

SURVEY OF THE SOUTH CAROLINA SHRIMP  
BAITING FISHERY, 1990

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## ERRATA

The preliminary figures for commercial harvest are in error, resulting in the following corrections.

**Abstract:** Based on preliminary commercial landings data, this catch exceeded the commercial catch during September and October and represented 46% of the total fall shrimp harvest.

**p. 15:** Figures for commercial landings through December totalled 3.233 million pounds of whole (white) shrimp. Landings reported for September and October were 2.3 million pounds. The lowest estimate of the recreational catch over bait for the comparable period exceeded this amount. The intermediate estimate, 2.75 million pounds, represented 46% of the total (baiting plus commercial) harvest of fall white shrimp. Total landings of fall white shrimp were above average despite last winter's freeze.

**Table 9, p. 16:** The percent of total fall shrimp harvest for 1990 should read 46%.

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## ABSTRACT

Information on the 1990 shrimp baiting fishery was obtained from a postseason mailout survey sent to 32% of the 9,703 permit holders. The return rate at the end of the designated four-week response period was 41%. An estimated 9,149 permit holders and 25,513 assistants participated in the 1990 season, making 71,153 trips to catch 2.75 million pounds of whole shrimp. Based on preliminary commercial landings data, this catch slightly exceeded the commercial catch during September and October and represented 41% of the total fall shrimp harvest. The minimum economic value of the baiting fishery, calculated as the sum of permit costs, direct trip expenses, and ex-vessel value of the catch, was \$7.1 million. Permit holders made an average of 7.8 trips/individual. About 86% of the effort occurred during September and October. About half of the effort was directed at Charleston Harbor and/or its tributaries, with most of the remaining effort deployed in the Beaufort/Port Royal area. The statewide catch rate (25.6 quarts of whole shrimp/trip) equalled the average of the last three seasons. Participants received an estimated average of 79 pounds of whole shrimp/individual for the season. A majority (54%) of respondents supported making the limit per permit holder rather than per boat. A near majority (46%) wanted a longer season. About one-third (32%) favored giving MRD authority to make adjustments in the season based on conditions, while 20% felt no changes in the management provisions were needed.

## ACKNOWLEDGEMENTS

Andy Applegate and David Whitaker contributed suggestions regarding survey design. Mary Jo Clise and the Computer Services Section provided computer printouts of permit holders by county group and the mailing labels. Joanna Walling, Jennie Freeman, Buck Custer, Harvey Atwater, and Billy Glenn assisted in preparing the mailout. Joanna Walling typed the report. The survey was funded with proceeds from sales of 1990 shrimp baiting permits.

## INTRODUCTION

The history of shrimp baiting in South Carolina was described by Theiling (1988). The first study of this fishery was done in 1987 and consisted of an on-site creel census of boating participants combined with a postseason mailout survey of registered boat owners (Theiling 1988). In 1988, the General Assembly passed legislation establishing a 60-day season between 1 September and 15 November, a limit of ten poles to mark bait, a 48-quart (whole shrimp) limit per boat per day, and requiring at least one participant per boat to have a permit keyed to the pole tag numbers. This provided a means to directly survey the participants and a postseason questionnaire was mailed to all permit holders (Waltz and Hens 1989). In 1989, the fishery was surveyed using a combination of methods from the earlier efforts. The 1989 survey consisted of an on-site creel census combined with a postseason mailout to 45% of the permit holders and included questions that addressed socioeconomic aspects of the fishery in addition to participation, effort, and catch. Results from this study were described by Low (1990).

The 1990 season began at noon on 7 September and ended at noon on 6 November. Information on the fishery was obtained by means of a postseason mailout survey. Objectives were to 1) estimate total participation (i.e., the number of active permit holders and their assistants), 2) estimate total effort (i.e., the number of trips), 3) estimate total catch, 4) estimate effort and catch by area, and 5) poll constituency support for possible management options.

## METHODS

The survey consisted of a mailout package sent by first-class mail to 32% (3,100) of the 9,703 permit holders on 9 November. Each package contained an introductory letter (Appendix a) explaining the purpose of the survey and providing instructions for completing the postage-paid, self-addressed postcard questionnaire (Appendix b). Also included was a summary of the 1989 survey results (Appendix c). Based on variances observed in previous surveys, the sample size needed to estimate average catch and effort with a 95% probability of being within +/- 5% of the true means is about 1,000. The response rate to the 1989 mailout within a reasonable recall period was 34%, therefore it was projected that this mailout would generate the target sample size. The mailout was stratified by residence categories based on the distribution of permit holders. An exception was made in the case of the Georgetown/Horry Counties category. In previous surveys, sample sizes from this area were inadequate because of the small number of permit holders residing in these counties. In the 1990 survey, questionnaires were sent to all permit holders from these counties in order to obtain an adequate number of responses. Mailouts were as follows: 1) Charleston County, N = 953; 2) Berkeley/Dorchester Counties, N = 559; 3) Beaufort/Jasper/Colleton/Hampton Counties, N = 587; 4) Georgetown/Horry Counties, N = 376; and 5) other counties, N = 625.-

It took five weeks for the distribution of returns to the 1989 questionnaire to approximate the distribution of registered permit holders in terms of percentage composition by area of residence. The most likely explanation was the disruption of mail service in those areas most heavily impacted by Hurricane Hugo. This period is somewhat lengthy in terms of reliable recall ability. For the 1990 survey, it was decided to terminate the response period when the target sample size ( $N = 1,000$ ) was obtained and its distribution was comparable in terms of rates of return by residence category.

## RESULTS

The distribution of permit holders in 1990 by area of residence was very similar to that in 1989 (Table 1). Forty (1.3%) of the mailout packages were returned as nondeliverable. At the end of week 4 (9 December), a total of 1,263 responses (41% of the mailout) had been received. The return rates by residential category were: 1) Charleston County, 40% ( $N = 379$ ); 2) Berkeley/Dorchester Counties, 40% ( $N = 224$ ); 3) Beaufort/Jasper/Colleton/Hampton Counties, 36% ( $N = 210$ ); 4) Georgetown/Horry Counties, 44% ( $N = 165$ ); and 5) other counties, 45% ( $N = 283$ ). The percentage of responses in each category received by week is shown in Table 1. By the end of the fourth week, the target sample size had been obtained and return rates by area of residence had stabilized, so the response period (for data analysis) was terminated. An additional 98 responses were received by the end of December, for a total return rate of 44% after adjustment for nondeliverable mailouts.

### Participation

Statewide, less than 6% of the permit holders did not make at least one shrimp baiting trip, based on expansions of percentages from the survey returns. Nonparticipation rates were very similar by residential category (Table 2). The estimated number of active permit holders was obtained by multiplying the number of permits issued in each residential category by the percentage of active respondents. Assistants were the numbers of different individuals who joined the permit holders on their trips (conceivably, some individuals were counted by more than one permit holder, but there was no way to determine this). The average number of assistants per permit holder reported for each residential category was multiplied by the estimated number of active permit holders to obtain the estimated number of assistants. The total numbers of participants by residential category equalled the sum of the active permit holders and assistants.

Respondents were asked to estimate the number of trips they made in each month and nearly all did so. Based on these data, nearly three-fourths of the active permit holders made at least one trip in September (Table 2). Practically all shrimpers participated during October, while just under half went in

Table 1. Distribution of permit holders by area of residence and response rates.

Counties	Area of residence of permit holders			
	N	1990 Percentage	1989 Percentage	
Charleston	3,269	33.7	33.1	
Berkeley/ Dorchester	1,804	18.6	18.8	
Beaufort/Jasper/ Colleton/Hampton				
Beaufort	1,088	11.2	13.0	
Jasper	289	3.0	3.5	
Colleton	484	5.0	5.5	
Hampton	369	3.8	4.2	
Total	2,230	23.0	26.2	
Georgetown/ Horry	381	3.9	1.9	
Other	2,019	20.8	20.0	
Percentage of category totals received by week				
	Week 1	Week 2	Week 3	Week 4
Charleston	59	26	13	2
Beaufort etc.	23	63	13	1
Berkeley/Dorch.	24	58	16	2
Georgetown/Horry	53	38	7	2
Other counties	16	66	16	2

Table 2. Estimated participation by residential category.

	Charleston County	Beau./Jasp. Coll./Hamp.	Berk./ Dorch.	George./ Horry	Other	Total
Permits issued	3,269	2,230	1,804	381	2,019	9,703
Percent active	94.9	93.3	94.6	93.9	94.0	94.3
Number active	3,105	2,081	1,707	358	1,898	9,149
Average number of assistants	2.91	2.74	2.99	3.01	2.42	2.79
Number of assistants	9,036	5,702	5,104	1,078	4,593	25,513
Total number of partici- pants	12,141	7,783	6,811	1,436	6,491	34,662
Percent of active permit holders shrimping by month:						
September	77%	73%	77%	71%	62%	73%
October	94%	90%	91%	93%	89%	92%
November	51%	56%	46%	45%	47%	49%

November. Rates of participation by month tended to be similar in all residential categories, although they were slightly lower for noncoastal residents (i.e., those residing in "other" counties).

### Effort

The average number of season trips per permit holder was obtained by summing the number of trips in each residential category and dividing it by the number of active permit holders. With the exception of noncoastal residents, there was relatively little difference by residential category (Table 3). The estimated numbers of trips per month were calculated by multiplying the 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 monthly components. The relative distribution of effort by month was very similar over all residential categories (Table 3).

The coastal area was divided into six geographical components (Fig. 1). The relative distribution of estimated effort by fishing area is indicated in Table 4. These figures were obtained by multiplying the total number of trips in each residential category by the percentages of (geographically reported) effort targeted at each area. About half of the total 1990 shrimp baiting effort was directed at Charleston Harbor and/or its tributaries. Most of the remaining effort was deployed in the Beaufort/Port Royal area. Very little effort was expended in the northern half of the state's coastal area.

The distribution of overall seasonal effort is shown in Fig. 2. Nearly 80% of the respondents reported making ten or fewer trips and well over half of these individuals made five or less. Nine percent of the respondents indicated that they made more than 15 trips. Replies from a few individuals suggested that shrimp baiting is virtually an occupation for them; one respondent reported making 50 trips during the 60 day season.

### Catch Rates

The catch rates (quarts of whole shrimp/trip) listed in Table 5 were obtained by averaging individual catch rates reported under the various fishing area designations. These calculations were limited to data from respondents who reported shrimping in only the particular area. For example, 25 Charleston County respondents reported that they shrimped only in the Wadmalaw/Edisto Island area; the listed figure is the mean of their catch rates. The statewide totals by fishing area represent the mean catch rates based on the numbers of observations indicated. Standard deviations ranged from 12.43 to 14.00 in the residential area categories.

Table 6 indicates the distribution of average seasonal catch rates by area of residence. Residents of the southern coastal counties (Beaufort, Jasper, Colleton, and Hampton) and those from the north coastal area (Georgetown and Horry Counties) did somewhat better than shrimpers from other counties and catch rates in those fishing areas tended to be higher as well.

Table 3. Estimated effort (number of trips) by residential category.

	Chas. County	Beau./Jasp. Coll./Hamp.	Berk./ Dorch.	George./ Horry	Other	Total
Average trips/ active permit holder	8.61	8.90	7.71	8.75	5.06	7.78
Percent of total trips by month:						
September	39%	36%	39%	38%	33%	37%
October	48%	50%	48%	51%	52%	49%
November	13%	14%	13%	11%	15%	14%
Estimated trips per month:						
September	10,426	6,668	5,133	1,191	3,169	26,587
October	12,832	9,261	6,317	1,598	4,994	35,002
November	3,476	2,592	1,711	344	1,441	9,564
Total trips	26,734	18,521	13,161	3,133	9,604	71,153

Table 4. Estimated effort (number of trips) by fishing area.

Residential Category	Fishing Area					
	B(1)	SH(2)	WE(3)	CH(4)	BB(5)	GA(6)
Charleston County	265	46	2,499	22,930	967	27
Beaufort/Jasper/ Colleton/Hampton	15,734	2,444	332	11	0	0
Berkeley and Dorchester	878	309	829	10,649	480	16
Georgetown and Horry	12	48	0	89	642	2,342
Other counties	5,374	1,283	1,430	960	242	315
Total	22,263	4,130	5,090	34,639	2,331	2,700
Percent of total	31%	6%	7%	49%	3%	4%



- 1 - BEAUFORT (including Calibogue and Port Royal Sounds, Broad River)
- 2 - ST. HELENA SOUND (including Coosaw, Combahee, and Ashepoo Rivers)
- 3 - WADMALAW/EDISTO ISLAND (including N. and S. Edisto Rivers)
- 4 - CHARLESTON HARBOR (including Kiawah, Stono, Folly, Ashley, Cooper, and Wando Rivers)
- 5 - BULLS BAY (including McClellanville area)
- 6 - GEORGETOWN (including Santee and Winyah Bays and Horry County intracoastal waterway)

Fig. 1. Shrimp baiting areas.

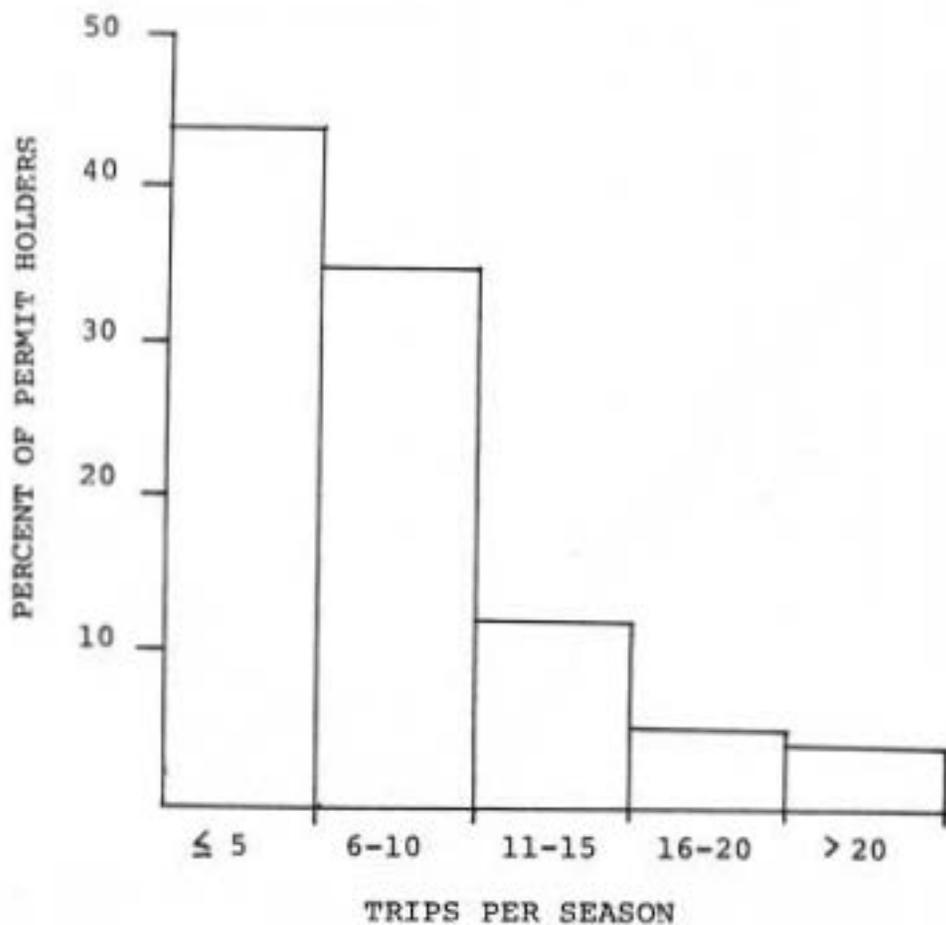


Fig. 2. Distribution of seasonal effort (number of trips).

Table 5. Catch rates (quarts of whole shrimp/trip) by residential category and fishing area.

Residential Category	Fishing Area						Total
	(1)	SH(2)	NE(3)	CH(4)	BB(5)	GA(6)	
Charleston County	35.0	-	25.1	23.3	32.0	-	23.8
Beaufort/Jasper/Colleton/Hampton	29.4	23.2	13.6	-	-	-	28.3
Berkeley and Dorchester	34.4	28.5	20.7	22.8	31.7	-	24.2
Georgetown and Horry	20.5	-	-	-	28.6	26.9	28.3
Other counties	27.2	23.3	19.0	25.4	20.5	25.4	25.5
Total state	28.6	23.8	21.0	23.2	28.8	26.7	25.6
Number of observations	266	41	71	440	27	86	1,177

Table 6. Distribution of average seasonal catch rates (quarts of whole shrimp/trip), in percentages of respondents.

Residential Category	Catch Rate				
	<10 qts.	10-20 qts.	21-30 qts.	31-40 qts.	41-48 qts.
Charleston County	14%	32%	28%	18%	8%
Beaufort/Jasper/Colleton/Hampton	11%	20%	29%	24%	16%
Berkeley and Dorchester	12%	31%	33%	16%	8%
Georgetown and Horry	8%	26%	29%	16%	21%
Other counties	10%	29%	30%	23%	8%
Total state	12%	28%	30%	20%	10%
Cumulative total %	12%	40%	70%	90%	100%

Catch

The total statewide catch was estimated in several ways. The first approach was to multiply the estimated number of trips in each fishing area by the average catch rate for that area, as summarized below:

<u>Fishing area</u>	<u>Trips</u>	<u>Catch rate</u>	<u>Catch (qts.)</u>
Beaufort (B)	22,263	28.57	636,054
St. Helena (SH)	4,130	23.78	98,211
Wadmalaw/Edisto(WE)	5,090	21.03	107,043
Charleston (CH)	34,639	23.21	803,971
Bulls Bay (BB)	2,331	28.78	67,086
Georgetown (GA)	2,700	26.72	72,144

The sum of the area catches is 1,784,509 quarts.

A second method is to multiply the number of active permit holders in each residential category by the average number of trips per permit holder, then multiply that figure by the mean catch rate in that category:

<u>Residential category</u>	<u>Active permits</u>	<u>Trips</u>	<u>Catch rate</u>	<u>Catch (qts.)</u>
Charleston County	3,105	8.61	23.84	637,339
Beaufort, Jasper	2,081	8.90	28.33	524,700
Colleton, Hampton				
Berkeley & Dorchester	1,707	7.71	24.20	318,496
Georgetown & Horry	358	8.75	28.29	88,633
Other Counties	1,898	5.06	25.45	244,422

The sum of the catches by residential category is 1,813,590 quarts.

Another estimate consists of multiplying the total estimated number of trips (71,153) by the statewide average catch rate (25.59 quarts/trip). This figure is 1,820,805 quarts.

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. The average seasonal catch can then be calculated and multiplied by the number of active permit holders in that residential category. This procedure produced the following results:

<u>Residential category</u>	<u>Average catch</u>	<u>Permits</u>	<u>Catch</u>
Charleston County	214.57	3,105	666,240
Beaufort, Jasper	269.37	2,081	560,559
Colleton, Hampton			
Berkeley & Dorchester	198.65	1,707	339,096
Georgetown & Horry	266.21	358	95,303
Other Counties	138.17	1,898	262,247

The total catch thus obtained is 1,923,445 quarts.

Finally, the estimated catches by residential category in each fishing area can be added up:

	<u>B</u>	<u>SH</u>	<u>WE</u>	<u>CH</u>	<u>BB</u>	<u>GA</u>
Charleston County	10,473	1,097	65,099	592,970	31,321	644
Beaufort, Jasper	481,303	65,792	6,613	312	0	0
Colleton, Hampton						
Berkeley & Dorch.	33,619	8,735	21,753	265,160	12,533	387
Georgetown & Horry	351	2,304	0	2,136	17,373	65,974
Other Counties	154,771	31,382	30,330	24,730	4,871	8,045
Total	680,517	109,310	123,795	885,308	66,098	75,050

The sum of these catches is 1,940,078 quarts.

These estimates range from 1,784,509 quarts to 1,940,078 quarts, with a mean for the five values of 1,856,485 quarts. When converted into pounds of whole shrimp (x 1.48), the catches range from 2,641,073 pounds to 2,871,315 pounds. The average is 2,747,598 pounds. Each estimation procedure has advantages and disadvantages and there is no obviously superior method, therefore the average value is probably a reasonable choice. The estimated 1990 shrimp baiting catch was then approximately 2.75 million pounds of whole shrimp (1.79 million pounds heads-off).

The distribution of seasonal catches per active permit holder is shown in Table 7. Depending on the total catch estimate selected, the average individual harvest ranged from 195 quarts (289 pounds) to 212 quarts (314 pounds) of whole shrimp. Based on the intermediate total catch estimate, the average individual permit holder and his assistants caught 203 quarts (300 pounds). Assuming that this was evenly divided between the permit holder and his assistants (2.79 per active permit holder), the average participant in the 1990 fishery realized 53 quarts (79 pounds) of whole shrimp for his effort, or about 51 pounds of heads-off shrimp.

### Management Options

The final category of information requested from respondents concerned their opinions on possible management options. Several of these (e.g. no changes in current status, establishing a longer season, and setting the limit per permit holder rather than per boat) had been mentioned by significant numbers of respondents in previous surveys. Following Hurricane Hugo, many shrimpers requested that the season be extended to make up for the lost time, an action that MRD is not allowed to take under current law. The other choices (allowing baiting only from an anchored boat with no poles, limiting the number of permits issued per fishing area based on a lottery drawing) were included as possible solutions to localized crowding problems, which have been cited by participants shrimping in the most popular areas. Table 8 summarizes the responses by residential area. The percentages indicate the proportion of respondents reporting support for the various measures.

Table 7. Distribution of seasonal catches by residential category.  
Catches are in quarts of whole shrimp.

Residential Category	Catch					
	<99	100-199	200-299	300-399	400-499	>500
Charleston County	35%	26%	15%	8%	7%	8%
Beaufort/Jasper/ Colleton/Hampton	27%	24%	15%	12%	10%	12%
Berkeley and Dorchester	33%	25%	21%	9%	8%	4%
Georgetown and Horry	30%	18%	20%	12%	8%	12%
Other counties	49%	29%	13%	3%	2%	3%
Total state	36%	26%	16%	8%	7%	7%
Cumulative total %	36%	62%	78%	86%	93%	100%

Table 8. Responses by residential category to possible management options,  
in percentages of total (N = 1,261) respondents.

Option	Charleston County	Beau./Jas./ Coll./Hamp.	Berk./ Dorch.	George./ Horry	Other	Total
No changes in current status	26%	22%	17%	14%	17%	20%
Longer season	44%	31%	48%	53%	53%	46%
Set limit per permit instead of per boat	40%	50%	60%	68%	64%	54%
Give MRD authority to adjust season based on conditions	33%	29%	33%	31%	35%	32%
Allow baiting only from an anchored boat, using no poles	4%	7%	5%	3%	2%	4%
Limit number of per- mits per area based on a lottery drawing	5%	2%	3%	<1%	2%	3%

## DISCUSSION

Survey Reliability

In past surveys, the mailout has been stratified by area of residence, with the percentages mailed to county groups approximating their relative composition in the permit holders list. The objective has been to obtain a sample composition similar to that of the permit holders population by area of residence, thereby permitting direct (i.e., unweighted) expansion of participation, effort, and catch indices.

Because the number of permit holders residing in the northern part of the coastal zone has been very small, this has resulted in inadequate numbers of responses from this area to permit reliable estimation of catch and effort in areas north of Charleston Harbor. The 1990 questionnaire was sent to all permit holders in Georgetown and Horry Counties, the objective being to assure adequate sample sizes within all residential categories while maintaining the minimum practical overall mailout (because of cost constraints). The mailout in residence categories with the largest numbers of permit holders (i.e., Charleston County and Beaufort/Jasper/Colleton/Hampton Counties) was reduced accordingly.

As a result, the percentage composition by residence categories of the overall sample population is not directly comparable to that of the total permit holder population, even though the response rates from each category were similar. Estimators based directly on the overall sample therefore are slightly biased by a relatively higher proportion (13.1% vs 3.9%) of respondents from the Georgetown/Horry County area. Thus, the results based on summations of estimates for the various residential categories are probably more accurate than those calculated directly from overall sample values. The similarity in standard deviations of parameter means for the various categories supports this assumption.

The range in total catch estimates was relatively narrow (155,569 quarts), with the highest estimate being only 8.7% greater than the lowest. An intermediate value, calculated as the mean of the five estimates, was within the statistical margin of error associated with overall sample size and appears to be an appropriate choice.

Season Comparisons

In contrast to the 1989 season, weather during most of the 1990 season was good. During September and early October, anecdotal information received from shrimpers and observations by MRD personnel indicated excellent shrimping for predominately large shrimp (21-25 and 26-30 count). In mid-October, several days of heavy rain occurred in conjunction with large tidal fluctuations. After this, success was reported to be highly variable and generally less than earlier in the season. The size of shrimp available in estuarine areas became much more variable, with quantities of substantially smaller shrimp occurring in the lower estuarine areas.

Descriptive values for the 1990 season are compared with those from previous years in Table 9. The number of permits issued for 1990 increased by 46%, more than double the increase observed in the preceding year. The rates of increase by residential category were very uniform, resulting in a relative composition by residential category that was very similar to that in 1989. The estimated number of active permit holders was 67% greater than in 1989. The average number of assistants per permit holder also grew substantially, resulting in a total participant level about double that of the previous two seasons. Because the average permit holder also made more trips, total effort was twice that observed in 1988, the last "normal" year (i.e., unaffected by aberrant conditions such as Hurricane Hugo). The estimated 1990 catch rate approximated the mean of the preceding three years' values. When it was expanded by the large increase in effort, the 1990 estimated total catch was greater than that in the previous two seasons combined.

Abundance of shrimp in the fall of 1989 was probably the greatest in about 15 years. In the absence of Hurricane Hugo, the projected shrimp baiting catch would have been about 1.77 million pounds. Because of the cold weather at Christmas 1989, the overwintering shrimp population was severely impacted and projected spring roe shrimp abundance was very low. Because of this, a closure of federal waters to shrimp trawling was implemented early in 1990 to protect what roe shrimp were present. In spite of anticipated subnormal abundance of fall white shrimp that typically follows a cold winter, the 1990 shrimp baiting harvest exceeded 1989's by a million pounds above what probably would have been caught in the absence of Hurricane Hugo.

This implies that 1) the trawl closure contributed to the abundance of fall shrimp and 2) the shrimp baiting fishery is capable of harvesting a substantial portion of the stock available to it. Preliminary landings data for the fall 1990 season support both contentions. Figures for commercial landings through December totalled 4.002 million pounds of whole (white) shrimp. Landings reported for September and October were 2.642 million pounds. The lowest estimate of the recreational catch over bait for the comparable period approximated this amount. The intermediate estimate, 2.75 million pounds, represented 41% of the total (baiting plus commercial) harvest of fall white shrimp. Landings of fall white shrimp were above average despite last winter's freeze. Preliminary results of a tagging study done at the beginning of the baiting season indicated that most tag returns came from baiters, with relatively few submitted by trawlers. These observations suggest that, when shrimp are moderately abundant, an intensive baiting fishery such as that in Charleston Harbor and its tributaries may harvest significant percentage of the available shrimp.

The economic impact of the shrimp baiting fishery is appreciable. The value of permits sold was \$242,575. Based on trip expense estimates from the 1989 survey adjusted upward for inflation (5%), baiters spent at least \$1.3 million in expenses directly related to their trips (e.g. for gas, bait, and ice). The estimated ex-vessel value of their catch (at \$2.04/pound for whole

Table 9. Season comparisons of participation, effort, and catch parameters.

	1987	1988	1989	1990
Permits	NA	5,509	6,644	9,703
% active permits	NA	92	82	94
Assistants/permit	NA	2.50	2.14	2.79
Participants	21,735	17,749	17,171	34,662
Season trips/permit	NA	6.99	5.73	7.78
Effort (trips)	40,101	35,609	31,624	71,153
Quarts whole shrimp/ trip	28.5	22.1	26.5	25.6
Million pounds of whole shrimp	1.80	1.16	1.25	2.75
Pounds/participant	83	65	73	79
Percent of total fall shrimp harvest	29	32	24	41

shrimp) was \$5.61 million. For the Charleston Harbor area alone (the most heavily utilized in the state), direct trip expenses represented an economic contribution of at least \$500,000 and baiters harvested at least \$2.5 million (ex-vessel value) worth of shrimp.

### Management Options

About 29% of the respondents to the 1989 survey indicated that no changes were necessary in the management of the shrimp baiting fishery. Returns of the 1990 questionnaire indicated that 26% of the Charleston County residents (the largest county group) felt no changes were warranted, although the "approval rating" in other residential categories was somewhat lower (Table 8). Statewide, 20% of the respondents supported no changes.

Of the 1989 survey respondents, 29% also favored a longer season. Overall, 46% of the 1990 survey returns indicated support for this option, with the majority of resident permit holders in the Georgetown/Horry County and inland residential categories backing it. Some of the support for a longer season stems from the belief that it would help alleviate crowding in heavily fished areas by dispersing effort over a longer period. It also would provide more flexibility for individuals to reschedule trips in event of bad weather, etc. This would be beneficial to those participants with limited time availability who live some distance away from the shrimping areas.

The only option that received support from a majority of respondents statewide was the change in the limit provision. In most other state fisheries with a bag or possession limit, the measure applies to the individual. The logic advanced by shrimpers is that each permit holder should be allowed a limit, rather than setting the limit by boat regardless of the number of participants (or permit holders) in it. This would make the limit concept consistent with that in other fisheries. Most shrimpers in every residential category except Charleston County felt that each permit holder in the boat should be allowed a limit.

After Hurricane Hugo eliminated one-third of the 1989 season for most shrimpers north of Edisto Island, MRD received numerous requests to extend the season in order to compensate for the lost time. The current statute prevents that. Based on that experience, a suggested option was to authorize MRD to open and close the season according to current conditions, rather than simply setting opening and closing dates with no provision for subsequent modification. Roughly one-third of the respondents in each residential category supported this concept.

Two other options were offered for comment, both intended to alleviate crowding in heavily fished and congested areas. The use of poles has been a problem, both because of navigation considerations and arguments among shrimpers over spacing in congested, popular shrimping areas. Shrimp can be caught effectively over bait from a boat anchored bow and stern, with bait scattered around it without marking poles. Eliminating poles would allow more boats to shrimp an area, reduce navigation obstructions,

and eliminate the problem of lost poles and tag replacements. This measure would also eliminate one of the more difficult aspects of the current law to enforce. Despite these apparent advantages, very few shrimpers supported this option.

If the number of permit holders continues to increase at the current rate, crowding at access sites and on the water is likely to become a major problem and lead to increased conflicts among shrimpers. The option of limiting the number of permits issued per area and selecting recipients by lottery drawing (similar to the process used to allocate hunting permits in some game management areas) was offered for comment. Very few shrimpers supported this concept and a greater number stated their opposition to it.

Both participation and total catch by shrimp baiters are increasing substantially and the amount of shrimp taken in this fishery may become an important management issue. In the absence of any obvious conservation problem, the harvest distribution is essentially an allocation issue. Numerous socioeconomic factors should be considered in evaluating management alternatives, e.g. the gross economic values of the recreational harvest and commercial landings, the social worth of the recreational experience and its dependence on yield to participants, the direct and indirect economic contributions of recreational and commercial activity, and vested interests (e.g. investments in gear) of each user group. The 1989 survey provided socioeconomic information on the recreational fishery for that evaluation.

It is likely that some consideration will eventually be given to additional restrictions on shrimp baiting, probably with the intent of either stabilizing proportional distribution of total physical yield or reducing the component produced by baiting. One option for accomplishing these objectives would be to modify the limit provision. This could be done by setting the limit per permit holder rather than per boat, with a lower daily limit. Respondents' comments indicate, however, that additional field coverage by law enforcement is necessary to make any regulations really effective, including those now in force.

## REFERENCES

- Theiling, D. 1988. Assessment of participation and resource impact of shrimp baiting in coastal South Carolina during 1987. S.C. Mar. Res. Center Tech. Rep. 69, 41 p.
- Waltz, W. and B. Hens. 1989. Survey of the South Carolina shrimp baiting fishery, 1988. S.C. Mar. Res. Center Tech. Rep. 71, 43 p.
- Low, R.A. 1990. Survey of the South Carolina shrimp baiting fishery, 1989. S.C. Mar. Res. Center Tech. Rep. 73, 50 p.



EQUAL OPPORTUNITY AGENCY

*South Carolina  
Wildlife & Marine  
Resources Department*

James A. Timmerman, Jr., Ph.D.  
Executive Director  
Paul A. Sandifer, Ph.D.  
Director of  
Marine Resources Division

ATTENTION SHRIMP BAITING PERMIT HOLDERS

The Marine Resources Division is surveying a sample of shrimp baiting permit holders to obtain data on participation, effort, catch, and related aspects of the recreational shrimp fishery. This information will be considered with that from previous surveys in the development of management strategies for South Carolina's shrimp fishery.

Because of the growing popularity and significance of recreational shrimp harvesting, it is VERY IMPORTANT that the Division have accurate, unbiased data in order to manage the shrimp fishery fairly and effectively. You are the best source of such information. Please answer the questions on the enclosed card honestly with your best estimates. Base your responses only on shrimping you did with your permit, tags, and poles. Please mark the card appropriately and return it even if you did no shrimp baiting this year. The card requires no postage.

Enclosed for your information is a summary of the results from the 1989 survey. (reverse side)

Thank you for your assistance.

Paul A. Sandifer  
Director  
Marine Resources Division

APPENDIX A

COUNTY CODE

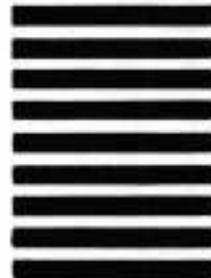


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**S.C. MARINE RESOURCES CENTER  
ATTN. SHRIMP SURVEY  
P.O. BOX 12559  
CHARLESTON, S.C. 29412**



1. Did you make any shrimp baiting trips with your permit in 1990?  YES  NO  
If not, leave questions 2-5 blank.
2. How many trips did you make using your permit, tags, and poles? If possible, indicate the number of trips made in each month.  
  

___ Total	___ SEP	___ OCT	___ NOV
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3. Please indicate the number of trips you made in each of the following areas:

___ BEAUFORT (incl. Calibogue & Pt. Royal Sds., Broad R.) ___ ST. HELENA SD. (incl. Coosaw, Combahee, & Ashepoo R.) ___ WADMALAW/EDISTO ID. (incl. N. & S. Edisto R.)	___ CHARLESTON HARBOR (incl. Kiawah, Stono, Folly, Ashley, Cooper, & Wando R.) ___ BULLS BAY (incl. McClellanville area) ___ GEORGETOWN (incl. Santee & Winyah Bays & Horry County)
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
4. How many different people assisted you on your trips? \_\_\_\_\_
5. What was your average catch of shrimp per trip? \_\_\_\_\_ quarts whole
6. Which of the following management options do you support? Check as appropriate.

<input type="checkbox"/> No changes	<input type="checkbox"/> Longer season (more days)	<input type="checkbox"/> Setting limit per permit holder instead of per boat
<input type="checkbox"/> Flexible season (MRD authority to open and close based on conditions)		
<input type="checkbox"/> Baiting only from anchored boat, using no poles		<input type="checkbox"/> Limited number of permits per area based on lottery drawing

## 1989 SURVEY SUMMARY

Information on the 1989 shrimp baiting fishery was obtained through an on-site creel census and a postseason mailout survey. The creel census took place at heavily utilized public access points from early October through the end of the season (13 November) in Beaufort and Charleston Counties. A total of 348 interviews was obtained. The postseason questionnaire was mailed to 45% of the 6,644 permit holders. The return rate as of the end of the designated five week response period was 34%.

Compared to the 1988 season, there was a 21% increase in the number of permit holders, but only an 8% increase in those (N = 5,469) who actually shrimped. Overall participation (N = 17,171 individuals) declined about 3% and total effort (31,337 - 31,911 trips) was down about 10%. The overall average catch rate (26.5 quarts of whole shrimp per boat trip) was 19% higher and the total harvest (approximately 1.25 million pounds of whole shrimp) was up about 8%. This catch represented about 24% of the total white shrimp harvest, compared to 31.5% in 1988. The average catch per participant was about 10% more than in 1988. Most shrimping took place in Charleston and Beaufort Counties, with relatively less effort in the Charleston area than in 1988.

Shrimpers spent an estimated minimum of \$756,000 for permits and expenses directly related to their trips, making the average cost of shrimp harvested about \$0.60 per pound. The catch was worth about \$3.75 million at contemporary dockside prices.

The impact of Hurricane Hugo was most obvious from Wadmalaw Island north. Statewide, nearly 18% of the permit holders did not go shrimping, compared to 8% in the previous year. Most of the nonparticipation was among residents of Charleston County (29% did not go) and the Berkeley/Dorchester area (24% of the permit holders in these counties did not participate). Had it not been for the storm, it is projected that participation would have been 25% higher, effort 42% greater, and total catch about 1.77 million pounds. The total direct economic impact of the storm on the fishery was estimated at about \$1.77 million.

Other than hurricane-related factors and weather, shrimpers reported few problems. About 29% of those who commented on management of the fishery felt no changes were necessary. The same percentage wanted a longer season. Many shrimpers felt that the season should have been extended due to the hurricane and thought that the Marine Resources Division should be granted the authority to make such inseason adjustments. The setting of the limit by boat rather than according to the number of permit holders in it was another major concern; shrimpers wanted to be allowed one limit per permit holder. In general, other comments were very similar to those made following the 1988 season.

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