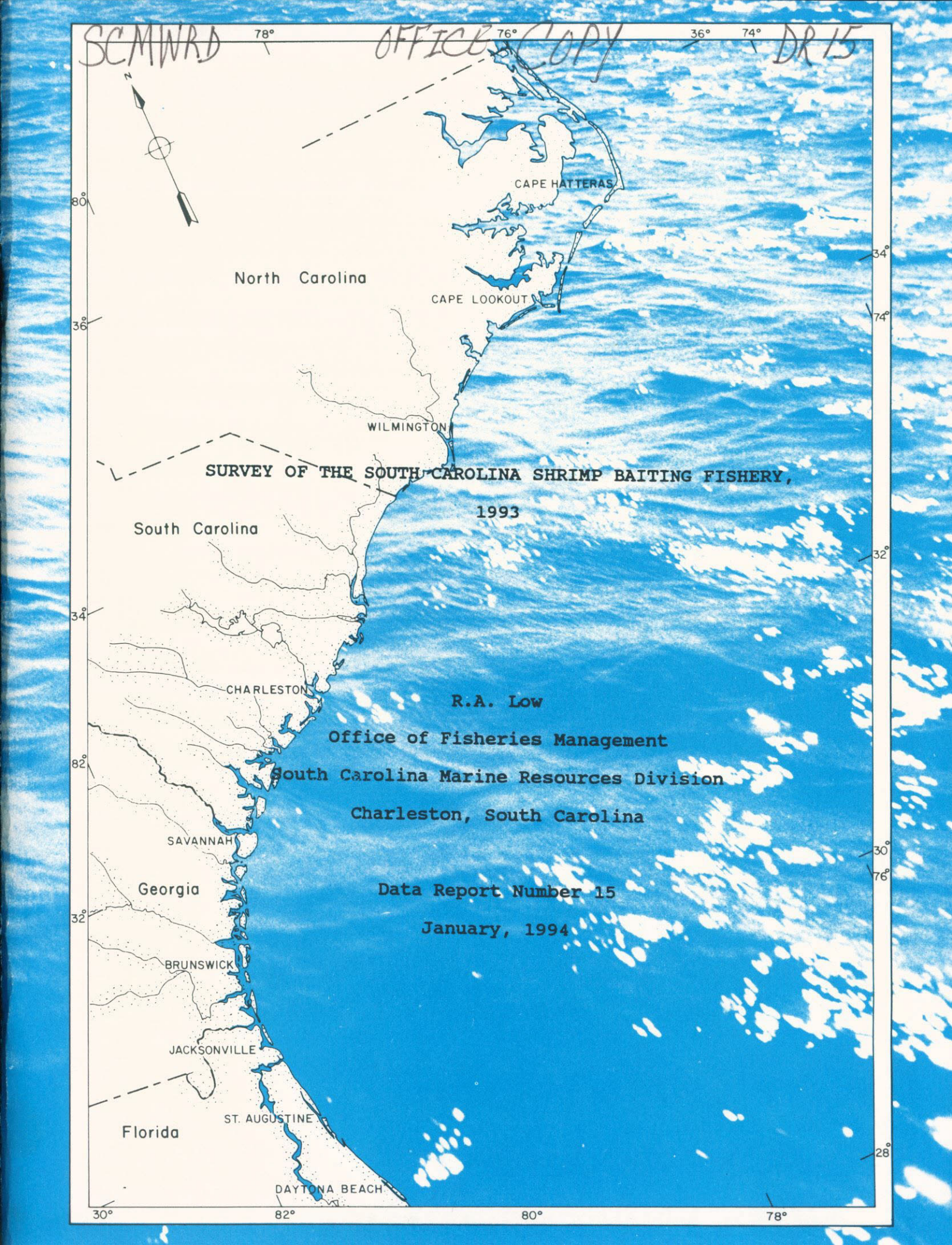

SURVEY OF THE SOUTH CAROLINA SHRIMP BAITING FISHERY, 1993

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Office of Fisheries Management

South Carolina Marine Resources Division

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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INTRODUCTION

Theiling (1988) described the history of shrimp baiting in South Carolina and the first survey (in 1987) of the fishery. Surveys have been conducted for each subsequent season using various approaches (Waltz and Hens 1989, Low 1990, 1991, 1992, and 1993; Liao 1993). These studies have addressed diverse aspects such as demographics of participants, constituency opinions of management options, user group conflicts, and economic parameters in addition to obtaining statistics on catch, effort, and participation.

In 1993, the season opened on 10 September and closed on 9 November. Information on the fishery was obtained from a postseason mailout survey. Primary objectives were to estimate 1) total participation (i.e., the number of active permit holders and their assistants), 2) total effort (i.e., the number of trips), 3) total catch, and 4) effort and catch by fishing area. Because of concern over illegal sales of shrimp caught over bait, the survey included an opinion poll on this issue.

METHODS

The survey package consisted of a two-sided questionnaire and a self-addressed business reply return envelope. The front of the questionnaire (Appendix 1a) contained an introductory statement and questions on fishery characteristics. The reverse side consisted of an opinion poll with the questions listed in one of two sequences (Appendices 1b and 1c) to evaluate possible bias associated with the order of listing. The mailout was sent first class to 3,500 (27%) of the 12,984 permit holders and was stratified according to area of residence in direct proportion to the distribution of permit holders (i.e., 27% of the permit holders randomly selected from each county were included).

Table 1 lists the numbers of permit holders by county of residence for the last three seasons. Each county's allotment was evenly divided between the two versions of the opinion poll. After adjustment for nondeliverables (N = 38), the effective mailouts were as follows: 1) Northern Coastal Group, 248; 2) Central Coastal Group, 1,477; 3) Southern Coastal Group, 791; 4) Central Inland Group, 640; and 5) other areas, 306.

Approximately four weeks were allowed for response. A longer period would have extended the time frame of effective recall beyond 60 days from the end of the season. By the end of the response period, the target sample level (based on variances observed during previous surveys) had been obtained and the stratification of respondents by area of residence was comparable to that of the overall permit holder population (Table 2). Questionnaires

Table 1. Distribution of permit holders in 1993 compared to that in 1992 and 1991.

Residence category	1993 N	1993 %	1992 N	1992 %	1991 N	1991 %
Northern Coastal						
Georgetown County	742	5.7	555	4.8	539	4.5
Horry County	191	1.5	154	1.3	142	1.2
Total	933	7.2	709	6.1	681	5.7
Central Coastal						
Berkeley County	1,283	9.9	1,211	10.5	1,392	11.6
Charleston County	3,509	27.0	3,094	26.7	3,562	29.7
Dorchester County	742	5.7	667	5.8	747	6.2
Total	5,534	42.6	4,972	43.0	5,701	47.5
Southern Coastal						
Beaufort County	1,517	11.7	1,436	12.4	1,413	11.8
Colleton County	651	5.0	586	5.1	587	4.9
Hampton County	446	3.4	431	3.7	443	3.7
Jasper County	353	2.7	360	3.1	351	2.9
Total	2,967	22.9	2,813	24.3	2,794	23.3
Central Inland						
Aiken County	460	3.5	379	3.3	344	2.9
Allendale County	115	0.9	124	1.1	126	1.0
Bamberg County	185	1.4	177	1.5	177	1.5
Barnwell County	219	1.7	193	1.7	202	1.7
Lexington County	593	4.6	481	4.2	383	3.2
Orangeburg County	495	3.8	444	3.8	440	3.7
Richland County	340	2.6	291	2.5	263	2.2
Total	2,407	18.5	2,089	18.1	1,935	16.1
Other	1,128	8.7	977	8.6	884	7.4
Nonresident	15	0.1	11	0.1	10	0.1
Grand Total	12,984		11,571		12,005	

Table 2. Distribution of permit holders and respondents by residence category.

Residence category	Percent of permit holders	Percent of respondents
Northern Coastal	7.2	6.9
Central Coastal	42.6	43.2
Southern Coastal	22.9	21.3
Central Inland	18.5	18.4
Other	8.7	10.2

Table 3. Estimated participation by residential category.

	Northern Coastal	Central Coastal	Southern Coastal	Central Inland	Other	Total
Permits issued	933	5,534	2,967	2,407	1,143	12,984
Percent active	93.1	91.1	91.5	89.7	90.8	91.0
Number active	869	5,041	2,715	2,159	1,038	11,822
Avg. no. of assistants	2.85	2.55	2.27	2.33	2.19	2.43
Number of assistants	2,477	12,855	6,163	5,030	2,273	28,798
Total participants	3,346	17,896	8,878	7,189	3,311	40,620
Percent active in designated month						
September	77	66	64	71	60	66
October	88	81	81	80	77	81
November	38	50	43	41	36	45

received afterwards were not included in the analysis.

RESULTS

The overall response rate during the allowed interval was 36.7% after adjustment for nondeliverables with 1,269 usable returned questionnaires. Response rates by residential category were as follows: 1) Northern Coastal Group, 35.1%; 2) Central coastal Group, 37.1%; 3) Southern Coastal Group, 34.1%; 4) Central Inland Group, 36.6%; and 5) other areas, 42.5%.

Participation

Statewide, 9% of the responding permit holders did not make at least one trip using their tags and poles. Some participated as assistants to other permit holders based on their responses; however, there was no way to quantify this activity. Participation (Table 3) was rather consistent between residential categories. The estimated number of active permit holders was obtained by multiplying the number of permits issued in each residential category by the percentage of positive responses received per area. Assistants were the numbers of different individuals who joined the permit holders on their trips. Undoubtedly, some individuals were counted by more than one respondent, but the extent of such duplication could not be ascertained and was assumed to be negligible. The average numbers of assistants per permit holder in each residential category were multiplied by the estimated number of active permit holders to obtain the estimated numbers of assistants. The total numbers of participants equalled the sum of the active permit holders and their assistants.

Respondents were requested to estimate the number of trips they made in each month. About two-thirds made at least one trip in September and a little less than half went during November. About 81% shrimped during October. Relatively more residents of the central and southern coastal areas shrimped in November than those from the other areas.

Effort

The average number of season trips per active permit holder was obtained by summing the number of trips in each residential category and dividing this figure by the number of active permit holders. These means were then multiplied by the numbers of estimated active permit holders in the overall populations to obtain estimates of seasonal effort by residential category (Table 4). The estimated numbers of trips per month were calculated by multiplying these season totals by the appropriate percentages of trips in each month, as determined from the data provided by respondents who broke their seasonal effort down into complete

Table 4. Estimated effort (number of trips) by residential category.

	Northern Coastal	Central Coastal	Southern Coastal	Central Inland	Other	Total
Avg. trips/active permit holder	7.9	7.4	7.4	5.6	4.2	6.8
Percent of total trips by month						
September	40	33	35	37	37	35
October	49	48	50	47	51	49
November	11	19	15	16	14	16
Estimated trips/month						
September	2,746	12,310	7,032	4,473	1,613	28,174
October	3,364	17,905	10,046	5,682	2,224	39,221
November	755	7,088	3,013	1,935	523	13,314
Estimated season trips	6,865	37,303	20,091	12,090	4,360	80,709
Percent of total effort	9	46	25	15	5	
1992	6	46	29	14	5	
1991	5	50	27	12	6	
1990	4	56	26	-	-	

monthly components. The estimated effort figures shown in the "total" category are those generated by adding the categorical figures.

An alternative procedure is to multiply the number of permits sold (12,984) by the active percentage (91.0%) to generate the estimated number of total active permit holders (i.e., N = 11,815). This value multiplied by the pooled average trips/permit holder (6.8) gives a total effort estimate (80,345 trips) which can then be multiplied by the pooled monthly percentages (from the "total" column in Table 4) to obtain another set of monthly effort estimates. These figures differ slightly from those in Table 4.

The coastal area was divided into six geographical components (Fig. 1). The relative distribution of effort by fishing area is indicated in Table 5. These figures were obtained by multiplying the total number of trips in each residential category by the percentages of effort reported for each area. Percentages were determined by summing all trips reported by area within each residential category, then dividing this figure by the number associated with each fishing area. In contrast to the distribution in the last two years, the Charleston Harbor area hosted the most effort in 1993, followed closely by the Beaufort/Port Royal Sound vicinity. The greatest change occurred in the Georgetown area, where effort increased by a factor of six over the 1992 level. There was a 22% decrease in the number of trips spent in Bulls Bay.

The distribution of seasonal effort in terms of average number of trips/permit holder is shown in Table 6. Results were nearly identical to those from last year with about 85% of all permit holders making ten trips or less. Only 5% of the respondents reported making more than 15 trips.

Catch Rates

Table 7 lists the average seasonal catch rates for each residential category. These were obtained by adding the reported CPUEs in each category and dividing by the number of observations. The CPUEs in Table 8 were calculated by summing the season catch estimates for an area and dividing this figure by the corresponding effort. Only the data from respondents who limited their activity to one area were included, since there was no way to separate catch and effort by area for respondents who shrimped in multiple areas. In contrast to the last two seasons, the catch rate was the highest in the Winyah/Santee Bays area, but the trend for the average catch rate to be relatively low in the Charleston Harbor area continued. There was much less variability between areas than in previous seasons.

The distribution of average seasonal CPUE is indicated in Table

BF - BEAUFORT (including Calibogue and Port Royal Sounds, Broad River)

SH - ST. HELENA SOUND (including Coosaw, Combahee, and Ashepoo Rivers)

WE - WADMALAW/EDISTO ISLAND (including N. and S. Edisto Rivers)

CH - CHARLESTON HARBOR (including Kiawah, Stono, Folly, Ashley, Cooper and Wando Rivers)

BB - BULLS BAY (including McClellanville area)

GH - GEORGETOWN (including Santee and Winyah Bays and Horry County intracoastal waterway)

Fig. 1. Shrimp baiting areas.

Table 5. Estimated effort (number of trips by fishing area.

Residential category	Fishing area Beaufort	St. Helena	Wadmalaw/Edisto	Charleston	Bulls Bay	Georgetown
Northern Coastal	22	11	0	0	906	5,926
Central Coastal	556	371	3,584	27,900	4,758	134
Southern Coastal	16,923	2,546	382	218	22	0
Central Inland	7,150	1,845	1,699	917	292	187
Other	1,034	499	419	312	918	1,178
Total	25,685	5,272	6,084	29,347	6,896	7,425
Percent of total	32	7	8	36	8	9
1992	38	6	9	31	14	2
1991	35	5	8	34	15	3
1990	31	6	7	49	3	4

Table 6. Distribution of seasonal effort (in percent).

Residential category	Trips/individual/season <5	5-10	11-15	16-20	>20
Northern Coastal	35	37	22	3	2
Central Coastal	42	39	11	4	3
Southern Coastal	43	38	11	5	3
Central Inland	53	41	3	1	2
Other	68	29	3	0	0
Total	46	38	10	3	2
1992	48	38	9	2	3
1991	58	30	8	2	3

Table 7. Catch rates (quarts of whole shrimp/trip) by residential category.

Residential category	CPUE 1993	1992	1991	1990
Northern Coastal	26.5	15.0	18.2	28.3
Central Coastal	22.3	24.3	17.9	24.0
Southern Coastal	24.0	26.3	24.1	28.3
Central Inland	24.0	30.3	24.6	)
Other	24.4	25.1	25.7	)25.5)

Table 8. Catch rates (quarts of whole shrimp/trip) by fishing area.

Fishing area	No. of observations (1993)	1993	1992	CPUE 1991	1990
Beaufort and vicinity	291	22.9	28.7	24.4	28.6
St. Helena Sd. area	51	23.8	29.7	25.0	23.8
Wadmalaw/Edisto Islands	60	22.5	30.0	24.2	21.0
Charleston Harbor area	294	20.4	23.4	14.1	23.2
Bulls Bay	53	26.4	20.3	22.5	28.8
Georgetown area	59	26.9	14.4	10.5	26.7

Table 9. Distribution of average seasonal CPUE in percentages of respondents.

Residential category	CPUE <10	10-20	21-30	31-40	41-48
Northern Coastal	4	41	28	12	15
Central Coastal	19	29	30	15	7
Southern Coastal	19	23	29	16	12
Central Inland	13	29	34	15	9
Other	19	25	23	17	15
Total	17	28	30	15	10
1992	15	28	24	17	16
1991	22	33	25	10	9

9. Results were generally similar to those in the last two seasons. About 45% of the shrimpers reported averaging 20 quarts or less of whole shrimp per trip, while one-fourth reported catching more than 30.

Because the residential stratification of the respondent population was comparable to that of the total active permit holder population, an unbiased estimate of the average statewide seasonal catch rate can be obtained by dividing the sum of reported seasonal catches by the total reported number of trips (ratio of averages value). This provides a seasonal CPUE estimator of 22.5 quarts of whole shrimp per trip. Another approach is to calculate the average of ratios statistic by adding the CPUE figures and dividing this by the number of observations: this value is 23.5 quarts per trip. The latter statistic is usually preferred because it is unweighted by the distribution of effort and normality assumptions are better met (Rothschild and Yong 1970).

Catch

There are numerous ways to estimate the total catch and the following examples are included primarily to illustrate the range of values that can be derived.

Because of the similar residential composition of the total permit holder population and the sample group, an unbiased catch estimate can be obtained by multiplying the estimated total number of trips (80,390 by one method, 80,709 from another) by the average of ratios CPUE estimator (23.5). This produces estimates of 1,889,165 quarts and 1,896,662 quarts, respectively. Using the ratio of averages CPUE index (22.5), the corresponding figures are 1,808,775 and 1,815,953 quarts.

Another approach is to multiply the estimated number of trips in each fishing area by the appropriate average catch rate and sum the results. The figures are as follows (using data from Tables 5 and 8).

Area	Trips	CPUE	Catch (quarts)
Beaufort and vicinity	25,685	22.9	588,187
St. Helena Sd. area	5,272	23.8	125,474
Wadmalaw/Edisto Islands	6,084	22.5	136,890
Charleston Harbor area	29,347	20.4	598,679
Bulls Bay	6,896	26.4	182,054
Georgetown area	7,425	26.9	199,733
			1,831,017

Another method is to multiply the number of active permit holders in each residential category by the average number of trips per permit holder to obtain the effort estimates, then multiply

these by the mean CPUE for each category. Using data from Tables 4 and 7, these are the results.

Residential category	Trips	CPUE	Catch (quarts)
Northern Coastal	6,865	26.5	181,923
Central Coastal	37,303	22.3	831,857
Southern Coastal	20,091	24.0	482,184
Central Inland	12,090	24.0	290,160
Other	4,360	24.4	106,384
			1,892,508

Within each residential category, the catch rate reported by each respondent can be multiplied by the number of trips reported to obtain that individual's season catch or the estimate provided by the respondent can be used. The average season catch can then be calculated and multiplied by the number of active permit holders in that residential category. This procedure, using the season catch estimates provided by the respondents, produces the following catch estimates.

Residential category	Average catch	Active permits	Catch (quarts)
Northern Coastal	193.3	869	167,978
Central Coastal	148.6	5,041	749,093
Southern Coastal	167.0	2,715	453,405
Central Inland	124.7	2,159	269,227
Other	106.0	1,038	110,028
			1,749,731

The range in total catch estimates generated by these various methods is 1,749,731 - 1,896,662 quarts. Using a conversion factor of 1.48 pounds of whole shrimp per quart, the catch estimates ranged from 2.590 M to 2.807 M pounds. There are trade-offs in terms of probable accuracy associated with each approach and an intermediate value based on averaging the various figures is probably the best overall choice. This would be about 2.72 M pounds of whole shrimp or 1.76 M pounds of heads-off product.

The distribution of catches per permit holder is shown in Table 10 and was very similar to that in the previous year. About three-quarters of the respondents caught less than 200 quarts during the season. Based on a total catch estimate of 2.72 M pounds and estimated participation, the average permit holder caught 155 quarts (230 pounds). Assuming that this was evenly shared among these individuals and their assistants, the typical participant in the 1993 fishery obtained about 67 pounds of whole shrimp. Parameter values for principal characteristics of the 1993 fishery are compared with those from previous years in Table 11.

Opinion Poll

Respondents were asked to indicate whether or not they intended

Table 10. Distribution of season catches (quarts of whole shrimp) in percentages of respondents by residential category.

Residential category	Catch <99	100-199	200-299	300-399	400-499	≥500
Northern Coastal	37	22	21	7	8	5
Central Coastal	47	26	15	6	3	3
Southern Coastal	44	25	14	7	3	6
Central Inland	46	33	15	4	1	1
Other	62	23	10	2	3	1
Total	47	27	15	5	3	3
1992	47	25	13	6	4	5
1991	54	24	14	4	2	2

Table 11. Season comparisons of participation, effort, and catch parameters.

	1987	1988	1989	1990	1991	1992	1993
Permits issued	NA	5,509	6,644	9,703	12,005	11,571	12,984
Percent active permits	NA	92	82	94	89	87	91
Assistants/permit holder	NA	2.50	2.14	2.79	2.24	2.15	2.43
Participants	21,735	17,749	17,171	34,662	34,821	31,812	40,620
Trips/permit holder	NA	7.0	5.7	7.8	6.6	6.1	6.8
Total effort (trips)	40,101	35,609	31,624	71,153	71,034	62,459	80,709
Quarts/trip (whole)	28.5	22.1	26.5	25.6	21.3	25.4	23.5
Total catch (M lbs whole)	1.80	1.16	1.25	2.75	2.14	2.35	2.72
Pounds/participant	83	65	73	79	62	74	67
% of total fall landings	29	32	24	46	29	39	44

to purchase a permit in 1994. There was little difference between areas with 82% of the total statewide sample population replying positively. About 16% were undecided and only 2% stated that they would not obtain a permit.

Assuming that no changes were made in the regulations, shrimpers were asked how much they were willing to pay for a baiting permit. Four percent gave a figure less than the current $25 fee. About 74% specified $25. Eight percent provided a figure between $26-$30, 3% between $31-$35, and 2% between $36-$40. Seven percent stated that they would pay $50 and less than 2% were willing to pay more than that.

The remaining questions dealt with the sales issue. Since 1983, it has been illegal to sell shrimp caught over bait, regardless of the harvester's status (e.g. having a land and sell license) and that of the buyer (e.g. being a licensed primary wholesale dealer). In order to legally sell shrimp landed in South Carolina (excluding mariculture product), the harvester must have either a land and sell or trawler captain's license, the initial buyer must be a licensed primary wholesale dealer, and the shrimp must have been taken by legal means (e.g. in season, in open areas, and by permitted gear). Dealers are required to report their purchases, either on a monthly dealer report or on weekly shrimp tickets, and channel netters must submit weekly reports of their daily landings. Although the sale of shrimp taken by cast net but not over bait is legal, the amount thus harvested is negligible.

Commercial shrimpers (primarily trawler operators) have frequently complained that the sale of shrimp caught over bait is a significant problem for several reasons. The sellers are not properly licensed commercial shrimpers (a trawler captain's license costs considerably more than a baiting permit). Shrimp baiters operate in areas that are mostly closed to trawling, the principal commercial method. They also maintain that sales of baited shrimp reduce local demand for legal commercial product. They view the practice as unfair competition.

Recreational shrimp baiters have also registered dissatisfaction with the sale of baited shrimp. They consider it an unsuitable use of a recreational resource and an abuse of what was intended to be solely a sporting activity. They maintain that some baiters go many times during the season and catch far more shrimp than they can personally use, and resent what they perceive as excessive harvest taken solely for sale.

Although not widely perceived as a conservation problem the harvest of substantial amounts of baited shrimp for sale is viewed by both commercial fishermen and true recreational shrimpers as an allocation problem, in that the quantities taken for illegal sale

Table 12. Responses to the questions on whether sales are a problem and if they can be effectively prevented.

Residential category	No. of observations		
	Illegal sales of baited shrimp are		
	not a problem	a minor problem	a major problem
Northern Coastal	9	41	35
Central Coastal	49	205	263
Southern Coastal	25	108	119
Central Inland	17	108	93
Other	23	52	45
	can be effectively prevented		cannot be prevented
Northern Coastal	42		35
Central Coastal	309		191
Southern Coastal	124		117
Central Inland	121		83
Other	69		39

DISCUSSION

Season Comparisons

Following a mild winter, abundance of roe white shrimp was high during the spring spawning season and postlarval sampling indicated a highly successful spawn. In the coastal area, the June-August period was the hottest on record and the fifth driest in the last century. The August survey of shrimp stocks by the Crustacean Management Program found that abundance was relatively high, although most of the shrimp were below average in size and in the more inland areas of the estuaries. October sampling in Charleston Harbor and the southern sounds resulted in relatively low catch rates. Seaward migration appeared to be delayed due to unusually high salinities as a result of continued dry conditions.

The 1993 overall average catch rate (23.5 quarts/trip) was somewhat below the 1987-1992 average (24.9). The overall catch was the second highest to date and nearly reached that estimated for 1990. This was partly due to a large increase in effort, attributable to a record number of active permit holders and slightly greater average effort per permit holder than in the past two years. Environmental conditions were generally favorable for the baiting fishery, in contrast to 1991 when heavy summer rains contributed to the outmigration of a substantial portion of the stock prior to the baiting season. The opposite was true in 1993 with dry conditions contributing to the delayed movement of shrimp out of the estuarine areas.

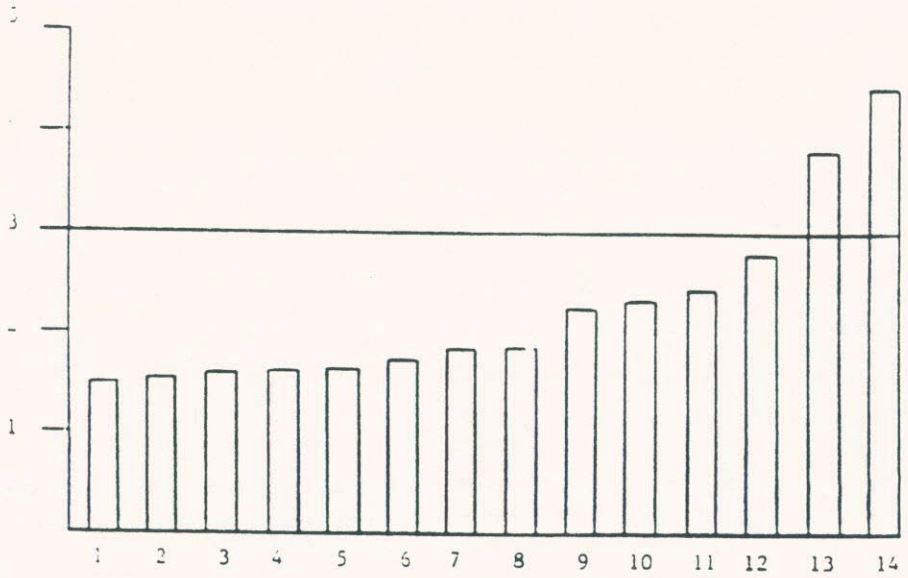
In recent years, the relative distribution of the fall white shrimp harvest among shrimp baiters and commercial shrimpers has been a principal issue. In 1992, a monitoring system was implemented that assigned commercial landings by area on a weekly basis and recreational and commercial landings in similar areas can therefore be examined during comparable time frames. The baiting areas and comparable commercial zones are as follows:

Baiting area	Commercial zone
Beaufort area	Hilton Head to Bay Point
St. Helena Sound	Bay Point to S. Edisto River
Wadmalaw/Edisto Islands	S. Edisto River to Stono Inlet
Charleston area	Stono Inlet to Dewees Inlet
Bulls Bay	Dewees Inlet to Cape Romain
Georgetown area	Cape Romain to N.C. line, including Santee and Winyah Bays

The comparison of recreational and commercial landings (for all gears) is shown in Table 15. In-season commercial landings were defined as those during week 2 of September through week 2 of

Table 13. Opinion ratings of possible management options.

Option no.	Percent in category 1	2	3	4	5	N	I	Rank
14	.047	.026	.067	.146	.713	1,230	4.449	1
13	.067	.091	.191	.266	.385	1,186	3.811	2
12	.239	.175	.277	.165	.144	1,208	2.800	3
11	.422	.138	.164	.143	.133	1,200	2.427	4
10	.452	.149	.151	.119	.128	1,207	2.319	5
9	.420	.202	.152	.133	.092	1,206	2.272	6
8	.529	.234	.111	.082	.044	1,215	1.878	7
7	.509	.259	.129	.070	.033	1,206	1.859	8
6	.549	.263	.120	.047	.020	1,226	1.723	9
5	.614	.235	.063	.062	.026	1,218	1.651	10
4	.626	.223	.092	.035	.025	1,217	1.613	11
3	.583	.286	.088	.030	.013	1,213	1.604	12
2	.613	.251	.084	.033	.019	1,218	1.594	13
1	.688	.184	.072	.035	.021	1,215	1.517	14



OPTIONS

1. Shrimp during daytime only.
2. Shrimp on certain days (nights) only.
3. Shrimp in certain areas only.
4. Shorten the season with no other changes.
5. Reduce the catch limit allowed per trip.
6. Reduce the number of poles allowed.
7. Limit the number of permits sold.
8. Extend the season with a lower catch limit per trip.
9. Extend the season with a limit on the number of trips allowed.
10. Allow sales (of baited shrimp) to dealers only with a commercial license required plus a baiting permit.
11. Allow sales (of baited shrimp) to dealers only with a special permit and catch reporting required.
12. Require ½ inch minimum mesh size in castnets.
13. Maintain the current regulations with no changes.
14. Increase the penalties for illegal sales.

Fig. 2. Approval ratings of management options.

Table 14. Comparison of opinion poll response parameters using forms 1 and 2.

Option no.	Index		Rank	
	Form 1	Form 2	Form 1	Form 2
14	4.50	4.40	1	1
13	3.91	3.72	2	2
12	2.81	2.79	3	3
11	2.51	2.34	4	4
10	2.40	2.25	5	6
9	2.27	2.27	6	5
8	1.95	1.81	7	8
7	1.85	1.88	8	7
6	1.71	1.74	10	9
5	1.67	1.63	11	10
4	1.72	1.50	9	14
3	1.62	1.59	13	11
2	1.65	1.54	12	12
1	1.51	1.53	14	13

November. The total commercial landings included those during August through the close of the season on January 14, 1994.

Comparisons between areas are influenced by such factors as the relative sizes of the baiting population and trawler fleets, proximity of population centers and trawler docks, accessibility of the inland waters, and extent of estuarine areas vs trawlable coastal waters. Table 16 shows the percentages of the combined recreational and commercial landings attributable to the baiting fishery. The shares were similar to those in 1992 for all areas except Georgetown. In 1993, the baiters' percentage of the total catch there increased substantially.

Illegal Sales

The remaining discussion addresses the issue of illegal sales of baited shrimp and various approaches to reduce the volume of shrimp available for this purpose. In addition to comments provided by respondents to this year's survey, information from previous surveys was also considered. Some aspects were previously discussed briefly in an article (Low 1991 b) in the spring 1991 issue of Coastal Perspective.

Most respondents recognized that a problem does exist with illegal sales, although they were rather evenly divided as to its severity. A majority of about 3:2 also believed that such sales can be largely prevented. Based on their comments and opinions of various proposals, they believed that this could be accomplished through a combination of more enforcement of existing laws and the deterrent value of increased penalties for violations of them.

Supporting this interpretation is the fact that the only two management proposals receiving favorable evaluations from shrimpers in all residential categories were no changes in the existing system and stiffer penalties. Respondents' comments to both this survey and previous ones have consistently referred to a perceived need for more law enforcement at the landings and on the water to reduce excessive catches. The extensive support for increased penalties is not surprising since the vast majority of respondents considered themselves law-abiding and therefore unaffected by such a measure.

Legalization of baiting for commercial harvest, subject to conditions, received more support than most of the other proposed options, including all but one in the restrictive category. A majority (50-60%), however, was opposed to both suggested proposals.

The remaining options were restrictive in some form and of three types: 1) limitation on effort, 2) limitation on catch, and

Table 15. Estimated shrimp baiting catches and reported commercial landings (all gears) by area, in in pounds of whole shrimp.

Area	Recreational	Commercial		Combined	
		In-season	Total	In-season	Total
Beaufort	870,517	85,341	207,966	955,858	1,078,483
St. Helena Sound	185,702	453,228	1,015,240	638,930	1,200,942
Wadmalaw/Edisto Is.	202,597	190,065	325,502	392,662	528,099
Charleston area	886,045	299,219	435,565	1,185,264	1,321,610
Bulls Bay	269,440	316,290	468,619	585,730	738,059
Georgetown area	295,605	651,532	1,044,249	947,137	1,339,854
Total	2,709,906	1,995,675	3,497,141	4,705,581	6,207,047

Table 16. Shrimp baiting catches expressed as percentages of landings in designated categories.

Area	In-season	Total combined
Beaufort	91	81
St. Helena Sound	29	15
Wadmalaw/Edisto Islands	52	38
Charleston Harbor area	75	67
Bulls Bay	46	37
Georgetown area	31	22
Total	58	44

3) gear restriction. Their intent, either direct or indirect, was to reduce the overall amount of shrimp landed and, by implication, the amount available for illegal sale.

The four most strongly opposed proposals placed some restriction on effort. Least popular was the proposal to limit shrimping to daytime only. The principal rationale for this measure is that it would facilitate law enforcement. It would also reduce effort in that many working shrimpers would be unable to go during the week. Such a measure would contribute to lower landings since daytime baiting is less effective in many areas; however, it would contribute to crowding both on the water and at access points, particularly on weekends. Restricting activity to certain days (nights) or areas was also particularly onerous to most respondents. Many noted that their choice of dates is already limited by factors such as employment, weather and tides. Under some circumstances, such a provision could also aggravate an already serious crowding problem. Depending on residential category, from 63% to 79% of the respondents limited their activity to only one fishing area. Should they by prohibited from shrimping in their usual locations, they might be unwilling to travel to alternative locations.

Restricting baiting to certain areas to facilitate law enforcement would probably be ineffective without companion measures to reduce effort. A likely consequence would be the intensification of geographic impact on commercial landings by concentrating baiting effort within certain areas. Increased crowding and access problems would also be likely. A variant of this approach, i.e., limiting use of a permit to designated locations, was suggested in the 1990 survey and drew virtually no support.

A shortened season would obviously reduce overall effort and catch, assuming that shrimpers did not compensate for this by making more trips per unit of time. This would work against those shrimpers with limited time available, however, and could be seriously disrupted by weather, such as happened with Hugo. Respondents to various surveys have consistently objected strongly to a shorter season.

Limiting the number of permits issued would presumably reduce overall effort and, indirectly, the overall catch. Without other changes, this would not contribute materially to improved law enforcement and the loss of revenues (assuming no fee increase) could reduce it.

The most direct and enforceable way to limit the amount of shrimp landed would be to reduce the allowable catch per trip per boat. This could be done either by simply reducing the current 48

quart (whole shrimp) limit per boat or by setting a lower limit per permit holder and allowing each permit holder in the boat to take that amount. South Carolina's limit is liberal compared to those in other states, but only if taken by the permit holder working alone. If shared with another individual, as is typically the case, then each participant's share of a limit catch would be comparable to that allowed in other states. Respondents were strongly opposed to reducing the current limit and only slightly less opposed to a lower catch limit combined with a longer season as compensation.

The two gear restrictions evaluated were a reduction in the number of poles allowed and a ½ inch minimum mesh regulation. Limiting the number of poles presumably would reduce the catch per trip assuming no increase in trip duration. Crowding on the water and navigational problems probably would be reduced somewhat. Respondents strongly opposed this measure, however, and a likely reaction to it if passed would be to extend trips to allow more passes through the poles.

The impact of a minimum mesh regulation on the overall season catch is difficult to project. The most positive benefit would be a reduction in the wastage of small shrimp, particularly early in the season. The percentage of shrimpers using ½ inch mesh varied considerably between areas several years ago, but the trend has been toward greater use of it. Statewide in 1991, the numbers of shrimpers using 3/8 inch and ½ inch mesh nets were about equal. The universal use of the larger mesh might increase the total catch above the level associated with the present mixed gear fishery for the same amount of effort, however, since the average catch rate in 1991 was about 10% greater with the ½ inch mesh (compared to 3/8 inch).

The least objectionable restrictive proposal (other than the minimum mesh option) was to extend the season with a limit on the number of trips allowed, although over 60% of the respondents were opposed to it. The main reaction to this measure concerned its enforceability. This approach has been extensively studied and numerous methods for designating the trips suggested, but none would be effective without substantially increased on-site enforcement. Since this is what respondents feel is necessary to make the existing laws effective, there was little support for an additional regulation requiring the same condition for its effectiveness. The most frequently mentioned season trip limit was ten. During the last three seasons, only 15% or so of the respondents have reported making more trips than that per season and only about 5% have made more than 15. The overall reduction in effort as a result of a ten-trip limit, therefore, would be fairly modest (<20%) and this approach assumes that most shrimpers would not make additional trips during an extended season. It is also

very probable that the shrimpers making illegal sales would simply ignore this measure, thus it is difficult to see how this provision would materially reduce the amount of shrimp sold illegally, particularly in conjunction with a longer season.

Assuming that illegal sales are a problem (as most respondents indicated), then, what can be done to curtail them that would not be perceived as unfairly restrictive by the legitimate recreational baiters? Four factors need to be addressed in any workable plan: 1) the source of the shrimp being sold illegally, 2) the distribution system, 3) equitability of regulations, and 4) enforceability given a practical limit on law enforcement presence.

To effectively limit sales of an item, you must control its source of supply (or demand for it, which is impractical in this instance). Based on comments from survey respondents, seafood dealers, and law enforcement agents, it appears that most of the illegal shrimp is sold to friends, neighbors, or acquaintances of the baiters rather than through the dealer-based distribution system or other regular channels. Although many respondents indicated roadside vendors as the main outlet, previous investigations by law enforcement have found no indication of significant illegal activity by these sellers. It appears that the harvesters are also the primary distributors of illegally sold shrimp. Given this situation, it would accomplish little to impose additional reporting requirements (a so-called "paper trail") on the dealer/retailer network.

The key to both the source and distribution of illegally sold baited shrimp is the harvester. Based on survey responses, a relatively small number of baiters account for most of the illegally sold shrimp. These individuals shrimp most of the season and take as many shrimp as they can, using whatever means necessary to circumvent the current regulations. Although undoubtedly casual sales do occur, it appears that most of the problem is attributable to individuals who systematically and deliberately violate the laws. Imposition of additional restrictions is therefore unlikely to deter this group. It would simply increase the burden of compliance for law-abiding shrimpers while doing nothing significant to reduce illegal sales. Many respondents commented that the legitimate recreational shrimpers should not be subjected to any more laws, since they do not contribute to the problem, in an attempt to curb illegal sales.

The equitability of any additional regulations is therefore a principal concern. If the legitimate shrimpers view these regulations as unnecessarily restrictive and unwarranted (as appeared to be the case with nearly all of the proposed measures), they will strongly oppose them through the political process and, if passed, the level of compliance will be questionable. Some of

the proposals would impact some residential groups more than others. It should be recognized that there are two major components of the permit holder population: 1) local coastal residents and 2) inland residents. A major consideration in evaluating any new law should be its effect on each component. Restrictions on effort tend to be more burdensome on the coastal residents, while catch limitations have relatively more impact on inland residents. Rather few measures would have a reasonably uniform impact on both groups.

Finally, the ability to enforce regulations is a major practical concern. Compliance with the current system is largely voluntary given the limited capabilities for on-site enforcement. The extent of area open to shrimping, the number and dispersion of access points (particularly in the southern coastal area), and the nighttime disposition of the fishery all contribute to the problem. Effective enforcement of both existing regulations as well as most new ones that have been suggested is dependent on a high frequency of inspections at landings and/or on the water. In order to achieve the enforcement level necessary to be effective, many more officers and support equipment would be required.

Most of the revenue from sales of baiting permits presently reverts to the Department's Law Enforcement Division. A significant increase in enforcement of shrimp baiting laws would require substantial additional funds. The most logical source would be the permit fee, yet respondents indicated little willingness to pay more than the current cost ($25). It therefore seems unlikely that an increase in permit fees alone would materially improve the ability to reduce illegal sales.

The position of the vast majority of respondents is rather clear and can be summarized briefly. Most recreational baiters abide by current laws and only a small group of renegades who systematically and deliberately violate them is largely responsible for illegal sales. Additional restrictions will impose a further burden on the legitimate shrimpers while being ignored (as are present laws) by this group. These additional limitations are unfair because they will restrict the group that does not cause the problem. What is needed is to concentrate on the group that does cause the problem. This can best be done by improving the enforcement of existing laws and increasing the penalties for violating them.

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APPENDIX 1a. Introductory statement and fishery statistics questions

South Carolina
Wildlife & Marine
Resources Department

EQUAL OPPORTUNITY AGENCY

James A. Timmerman, Jr., P
Executive Dir
Paul A. Sandifer, P
Direct
Marine Resources Div

ATTENTION SHRIMP BAITING PERMIT HOLDERS

The enclosed survey contains questions on your shrimp baiting activities during the past season. These questions are similar to those in previous surveys with your answers being used to estimate participation, effort, and catch by area. Please answer them honestly with your best estimates. Base your responses only on shrimpin you did with your permit and poles. The return envelope requires no postage. Pleas complete and return the form even if you did no shrimping.

The sale of baited shrimp is perceived to be a significant problem. A portion of the questionnaire addresses this issue. We would like your opinions regarding th sale of baited shrimp and various options that may be considered to reduce the amoun of shrimp available for potential sale. Any changes to current law must be enacted by the General Assembly. Please take the time to answer these questions, as your collective responses could decisively influence the future management of this fisher

- -

1. What county do you live in? _____

2. How many trips did you make using your permit and gear?

   _____SEP _____OCT _____NOV _____All season _____ NONE

3. Please indicate the number of trips you made in each area:

   _____BEAUFORT (incl. Calibogue Sd., Pt. Royal Sd., Broad R., Whale Branch R., etc.)

   _____ST. HELENA SD. (incl. Coosaw, Morgan, Combahee, & Ashepoo R.)

   _____WADMALAW/EDISTO IS. (incl. N. and S. Edisto R.)

   _____CHARLESTON (incl. harbor and area rivers)

   _____BULLS BAY (incl. the McClellanville area)

   _____GEORGETOWN (incl. Santee & Winyah Bays and Horry Coun

4. How many different people assisted you on your trips? _____

5. What was your average catch of shrimp per trip (in quarts of whole shrimp)? ____

6. What was your total catch for the season (in quarts of whole shrimp)? _____

7. Will you get a baiting permit next year? ___YES ___NO ___UNDECIDED

8. What is the maximum amount you would pay for a baiting permit assuming no change in the current regulations? $_____

PLEASE COMPLETE THE OTHER SIDE!

P. O. Box 12559 ☐ Charleston, South Carolina 29422-2559 ☐ Telephone: 803 – 795-6350

APPENDIX 1b. Opinion poll, form 1.

What is your opinion regarding the sale of shrimp caught over bait, a practice that is currently illegal. Please check all that apply.

Illegal sales are 1) __not a problem 2) __a minor problem 3) __a major problem

Illegal sales 1) ___can be effectively prevented 2) ___cannot be controlled

If the General Assembly amends shrimp baiting laws, please indicate your position on the following possible types of amendments for the baiting fishery:

Regulatory action	Strongly oppose	Oppose	Neutral	Support	Strongly support
Maintain current laws/no changes	___	___	___	___	___
Reduce the trip catch limit	___	___	___	___	___
Reduce the number of poles	___	___	___	___	___
Require ½ inch minimum mesh	___	___	___	___	___
Limit number of permits sold	___	___	___	___	___
Shrimp certain areas only	___	___	___	___	___
Shrimp certain days only	___	___	___	___	___
Shrimp daytime only	___	___	___	___	___
Shorten season with no other changes	___	___	___	___	___
Extend season with lower trip catch limit	___	___	___	___	___
Extend season with limit on number of trips allowed	___	___	___	___	___
Increase penalties for illegal sales	___	___	___	___	___
Allow sales to dealers only with commercial license plus baiting permit	___	___	___	___	___
Allow sales to dealers only with special permit and catch reporting requirement	___	___	___	___	___

Any suggestions or comments?

APPENDIX 1c. Opinion poll, form 2.

What is your opinion regarding the sale of shrimp caught over bait, a practice that is currently illegal. Please check all that apply.

Illegal sales are 1) __not a problem 2) __a minor problem 3) __a major problem

Illegal sales 1) ___can be effectively prevented 2) ___cannot be controlled

If the General Assembly amends shrimp baiting laws, please indicate your position on the following possible types of amendments for the baiting fishery:

Regulatory action	Strongly oppose	Oppose	Neutral	Support	Strongly support
Allow sales to dealers only with special permit and catch reporting requirement	___	___	___	___	___
Allow sales to dealers only with commercial license plus baiting permit	___	___	___	___	___
Shorten season with no other changes	___	___	___	___	___
Extend season with lower trip catch limit	___	___	___	___	___
Extend season with limit on number of trips allowed	___	___	___	___	___
Increase penalties for illegal sales	___	___	___	___	___
Reduce the trip catch limit	___	___	___	___	___
Reduce the number of poles	___	___	___	___	___
Require ½ inch minimum mesh	___	___	___	___	___
Limit number of permits sold	___	___	___	___	___
Shrimp certain areas only	___	___	___	___	___
Shrimp certain days only	___	___	___	___	___
Shrimp daytime only	___	___	___	___	___
Maintain current laws/no changes	___	___	___	___	___

Any suggestions or comments?