	<b>77</b>	<b>473</b>
	<b>52.6%</b>	<b>31.1%</b>	<b>16.3%</b>	<b>100.0%</b>
SC Non-Coastal	45	6	0	51
	88.2%	11.8%	0.0%	100.0%
SC Totals:	294	153	77	524
	56.1%	29.2%	14.7%	100.0%
Out-of-State	23	153	164	340
	6.8%	45.0%	48.2%	100.0%
<b>Totals:</b>	<b>317</b>	<b>306</b>	<b>241</b>	<b>864</b>
	<b>36.7%</b>	<b>35.4%</b>	<b>27.9%</b>	<b>100.0%</b>

\* Two license records had zero or a blank for vessel length.

<b>Regions</b>	<b>Part B. Vessel Greater Than 30 Feet:</b>			<b>Percentages by Column</b>		
	<b>Percentage by Region</b>			<b>31 to 60</b>	<b>60+</b>	<b>Totals</b>
	<b>31 to 60</b>	<b>60+</b>	<b>Totals</b>			
Northern	15	14	29	2.7%	2.6%	5.3%
	51.7%	48.3%	100.0%			
Central**	67	37	104	12.2%	6.8%	19.0%
	64.4%	35.6%	100.0%			
Southern**	71	26	97	13.0%	4.8%	17.7%
	73.2%	26.8%	100.0%			
<b>SC Totals:</b>	<b>153</b>	<b>77</b>	<b>230</b>	<b>28.0%</b>	<b>14.1%</b>	<b>42.0%</b>
	66.5%	33.5%	100.0%			
Out-of-State	153	164	317	28.0%	30.0%	58.0%
	48.3%	51.7%	100.0%			
<b>Totals:</b>	<b>306</b>	<b>241</b>	<b>547</b>	<b>55.9%</b>	<b>44.1%</b>	<b>100.0%</b>

Northern, SC- Georgetown & Horry Co.; Central, SC-Berkeley, Charleston & Dorchester Co.,

Southern, SC-Beaufort, Colleton, & Jasper Co.

\*\* Six Non-Coastal Counties were assigned to the Southern and Central areas based upon the location of their inland county.

(Source: Ray Rhodes, SCDNR)

vessels although there are 29 larger vessels that have homeports in the Northern region. Accordingly, one would expect smaller impacts from reduced shrimp trawling in the Northern region than in the Central or Southern regions.

The South Carolina Department of Natural Resources defines “regular” shrimp vessels, 31 feet and larger, as those that unloaded shrimp in South Carolina more than four times in 1999. The distribution of these “regular” vessels across SC regions is displayed in Table 16.<sup>7</sup> According to the SCDNR, these “regular” vessels comprise the

**Table 16. Vessels over 30 feet in length regularly unloading in South Carolina during the 1999 trawler season**

Regions	"Regular"* Vessels	Vessel Size Groups:***							
		Residency**:		Resident		Non-Resident		All Vessels	
		SC	Non-SC	31 to 60 ft.	> 60 ft.	31 to 60 ft.	> 60 ft.	31 to 60 ft.	> 60 ft.
Northern	21	17	4	9	8	2	2	11	10
Central	100	75	25	48	27	16	9	64	36
Southern	96	82	14	60	22	11	4	70	26
	217	173	44	116	57	29	15	145	72

\* "Regular" vessels unloaded shrimp in South Carolina more than four times in the 1999 trawler season.

\*\* Residency was estimated based upon interviews of seafood dealers and port agents.

\*\*\* The size of vessels able to dock and unload in a given region is influenced by dredging activities and water depth of creeks and rivers. The size distribution of resident vessels in a given region was assumed to be the same for non-resident vessels.

Northern Region: Georgetown and Horry County.

Central Region: Berkeley, Charleston, and Dorchester County.

Southern Region: Beaufort, Colleton, and Jasper County.

(Source: R. Rhodes, SCDNR.)

shrimp fleet (except for the part time small vessels) that lands shrimp in South Carolina ports. Note that for the mid size vessels, 116 of the 145 vessels (80%) that land shrimp in SC are registered to SC residents. And 57 of the 72 large vessels (79%) that land shrimp in SC are registered to SC residents. In 1999, 5,120,000 pounds (heads off) of shrimp were landed in SC ports. These landings are allocated to the 294 small vessels registered to SC residents – no landings are allocated to small vessels registered to non-residents – and to the “regular vessels” described in Table 16. These allocations are displayed in Table 17.

<sup>7</sup> These estimates of “regular” mid-sized and large vessels by SC DNR provide the only guideline on how to allocate the “landings” data from SC DNR to vessels registered to SC residents and to nonresidents .

**Table 17. Commercial Shrimp Trawler Fleet Projected Breakeven Fleet**

**Part A. Estimated Total Catch by Vessels Licensed to SC Residents, 1999**

Vessel Size	1	2	3	4	5	6	7	8	9	10	11
	Per Vessel Catch Estimated lbs heads-off	B-Even lbs heads-off	% in SC by SC Vessels	"Regular" Number SC Vessels n	Estimated Total Catch lbs heads-off	Estimated Catch out of SC per vessel lbs Hoff	by SC Fleet n	Total lbs Hoff	Estimated Catch in SC per vessel lbs HOff	Annual Catch in SC n	Total
small	2,788	1,970	100%	294	819,672	0	294	0	2,788	294	819,672
med	18,618	15,905	87%	116	2,159,688	2,420	116	280,759	16,198	116	1,878,929
large	42,487	44,359	94%	57	2,421,759	2,549	57	145,306	39,938	57	2,276,453
<b>TOTAL SC FLEET</b>				467	5,401,119		467	426,065		467	4,975,054

**Part B. Constrained Total Catch and Breakeven Total Catch by Vessels Licensed to SC Residents, 1999**

Vessel Size	12	13	14	15	16	17	18	19	20	21	22	23
	Total SC Landings Catch constrained per vessel lbs Hoff	n	Shrimp landed in SC by SC Trawlers^ lbs Hoff	Break Even Total Catch per vessel lbs heads-off	n	Breakeven Total	Break Even Catch out of SC per vessel lbs Hoff	n	Total lbs Hoff	Breakeven Catch in SC per vessel lbs	n	total
small	2,342	294	688,656	1,970	294	579,180	0	294	0	1,970	294	579,180
med	13,609	116	1,578,601	15,905	116	1,844,980	2,068	116	239,847	13,837	116	1,605,133
large	33,554	57	1,912,586	44,359	57	2,528,463	2,662	57	151,708	41,697	57	2,376,755
<b>TOTAL SC FLEET</b>		467	4,179,843		467	4,952,623		467	391,555		467	4,561,068

**Part C. Constrained Total Catch and Breakeven Total Catch by Vessels Licensed to Non-SC Residents, 1999**

Vessel Size	24	25	26	27	28	29	30	31	32	33	34
	Per Vessel Catch Estimated lbs heads-off	B-Even lbs heads-off	% in SC by NON SC Vessels	"Regular" Number NON SC Vessels n	Estimated Total Catch lbs heads-off	Estimated Catch out of SC per vessel lbs Hoff	by NON SC Fleet n	Total lbs Hoff	Estimated Catch in SC per vessel lbs HOff	Annual Catch in SC n	Total
small	2,788	1,970	100%	23	64,124	2,788	23	64,124	2,788	23	64,124
med	18,618	15,905	79%	29	539,922	3,947	29	114,463	14,671	29	425,459
large	42,487	44,359	71%	15	637,305	12,449	15	186,730	30,038	15	450,575
<b>TOTAL NON-SC FLEET</b>				67	1,241,351		67	365,318		67	940,157

**Part D. Constrained Total Catch and Breakeven Total Catch by All Vessels Licensed to Shrimp in SC, 1999**

TOTAL LANDINGS IN SOUTH CAROLINA, 1999			Size: N of vessels CATCH(lbs heads of)	
N	35	36	37	38
	N	lbs heads-off		
SC FLEET	467	4,179,843	small	317 752,780
NON SC FLEET	67	940,157	med	145 2,004,060
<b>TOTAL</b>	534	5,120,000	large	72 2,363,161
			All	534 5,120,000

In Table 17, we use survey estimates of catch and breakeven analysis to allocate the 5,120,000 pounds of shrimp landed in SC ports in 1999 (the baseline “catch”) and to determine the potential for entry or exit of vessels from the 1999 fleet. Beginning in column (1), the 1999 catch per vessel is estimated. This can be compared to the breakeven catch needed in 1999 by size of vessel in column (2). In column (3) the share of catch that was made in SC by vessel owner/operators that were residents of SC is displayed. Note that 100% of the small vessel catch was in SC while it was 87% for mid-sized vessels and 94% for large vessels.

The numbers of vessels registered to SC residents that were “regular” vessels, as defined in Table 16, are shown in column (4). In 1999, the total regular SC Shrimp Trawler fleet included 467 vessels -- 294 small vessels, 116 medium vessels and 57 large vessels licensed to SC residents and assumed to be “regular” vessels.<sup>8</sup> In column (5), survey based estimates of the actual total catch by SC vessels (those registered to SC residents) are obtained by multiplying the number of vessels in column (4) by the survey average catch. Using the survey estimates of the share of catch in SC by SC vessels in column (3) the estimated catch by SC vessels in waters out of SC is shown in column (8) and the catch in SC waters is displayed in column (11). Note that the implied total catch by SC vessels in SC waters in column (11) is 4,975,054 pounds (heads-off). This estimate is adjusted to the benchmark 1999 landings reported by SC DNR of 5,120,000 pounds of shrimp in two ways. First, non-resident landings in SC in 1999 are estimated from reported catch shares by nonresident shrimpers (column 26), the number of nonresident vessels (column 27) and breakeven catch rates (column 25). As shown in column (33), this amounts to about 940,157 pounds of shrimp landed by nonresident vessels in SC ports. This means that “regular” SC vessels landed 4,179,843 pounds of shrimp in SC ports as shown in column (14). Each size vessel is assumed to absorb the reduction in estimated catch of 4,975,054 to the constrained “catch” of 4,179,843 pounds

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<sup>8</sup> Since SC DNR did not indicate “regular” status of small vessels, we assume that all licensed small vessels were “regular” vessels. While many of the small vessel operators are part time shrimpers and some may not shrimp in a given year, they are the vessels that have the least investment and most flexibility (their breakeven catch is substantially below their estimated average) in deciding to enter or exit the fleet if aggregate catch changes. This financial flexibility suggests that small vessel owners will be active in the fleet even though they have fewer options for shrimping out of SC waters. Accordingly, they are considered “regular” vessels despite their small catch per vessel. The count of small vessels is taken directly from the SC DNR license files as displayed in Table 15 – 294 SC vessels and 23 Non resident vessels. However, the number of large vessels is taken from Table 16, which identifies the number of “regular” vessels that unload more than four times a year in SC Ports. There were 145 “regular” mid-size vessels in 1999 – 116 SC vessels and 29 nonresident vessels. From Table 16, 153 mid-sized vessels were licensed to SC residents – so the assumption is that 116 off these 153 vessels (76%) are “regular” vessels that land shrimp in SC ports.

Of the 72 “regular” large vessels, 57 were SC vessels (and 15 were nonresident vessels). From Table 15, note that there were 77 large vessels licensed to SC residents so the 57 “regular” large SC vessels represents about 74% of the total number of SC-based large vessels. Using the SCDNR definitions of “regular” vessels is useful since the size of the annual shrimp catch is estimated by DNR from landings data in *SC ports*. So it is important to identify the set of vessels that is responsible for generating the landings data. The “regular” vessels represent the best available estimate of the subset of vessels responsible for the catch landed in SC ports. However, it is likely that the approximately 25% of the mid and large SC fleet that is “non-regular” also contributes to the landings data. *Accordingly the estimates of the change in total fleet size under reduced catch scenarios should be seen as a conservatively estimated minimum impact.*

available to SC vessels. The constrained catch per vessel in SC by SC vessels is displayed in column (12) of Table 17. Given the number of SC vessels in 1999 shown in column (13), and the constrained catch in SC waters by SC vessels in column (12), the total catch by SC vessels in SC waters is estimated in column (14). In contrast, the breakeven catch in SC per vessel size is shown in column (21). Note in column (21) that the total breakeven catch by SC vessels in SC waters (**1,970**) is less than the constrained estimate for small vessels catch in 1999 (**2,342**). **This indicates more small vessels could enter the fleet under 1999 conditions.** However, mid-sized SC vessels need **13,837** pounds of heads off shrimp from SC to breakeven but only caught and landed **13,609** pounds in SC ports. Large SC vessels need **41,697** pounds of shrimp from SC waters but only landed about **33,554** pounds in 1999 from SC waters. Some of these vessels must exit the fleet to allow the remaining mid and large vessels to reach breakeven levels.

To estimate the macroeconomic impacts of the fleet on regional economies, two steps are needed. First, “industry” scenarios are constructed that reflect the entry or exit of shrimp trawler vessels from the fleet for baseline 1999 levels of aggregate catch and if the overall commercial catch declines by 10%, 20%, 30%, 40% or 50%. Second, the changes in sales (landings) of South Carolina commercial shrimpers are used to estimate the reductions in employment, income and sales in the coastal regions of South Carolina if the industry downsizes. Impact Models for Planning (IMPLAN) models are used to estimate total impacts from reduced numbers of commercial vessels, reduced need for inputs like fuel, ice, repair services and packing fees, and reduced area household spending as commercial shrimp and related incomes decline. IMPLAN models are constructed for the three multi-county regions along the coast.

### *Industry Change Scenarios*

Projected changes in the size of the commercial trawler fleet are constructed to reflect declines in annual commercial catch, ranging from 10% to 50%, in two steps. First, the breakeven analysis (see Table 12) is used to establish the *minimum* catch each size vessel needs to breakeven. As noted above, breakeven revenues are **\$7,544, \$60,917 and \$169,896** for small, medium and large vessels, respectively. Given a fixed gross price of \$3.83 per pound (heads-off) these revenues streams are equivalent to approximate annual catches per year of **1,970, 15,905 and 44,359** (in pounds of head-off shrimp) for small, medium and large vessels, respectively.

Second, the shrimp trawlers, by size group, are allowed to enter or exit the industry to accommodate the decline in the commercial catch. In each case, the key assumption is that individual trawlers must operate at the breakeven level of catch to stay in business. This means that as the aggregate commercial catch declines, the size of the fleet adjusts to allow vessels that remain to catch the breakeven level. Exits of vessels by size group are estimated by comparing estimates of actual catch in 1999 (and, reduced catch from the 1999 baseline) with the breakeven catch per vessel for each size group. If the estimated catch exceeds the breakeven then vessels enter the fleet in proportion to the excess of the breakeven catch over the estimated actual catch. Conversely, if the breakeven catch is greater than the actual, vessels exit in proportion to the gap between breakeven and actual. By allowing vessels to enter or exit using these rules, we obtain a “breakeven fleet” size that is compatible with the size of the aggregate shrimp landings

under the 1999 levels of landings. Next, we simulate the effect of reduced landings – from 10% to 50 % of the 1999 landings – on the size of the SC fleet. The size of the baseline (1999) breakeven commercial fleet is shown in Panel A of Table 18. Note that the 1999 breakeven fleet is composed of 350 small vessels, 114 medium vessels and 46 large vessels – a total of 509 “regular” SC vessels. As shown in column (8) of Panel B in Table 18, the 1999 breakeven fleet has 56 more small vessels but finds 2 fewer medium vessels and a loss of 11 large vessels from the actual “regular” SC fleet in 1999. Even with no change from the 1999 landings of 5,120,000 pounds (heads-off) of shrimp, some medium and large vessels must exit to allow the remaining vessels to breakeven. However, small vessels can enter and breakeven so the total fleet size increases. As the aggregate catch declines in 10% increments, the total fleet size falls by 8 (2.2% of the 1999 actual level) for a 10 percent reduction and by 212 vessels (56.3% of the 1999 fleet) with a 50% reduction in catch. It is notable that with a 30% or larger sustained reduction in catch, the largest numbers of vessels that exit are small while the largest vessels experience the largest percentage decline in vessel numbers.

**Table 18. Change in Shrimp Trawler Fleet As Commercial Catch Declines From 1999 Levels**

Assumes SC Vessels Exit to Meet B-E Levels of Catch								Change in SC Breakeven Fleet From 1999 B-E Fleet				Breakeven Check Catch in SC by SC		ALL
Actual SC CATCH	Actual as % of Break-Even	Fleet size			Catch			Small	Medium	Large	Total	VESSLS	VESSLS	
4,179,843	91.6%	350	114	46	509	0.0%	0	0	0	0	4,507,058	612,942	5,120,000	
3,761,859	82.5%	315	103	41	459	10.0%	-35	-11	-5	-51	4,056,352	551,648	4,608,000	
3,343,874	73.3%	280	91	37	408	20.0%	-70	-23	-9	-102	3,605,647	490,353	4,096,000	
2,925,890	64.1%	245	80	32	357	30.0%	-105	-34	-14	-153	3,154,941	429,059	3,584,000	
2,507,906	55.0%	210	68	28	306	40.0%	-140	-46	-18	-204	2,704,235	367,765	3,072,000	
2,089,922	45.8%	175	57	23	255	50.0%	-175	-57	-23	-255	2,253,529	306,471	2,560,000	

**Panel B. Change in SC Fleet from 1999 Actual Fleet**

Assumes SC Vessels Exit to Meet B-E Levels of Catch								Change in SC Fleet from Actual SC Fleet in 1999				Percentage Change in SC Fleet from Actual SC Fleet in 1999			
Actual SC CATCH	Actual as % of Break-Even	Fleet size			Catch			SC Fleet in 1999				SC Fleet in 1999			
lbs. head-off	Break-Even	Small	Medium	Large	Total	Reduction	Small	Medium	Large	Total	Small	Medium	Large	Total	
4,116,398	83.7%	350	114	46	509	0.0%	56	-2	-11	42	18.9%	-1.6%	-19.5%	11.3%	
3,704,758	75.3%	315	103	41	459	10.0%	21	-13	-16	-8	7.0%	-11.5%	-27.6%	-2.2%	
3,293,118	67.0%	280	91	37	408	20.0%	-14	-25	-20	-59	-4.9%	-21.3%	-35.6%	-15.8%	
2,881,479	58.6%	245	80	32	357	30.0%	-49	-36	-25	-110	-16.8%	-31.2%	-43.7%	-29.3%	
2,469,839	50.2%	210	68	28	306	40.0%	-84	-48	-29	-161	-28.7%	-41.0%	-51.7%	-42.8%	
2,058,199	41.8%	175	57	23	255	50.0%	-119	-59	-34	-212	-40.6%	-50.8%	-59.8%	-56.3%	

The key finding from this entry/exit analysis is that full time large and mid-sized vessels will exit even if there is no sustained reduction in catch from 1999 levels. The largest vessels exit in the largest proportion to their 1999 level. The entry of small part-time vessels if catch reductions are modest (less than 10%) reflects the limited investment expense for these part-time operators.

With declines in aggregate commercial catch, the estimated loss of 8 to 234 vessels is probably a best case scenario for the industry since very conservative (small) estimates were made of the catch needed by South Carolina resident vessel owner /operators to break-even. Moreover, the household incomes associated with these break-even catch levels are not large. The low annual rates of return on investment in the commercially important larger vessels also suggests that it will be increasingly difficult for many owner/operators to absorb the opportunity cost of keeping capital invested in the trawler operations.

#### *State and Coastal Region Impacts Of A Downsized Commercial Trawler Fleet*

Allocation of the reduced fleet and associated value of shrimp landings across regions in South Carolina is shown in Table 19. In Panel A of Table 19, the statewide losses of vessels are shown for each downsize scenario in the upper half of the panel while the associated losses in direct sales by the commercial shrimping industry are noted in the lower half of the panel. For example, with a 20% reduction in landings total fleet size decline by 59 vessels and the value of lost sales by these vessels is \$5,026,435 per year. Even with no change in the landings rate from its 1999 level, we expect exits of 2 mid-sized vessels and 11 large vessels over time. While 56 small vessels could enter, leaving a net gain to the SC commercial fleet, total commercial shrimp sales decline by about \$1.6 million per year at 1999 levels of landings.

The fleet reductions are allocated to the three coastal regions and the rest of South Carolina in Panels B through E. Looking at a 20% reduction in catch, the Southern region loses 26 vessels and about \$2.14 million in sales (Panel B). The Central region loses fewer vessels, 21, but sustains a greater loss in sales -- about \$2.25 million in sales per year (Panel C.). The Northern region loses 10 vessels and about \$0.63 million in annual sales (Panel D). Losses by owners elsewhere in SC are minimal.

Table 19. South Carolina and Region Changes in Shrimp Fleet and Sales

<b>Panel A. South Carolina State Total</b>										
<b>Baseline 1999</b>			Change in Number of "Regular" Vessels with Sustained Catch Reduction of:							
	<b>Licensed</b>	<b>"Regular"</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels	n	n	n	n	n	n	n	n	n	n
Small	294	294	56	21	-14	-49	-84	-119		
Medium	153	116	-2	-13	-25	-36	-48	-59		
Large	77	57	-11	-16	-20	-25	-29	-34		
<b>TOTAL</b>	<b>524</b>	<b>467</b>	<b>43</b>	<b>-8</b>	<b>-59</b>	<b>-110</b>	<b>-161</b>	<b>-212</b>		
<b>Baseline 1999</b>			Change in Value of Landings by SC Shrimp Vessels with Sustained Catch Reduction of:							
	<b>Per Vessel</b>	<b>Total</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels										
Small	\$7,545	\$2,218,259	\$422,526	\$158,447	-\$105,631	-\$369,710	-\$633,788	-\$897,867		
Medium	\$60,916	\$7,066,273	-\$121,832	-\$791,910	-\$1,522,904	-\$2,192,981	-\$2,923,975	-\$3,594,053		
Large	\$169,895	\$9,684,013	-\$1,868,845	-\$2,718,320	-\$3,397,899	-\$4,247,374	-\$4,926,954	-\$5,776,429		
<b>TOTAL</b>		<b>\$18,968,546</b>	<b>-\$1,568,151</b>	<b>-\$3,351,782</b>	<b>-\$5,026,435</b>	<b>-\$6,810,066</b>	<b>-\$8,484,718</b>	<b>-\$10,268,349</b>		
Price:	3.83									
<b>Panel B. Southern Region - Beaufort, Colleton, Jasper</b>										
<b>Baseline 1999</b>			Change in Number of "Regular" Vessels with Sustained Catch Reduction of:							
	<b>Licensed</b>	<b>"Regular"</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels	n	n	n	n	n	n	n	n	n	n
Small	114	114	22	8	-5	-19	-33	-46		
Medium	68	60	-1	-7	-13	-19	-25	-31		
Large	26	22	-4	-6	-8	-10	-11	-13		
<b>TOTAL</b>		<b>196</b>	<b>16</b>	<b>-5</b>	<b>-26</b>	<b>-47</b>	<b>-69</b>	<b>-90</b>		
<b>Baseline 1999</b>			Change in Value of Landings by SC Shrimp Vessels with Sustained Catch Reduction of:							
	<b>Per Vessel</b>	<b>Total</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels										
Small	\$7,545	\$860,141	\$163,836	\$61,439	-\$40,959	-\$143,357	-\$245,755	-\$348,152		
Medium	\$60,916	\$3,654,969	-\$63,017	-\$409,609	-\$787,709	-\$1,134,301	-\$1,512,401	-\$1,858,993		
Large	\$169,895	\$3,737,689	-\$721,308	-\$1,049,176	-\$1,311,470	-\$1,639,337	-\$1,901,631	-\$2,229,499		
<b>TOTAL</b>		<b>\$8,252,800</b>	<b>-\$620,489</b>	<b>-\$1,397,346</b>	<b>-\$2,140,138</b>	<b>-\$2,916,995</b>	<b>-\$3,659,787</b>	<b>-\$4,436,644</b>		
<b>Panel C. Central Region - Berkeley, Charleston, Dorchester</b>										
<b>Baseline 1999</b>			Change in Number of "Regular" Vessels with Sustained Catch Reduction of:							
	<b>Licensed</b>	<b>"Regular"</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels	n	n	n	n	n	n	n	n	n	n
Small	29	29	6	2	-1	-5	-8	-12		
Medium	64	48	-1	-5	-10	-15	-20	-24		
Large	37	27	-5	-8	-9	-12	-14	-16		
<b>TOTAL</b>		<b>104</b>	<b>-1</b>	<b>-11</b>	<b>-21</b>	<b>-32</b>	<b>-42</b>	<b>-52</b>		
<b>Baseline 1999</b>			Change in Value of Landings by SC Shrimp Vessels with Sustained Catch Reduction of:							
	<b>Per Vessel</b>	<b>Total</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels										
Small	\$7,545	\$218,808	\$41,678	\$15,629	-\$10,419	-\$36,468	-\$62,517	-\$88,565		
Medium	\$60,916	\$2,923,975	-\$50,413	-\$327,687	-\$630,167	-\$907,441	-\$1,209,921	-\$1,487,194		
Large	\$169,895	\$4,587,164	-\$885,242	-\$1,287,625	-\$1,609,531	-\$2,011,914	-\$2,333,820	-\$2,736,203		
<b>TOTAL</b>		<b>\$7,729,947</b>	<b>-\$893,978</b>	<b>-\$1,599,683</b>	<b>-\$2,250,118</b>	<b>-\$2,955,823</b>	<b>-\$3,606,258</b>	<b>-\$4,311,963</b>		



**Table 19. South Carolina and Region Changes in Shrimp Fleet and Sales(continued)**

<b>Panel D. Northern Region - Georgetown, Horry</b>										
<b>Baseline 1999</b>			Change in Number of "Regular" Vessels with Sustained Catch Reduction of:							
	<b>Licensed</b>	<b>"Regular"</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels	n	n	n	n	n	n	n	n	n	n
Small	106	106	20	8	-5	-18	-30	-43		
Medium	15	9	0	-1	-2	-3	-4	-5		
Large	14	8	-2	-2	-3	-4	-4	-5		
<b>TOTAL</b>		<b>123</b>	<b>18</b>	<b>4</b>	<b>-10</b>	<b>-24</b>	<b>-38</b>	<b>-52</b>		
<b>Baseline 1999</b>			Change in Value of Landings by SC Shrimp Vessels							
<b>Breakeven Revenue</b>			with Sustained Catch Reduction of:							
	<b>Per Vessel</b>	<b>Total</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels										
Small	\$7,545	\$799,781	\$152,339	\$57,127	-\$38,085	-\$133,297	-\$228,509	-\$323,721		
Medium	\$60,916	\$548,245	-\$9,453	-\$61,441	-\$118,156	-\$170,145	-\$226,860	-\$278,849		
Large	\$169,895	\$1,359,160	-\$262,294	-\$381,519	-\$476,898	-\$596,123	-\$691,502	-\$810,727		
<b>TOTAL</b>		<b>\$2,707,186</b>	<b>-\$119,407</b>	<b>-\$385,833</b>	<b>-\$633,139</b>	<b>-\$899,565</b>	<b>-\$1,146,871</b>	<b>-\$1,413,297</b>		
<b>Panel E. Rest of South Carolina</b>										
<b>Baseline 1999</b>			Change in Number of "Regular" Vessels with Sustained Catch Reduction of:							
	<b>Licensed</b>	<b>"Regular"</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels	n	n	n	n	n	n	n	n	n	n
Small	45	45	9	3	-2	-8	-13	-18		
Medium	6	0	0	0	0	0	0	0		
Large	0	0	0	0	0	0	0	0		
<b>TOTAL</b>		<b>45</b>	<b>9</b>	<b>3</b>	<b>-2</b>	<b>-8</b>	<b>-13</b>	<b>-18</b>		
<b>Baseline 1999</b>			Change in Value of Landings by SC Shrimp Vessels							
<b>Breakeven Revenue</b>			with Sustained Catch Reduction of:							
	<b>Per Vessel</b>	<b>Total</b>	<b>0%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>40%</b>	<b>50%</b>		
Vessels										
Small	\$7,545	\$339,530	\$64,672	\$24,252	-\$16,168	-\$56,588	-\$97,008	-\$137,429		
Medium	\$60,916	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
Large	\$169,895	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
<b>TOTAL</b>		<b>\$339,530</b>	<b>\$64,672</b>	<b>\$24,252</b>	<b>-\$16,168</b>	<b>-\$56,588</b>	<b>-\$97,008</b>	<b>-\$137,429</b>		

### **Total Impacts From A Smaller Commercial Shrimp Vessel Fleet in South Carolina.**

Using IMPLAN models of interindustry linkages for the State of South Carolina and for each of the three coastal regions, the direct reductions in commercial shrimp landings in Table 19 are converted to total sales, income, employment and state/local tax revenue impacts. These results are displayed in Table 20. The driving force behind these economic impacts is the reduction in final sales by commercial trawlers. The demand for supplies from local establishments by commercial trawlers declines as the commercial fishing sector sales fall. However, we assume that South Carolina shrimp wholesalers who pack and ship shrimp do not close down as the remaining fleet continues to land shrimp in amounts needed to maintain the viability of South Carolina shrimp packing facilities. Of course, this assumption may be unrealistic and some wholesalers may shut down as well. If so aggregate impacts on the regional economy will be larger and the total economic impacts presented in Table 20 may represent a lower bound.

**Table 20. Total Impacts of Reduced Shrimp Catch on the South Carolina and Coastal Economies**  
**South Carolina Total**

	Landings in 1999	Reductions in Commercial Landings:					
		0%	10%	20%	30%	40%	50%
<b>Direct Sales</b>	\$18,968,546	-\$1,568,151	-\$3,351,782	-\$5,026,435	-\$6,810,066	-\$8,484,718	-\$10,268,349
<b>Total Sales</b>		<b>-\$2,251,657</b>	<b>-\$4,818,861</b>	<b>-\$7,226,512</b>	<b>-\$9,790,841</b>	<b>-\$12,198,490</b>	<b>-\$14,762,818</b>
<b>Total Labor Income</b>		-\$843,387	-\$1,804,967	-\$2,706,784	-\$3,767,286	-\$4,569,102	-\$5,529,605
<b>Total Property Income</b>		-\$890,050	-\$1,904,832	-\$2,856,544	-\$3,870,189	-\$4,821,900	-\$5,835,546
<b>Total Income</b>		<b>-\$1,733,437</b>	<b>-\$3,709,799</b>	<b>-\$5,563,328</b>	<b>-\$7,637,475</b>	<b>-\$9,391,002</b>	<b>-\$11,365,151</b>
<b>Total Employment</b>		<b>-56</b>	<b>-119</b>	<b>-179</b>	<b>-243</b>	<b>-302</b>	<b>-366</b>
<b>Total SC Taxes</b>		<b>-\$110,813</b>	<b>-\$237,156</b>	<b>-\$355,646</b>	<b>-\$481,847</b>	<b>-\$600,337</b>	<b>-\$726,538</b>
<b>Southern Region: Beaufort, Colleton, Jasper</b>							
	Landings in 1999	Reductions in Commercial Landings:					
		0%	10%	20%	30%	40%	50%
<b>Direct Sales</b>	\$8,252,800	-\$620,489	-\$1,397,346	-\$2,140,138	-\$2,916,995	-\$3,659,787	-\$4,436,644
<b>Total Sales</b>		<b>-\$836,071</b>	<b>-\$1,882,839</b>	<b>-\$2,883,706</b>	<b>-\$3,930,473</b>	<b>-\$4,931,340</b>	<b>-\$5,978,107</b>
<b>Total Labor Income</b>		-\$317,799	-\$715,686	-\$1,096,125	-\$1,494,012	-\$1,874,452	-\$2,272,339
<b>Total Property Income</b>		-\$354,413	-\$798,141	-\$1,222,412	-\$1,666,140	-\$2,090,411	-\$2,534,139
<b>Total Income</b>		<b>-\$672,212</b>	<b>-\$1,513,827</b>	<b>-\$2,318,537</b>	<b>-\$3,160,152</b>	<b>-\$3,964,863</b>	<b>-\$4,806,478</b>
<b>Total Employment</b>		<b>-23</b>	<b>-53</b>	<b>-81</b>	<b>-110</b>	<b>-138</b>	<b>-168</b>
<b>Total SC Taxes</b>		<b>-\$42,860</b>	<b>-\$96,522</b>	<b>-\$147,830</b>	<b>-\$201,492</b>	<b>-\$252,800</b>	<b>-\$306,461</b>
<b>Central Region: Berkeley-Charleston-Dorchester</b>							
	Landings in 1999	Reductions in Commercial Landings:					
		0%	10%	20%	30%	40%	50%
<b>Direct Sales</b>	\$7,729,947	-\$893,978	-\$1,599,683	-\$2,250,118	-\$2,955,823	-\$3,606,258	-\$4,311,963
<b>Total Sales</b>		<b>-\$1,302,253</b>	<b>-\$2,330,250</b>	<b>-\$3,277,735</b>	<b>-\$4,305,732</b>	<b>-\$5,253,217</b>	<b>-\$6,281,214</b>
<b>Total Labor Income</b>		-\$488,785	-\$874,631	-\$1,230,258	-\$1,616,104	-\$1,971,731	-\$2,357,578
<b>Total Property Income</b>		-\$511,941	-\$916,066	-\$1,288,540	-\$1,692,665	-\$2,065,140	-\$2,469,265
<b>Total Income</b>		<b>-\$1,000,726</b>	<b>-\$1,790,697</b>	<b>-\$2,518,798</b>	<b>-\$3,308,769</b>	<b>-\$4,036,871</b>	<b>-\$4,826,843</b>
<b>Total Employment</b>		<b>-32</b>	<b>-57</b>	<b>-80</b>	<b>-106</b>	<b>-129</b>	<b>-154</b>
<b>Total SC Taxes</b>		<b>-\$66,157</b>	<b>-\$118,382</b>	<b>-\$165,516</b>	<b>-\$218,741</b>	<b>-\$266,876</b>	<b>-\$319,100</b>
<b>Northern Region: Georgetown, Horry</b>							
	Landings in 1999	Reductions in Commercial Landings:					
		0%	10%	20%	30%	40%	50%
<b>Direct Sales</b>	\$2,707,186	-\$119,407	-\$385,833	-\$633,139	-\$899,565	-\$1,146,871	-\$1,413,297
<b>Total Sales</b>		<b>-\$169,770</b>	<b>-\$548,568</b>	<b>-\$900,181</b>	<b>-\$1,278,979</b>	<b>-\$1,630,593</b>	<b>-\$2,009,391</b>
<b>Total Labor Income</b>		-\$62,904	-\$203,257	-\$333,538	-\$473,891	-\$604,172	-\$744,526
<b>Total Property Income</b>		-\$68,432	-\$221,120	-\$362,850	-\$515,538	-\$657,268	-\$809,956
<b>Total Income</b>		<b>-\$131,336</b>	<b>-\$424,377</b>	<b>-\$696,388</b>	<b>-\$989,429</b>	<b>-\$1,261,440</b>	<b>-\$1,554,482</b>
<b>Total Employment</b>		<b>-4</b>	<b>-14</b>	<b>-23</b>	<b>-33</b>	<b>-42</b>	<b>-51</b>
<b>Total SC Taxes</b>		<b>-\$8,434</b>	<b>-\$27,252</b>	<b>-\$44,719</b>	<b>-\$63,537</b>	<b>-\$81,004</b>	<b>-\$99,822</b>

State level impacts in Table 20 are larger than the sum of the three coastal areas – “added-up” for two reasons. First, the sales reductions by resident trawler owner/operators that do not live in a coastal county are included as part of the state total decline in final sales of the commercial fish sector. Second, multiplier (linkage) impacts are larger at the state level than for sub-regions of the state since there are fewer import leakages from the state model compared to individual sub-regions of the state. Aggregate economic impacts are reported in Table 20 for Total Sales, Total Income, Total Employment and Total State and Local Taxes in South Carolina (Federal tax impacts are not reported).

Looking first at the statewide impacts in the top panel of Table 20, the loss in total sales ranges from \$2.25 million with no further reduction in catch to \$14.76 million for a 50% reduction from the 1999 breakeven baseline. Total income losses range from \$1.73 million to \$11.37 million over the same scenarios and employment falls by 56 to 366 jobs. Finally, taxes decline by \$110,813 in the no change scenario to \$728,538 in the 50% reduction in catch scenario. Generally, the total economic impacts on the Southern and Central regions are comparable across all categories – each with about 40 to 45% of the state losses. The Northern region accounts for about 15% of the statewide losses.

### Sensitivity of Results to a Price Decline:

South Carolina shrimpers are price takers with the price received set by national market conditions. With increased competition from imports, it is possible that shrimp prices will be consistently lower than the 1999 average. In this section, we repeat the calculations above assuming that average prices declines from \$3.83 to \$3.58 (a \$.25 reduction) per pounds, heads-off.

As shown in Table 21, the impact on the fleet size is sizable from this price decline. For example, a 20% reduction in catch results in a 13% loss in small vessels, a 28% loss in mid-sized vessels and a 41% reduction in large vessels. The corresponding losses with the baseline price of \$3.83 are -4.9%, -21.3%, and -35.6% for small, mid-sized and large vessels.

**Table 21. Expected Change in Shrimp Trawler Fleet if Commercial Catch Declines From 1999 Levels: Heads Off Price \$3.58**

Catch Reduction	Fleet size	Change in SC Fleet from Actual SC Fleet in 1999				Percentage Change in SC Fleet from Actual SC Fleet in 1999			
		(294)	(116)	(57)	(467)	Small	Medium	Large	Total
0.0%		26	-12	-15	-1	8.7%	-10.2%	-26.6%	-0.4%
10.0%		-6	-22	-19	-48	-2.1%	-19.2%	-33.9%	-12.7%
20.0%		-38	-33	-24	-94	-13.0%	-28.2%	-41.3%	-25.1%
30.0%		-70	-43	-28	-141	-23.9%	-37.1%	-48.6%	-37.4%
40.0%		-102	-53	-32	-188	-34.8%	-46.1%	-55.9%	-49.8%
50.0%		-134	-64	-36	-234	-45.6%	-55.1%	-63.3%	-62.1%

The aggregate impacts on the state economy also increase as illustrated in Table 22.

**Table 22. Expected Loss in Sales, Income, Employment and Taxes if Commercial Catch Declines From 1999 Levels: Heads Off Price**

Catch Reduction	\$3.58				
	State of South Carolina Losses in:				
	Sales \$ million	Income \$ million	Employment number	Taxes \$ million	
0.0%	-\$4.47		-\$3.44	-111	-\$0.22
10.0%	-\$6.69		-\$5.15	-166	-\$0.33
20.0%	-\$9.24		-\$7.11	-239	-\$0.45
30.0%	-\$11.46		-\$8.82	-284	-\$0.56
40.0%	-\$13.67		-\$10.53	-339	-\$0.67
50.0%	-\$15.98		-\$12.30	-396	-\$0.79

### Summary and Recommendations

We find that most full time owner/operators of commercial shrimp trawlers are operating at about breakeven levels of activity. If 1999 catch rates were to persist over the next 5 to 10 years, we expect that both mid-sized and large vessels will exit the industry while owner/operators of small, part-time vessels could increase in small numbers. Reduction in commercial catch rates would exacerbate the rate of exit of all vessel sizes – though the largest vessels would show the largest percentage declines.

The most important assumptions in this analysis are: 1. Future prices of shrimp landed in SC will increase at the same rate as the costs of operations and ownership for commercial shrimp trawlers; and 2. Some vessels will exit so that remaining vessels can operate at breakeven levels over the long run. As Ward and Sutinen (1994: 920) conclude,

“In equilibrium, the total stock of capital remains at the same level with depreciation and retirement of vessels offset by new investment. When the fleet grows in size, average landings and revenue per vessel decline with biomass per unit effort ..., fishing effort costs remain the same, and rents to the resource are dissipated.”

Alternatively, as the “abundance” of shrimp available to commercial trawlers declines, the fleet size will contract to lift the per vessel catch to levels needed to maintain long run breakeven revenues. The analysis presented here suggests that in 1999, most full time shrimp vessel owner/operators were earning a low rate of return on their investments in shrimp vessels. At present, most seem willing to accept the lower than market rates to continue operating their businesses – echoing findings by Ward and Sutinen and others that there is a “resistance to change” by fisherman perhaps associated with “monetary conversion costs, nonmonetary factors and personal preferences.” (Ward and Sutinen p. 920). Nonetheless, if catch rates decline, the opportunity costs of remaining in commercial shrimping will increase for all owner/operators and the economic pressure to exit will increase.

While the overall economic impacts at the regional and state levels of a declining commercial shrimp trawler fleet are not large relative to the overall size of the regional

economies, commercial shrimping is likely to be very important to the vitality of selected communities along the coast that are home ports to large numbers of commercial vessels and the associated packing and related businesses. Moreover, non-market valuation of the willingness of South Carolina residents to pay for the presence of a viable commercial shrimping fleet could be substantially larger than the direct economic impacts. This report does not address these non-market valuations or attempt to estimate the socially optimal size of the commercial shrimp fleet.

In this analysis we have demonstrated that the SC resident shrimp fleet is under considerable economic pressure from several sources. First, nonresident vessels are taking a larger share of the commercial licenses and tend to have larger vessels shrimping in SC waters. Second, the rapid increase in shrimp baiting activities may limit the total catch in SC waters. Finally, mid and large commercial vessels are operating on very thin profit margins (or losses) and will be hard pressed to stay in shrimping even at 1999 levels of commercial catch. To maintain the long run viability of the SC commercial shrimp trawler fleet with 1999 vessel numbers and size distribution, annual landings by the commercial fleet need to increase. This might be accomplished in several ways. If shrimp baiting were shown to reduce commercial catch, then increased shrimp baiting license fees and/or reductions in limits on the size of the recreational catch would be one avenue for improving the prospects for commercial shrimpers.

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## APPENDIX A.

## Descriptive Statistics of Vessel Operating and Maintenance Costs

Costs to Vessel Owner	15 to 30 ft.	31 to 60 ft.	61 to 100 ft.
	Mean (Standard Error) No. of Observ	Mean (Standard Error) No. of Observ	Mean (Standard Error) No. of Observ
Ice	\$263 (73.4) [18]	\$1,938 (355.1) [31]	\$6,342 (3,042.0) [29]
Fuel	\$980 (342.6) [28]	\$7,116 (1,560.0) [33]	\$14,036 (2,273.5) [29]
Groceries	\$99 (50.2) [28]	\$1,386 (276.3) [34]	\$2,603 (563.3) [28]
Packing	\$116 (107.2) [28]	\$3,734 (1,322.4) [29]	\$4,742 (1,687.7) [25]
Crew Shares	\$352 (266.6) [27]	\$16,045 (3,351.5) [31]	\$41,712 (5,416.8) [28]
Hull Insurance	\$87 (38.7) [28]	\$1,702 (337.2) [33]	\$5,093 (789.5) [32]
Other Insurance	\$0 (0.0) [27]	\$102 (66.0) [31]	\$225 (207.0) [29]
Hardware & Marine Supplies	\$356 (186.3) [28]	\$4,771 (1,203.4) [34]	\$12,676 (2,222.2) [31]
Loans	\$622 (270.9) [29]	\$3,165 (829.0) [32]	\$6,266 (2,308.9) [28]
Car & Truck Expenses	\$714 (255.8) [29]	\$1,256 (230.9) [33]	\$2,833 (712.0) [29]
Repair & Maintenance of Electronics	\$106 (53.4) [29]	\$654 (158.4) [35]	\$1,611



## Appendix A. (continued)

<b>Cost to Vessel Owner</b>	<b>15 to 30 feet</b> Mean (Standard Error) No. of Observ	<b>31 to 60 feet</b> Mean (Standard Error) No. of Observ	<b>61 to 100 feet</b> Mean (Standard Error) No. of Observ
Repair & Maintenance of Gear	\$190 (51.8) [28]	\$1,883 (399.7) [36]	\$7,695 (1,273.6) [29]
New Electronics	\$91 (40.0) [28]	\$714 (175.0) [34]	\$2,281 (443.5) [32]
New Doors & Sleds	\$88 (28.7) [28]	\$914 (305.3) [34]	\$1,627 (252.8) [31]
New BRDS	\$13 (5.4) [28]	\$113 (62.6) [32]	\$173 (25.5) [31]
New Nets	\$278 (70.2) [27]	\$2,124 (459.5) [35]	\$4,709 (820.1) [32]
New TED's	\$50 (22.3) [28]	\$2,124 (459.5) [35]	\$973 (106.9) [32]
Price of Ice	\$2.50 per block (1.32) [7]	\$10.60 per block (1.46) [28]	\$8.66 per block (0.35) [28]
Quantity of Ice Purchased	9.85 blocks per week (5.81) [10]	11.41 blocks per week (1.24) [28]	28.15 blocks per week (3.17) [26]
Price of Fuel	\$1.07 per gallon (0.09) [19]	\$0.81 per gallon (0.02) [31]	\$0.78 per gallon (0.02) [30]
Quantity of Fuel Purchased	130 gallons (29.2) [12]	495 gallons (72.3) [33]	1168 gallons (91.1) [27]
Cost of Packing Fee	\$0.07 per lb (0.03) [13]	\$0.25 per lb (0.03) [20]	\$0.25 per lb (0.05) [19]
% Shrimp Headed & Packed on Docks	13% shrimp (6.4) [18]	59% shrimp (10.5) [20]	56% shrimp (10.2) [22]

## Appendix B. Price Data.

**Table B-1. Pounds (heads-off) and ex-vessel value of all shrimp and September-October white shrimp landed in South Carolina, 1979-99 (Source Fisheries Statistics Section, Office of Fisheries Management).**

Year Landed	(Pounds and Dollars in Thousands)						Ex-vessel Prices (Dollars Per Pound)					
	Pounds:			Ex-vessel Value:			Nominal Prices		Deflated Prices*		CENT/LB	
	Total	Sept-Oct	Percent	Total	Sept-Oct	Percent	Total	Sept-Oct	Total	Sept-Oct	NOM	DEFL
1979	4,252	1,956	46.0%	\$ 16,391	\$ 8,636	52.7%	\$ 3.85	\$ 4.42	\$ 3.85	\$ 4.42	442	442
1980	4,446	1,648	37.1%	13,043	4,999	38.3%	2.93	3.03	2.80	2.90	303	290
1981	1,868	709	38.0%	6,175	2,440	39.5%	3.31	3.44	3.18	3.31	344	331
1982	3,393	1,532	45.2%	14,729	7,354	49.9%	4.34	4.80	4.34	4.80	480	480
1983	3,455	1,224	35.4%	14,441	5,309	36.8%	4.18	4.34	4.11	4.26	434	426
1984	1,464	168	11.5%	5,136	736	14.3%	3.51	4.38	3.35	4.18	438	418
1985	2,124	287	13.5%	6,361	1,152	18.1%	2.99	4.02	3.16	4.24	402	424
1986	3,871	1,331	34.4%	16,624	6,098	36.7%	4.29	4.58	4.61	4.92	458	492
1987	3,667	1,741	47.5%	11,926	5,522	46.3%	3.25	3.17	3.38	3.30	317	330
1988	2,768	900	32.5%	10,339	3,784	36.6%	3.74	4.20	3.52	3.96	420	396
1989	4,660	1,593	34.2%	12,760	4,717	37.0%	2.74	2.96	2.46	2.66	296	266
1990	3,717	1,765	47.5%	13,252	6,385	48.2%	3.57	3.62	3.15	3.20	362	320
1991	5,924	1,605	27.1%	16,895	4,807	28.5%	2.85	3.00	2.70	2.84	300	284
1992	4,264	1,445	33.9%	13,112	4,508	34.4%	3.08	3.12	2.93	2.97	312	297
1993	5,290	1,173	22.2%	15,830	4,081	25.8%	2.99	3.48	2.76	3.21	348	321
1994	3,478	1,242	35.7%	14,588	5,356	36.7%	4.19	4.31	3.94	4.05	431	405
1995	6,860	2,543	37.1%	21,693	7,347	33.9%	3.16	2.89	2.99	2.73	289	273
1996	3,445	1,176	34.1%	12,221	4,710	38.5%	3.55	4.01	2.92	3.30	401	330
1997	4,452	1,719	38.6%	19,290	7,625	39.5%	4.33	4.44	3.86	3.95	444	395
1998	4,073	1,753	43.0%	15,417	5,953	38.6%	3.79	3.40	3.64	3.27	340	327
1999	5,123	2,128	41.5%	18,362	7,940	43.2%	3.58	3.73	3.63	3.78	373	378
1979-88 Means:	3,131	1,150	34.1%	\$ 11,517	\$ 4,603	36.9%	\$ 3.64	\$ 4.04	\$ 3.63	\$ 4.03		
1989-99 Means:	4,662	1,649	35.9%	\$ 15,765	\$ 5,766	36.8%	\$ 3.44	\$ 3.54	\$ 3.18	\$ 3.27		
1995-99 Means:	4,791	1,864	38.9%	\$ 17,397	\$ 6,715	38.8%	\$ 3.68	\$ 3.69	\$ 3.41	\$ 3.41		

\* Deflated with the Producer Price Index for Crude Foodstuffs and Feedstuffs (U.S. Bureau of Labor Statistics).

SOURCE: Ray Rhodes, SCDNR

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