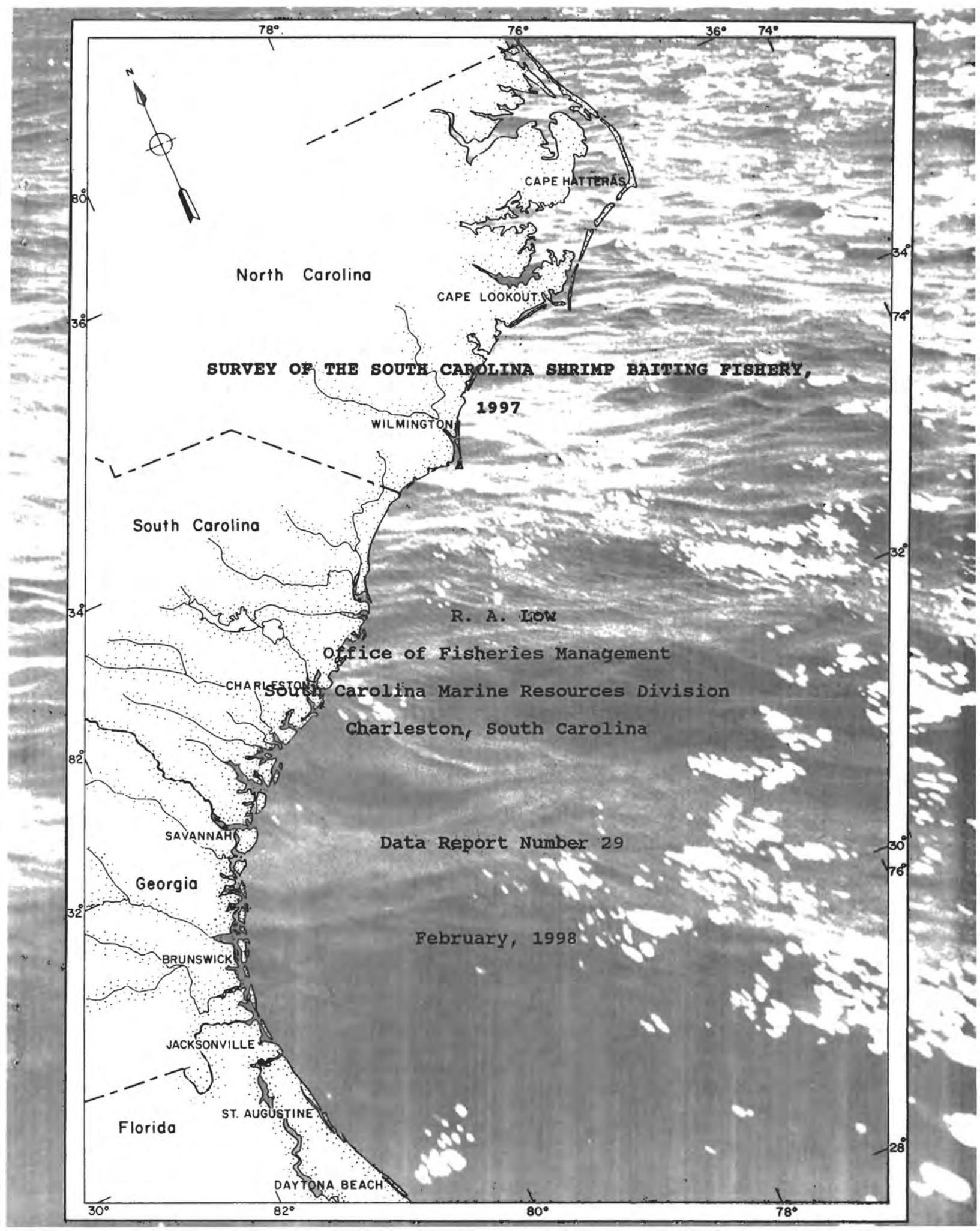

SURVEY OF THE SOUTH CAROLINA SHRIMP BAITING FISHERY, 1997

R. A. Low

Office of Fisheries Management

South Carolina Marine Resources Division

Charleston, South Carolina

Data Report Number 29

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ACKNOWLEDGMENTS

Mary Jo Clise and the Computer Services Section provided computer listings of permit holders and mailing labels. Printing of survey materials was done in the SCDNR Print Shop in Columbia under the supervision of B. R. Hook. Joe Moran of the Fisheries Statistics Section provided information on commercial landings. The survey was funded with proceeds from sales of 1997 shrimp baiting permits at a cost of approximately $1,500.

INTRODUCTION

Theiling (1988) described the history of shrimp baiting in South Carolina. Surveys have been conducted annually since 1987, using various approaches to address several objectives and issues (Theiling 1988, Waltz and Hens 1989, Liao 1993, Low 1990, 1991, 1992, 1993, 1994, 1995, 1996, and 1997). These studies have obtained statistics on participation, effort, and catch for each season, in addition to information on demographics of participants and constituency opinions on management options, user group conflicts, and economic issues.

Data for the 1997 fishery were obtained from a postseason mailout survey. The objectives were to estimate 1) total participation (i.,e., the numbers of active permit holders and their assistants), 2) total effort in numbers of trips, 3) total catch, and 4) effort and catch by shrimping area.

METHODS

The survey was identical to those of the previous three years. The survey package consisted of an introductory statement and a self-addressed business reply postcard questionnaire (Fig. 1). The package was sent by first class mail to 3,994 permit holders out of a total population of 15,488. The sample was randomly selected and stratified in direct proportion to the percentage of permit holders residing in each county. A three-week return period was specified in order to minimize problems associated with recall and responses received after that were not included in the analysis.

RESULTS

The effective mailout (after subtraction of nondeliverables) was 3,969 with a return rate of 38.3% (N = 1,521) by the cutoff date. Distributions of the total permit holder populations in the last three years by county of residence compared to that in the first year of permit sales are shown in Table 1. The distributions of the 1997 permit holder population and sample are provided in Table 2. As has been generally the case, the return rates from noncoastal residents were slightly higher, but the overall distribution of the sample group was comparable to that of the total population.

Participation

About 8.7% of the respondents indicated that they had made no trips using their gear tags. The estimated numbers of active permit holders (Table 3) were obtained by multiplying the number of permits issued in each residence category by the percentage of positive responses received per area. Assistants were the numbers of different individuals who accompanied the permit holders. Although some individuals probably were counted by more than one

1. What county do you live in? _____

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

   _____ SEP _____ OCT _____ NOV _____ All season

3. Please indicate the number of trips you made in <u>each</u> area, as indicated on the enclosed map.

   _____ BEAUFORT _____ CHARLESTON

   _____ ST. HELENA SD _____ BULLS BAY

   _____ WADMALAW/EDISTO IS. _____ GEORGETOWN

4. How many <u>different</u> 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? _____ quarts

Fig. 1. Survey questionnaire.

Table 1. Distributions of permit holder populations, in percentages of permit holders by county.

County	1988	1995	1996	1997
Abbeville	0.1	0.3	0.3	0.3
Aiken	2.0	3.7	3.7	3.7
Allendale	1.2	0.8	0.9	0.9
Anderson	0.2	0.4	0.4	0.5
Bamberg	1.5	1.3	1.3	1.3
Barnwell	1.3	1.8	1.8	2.0
Beaufort	10.3	10.1	10.1	9.7
Berkeley	9.4	10.2	9.7	9.7
Calhoun	0.4	0.8	0.8	0.9
Charleston	41.2	25.6	25.7	25.6
Cherokee	<0.1	<0.1	<0.1	<0.1
Chester	<0.1	0.2	0.2	0.2
Chesterfield	<0.1	<0.1	<0.1	<0.1
Clarendon	0.1	0.4	0.5	0.5
Colleton	5.0	5.0	4.8	4.9
Darlington	0.1	0.5	0.7	0.6
Dillon	0	0.2	0.2	0.2
Dorchester	6.9	5.7	5.5	5.4
Edgefield	<0.1	0.3	0.3	0.3
Fairfield	0.1	0.3	0.2	0.2
Florence	0.2	1.3	1.4	1.5
Georgetown	2.4	5.8	5.8	5.6
Greenville	0.2	0.8	0.8	0.8
Greenwood	0.1	0.4	0.5	0.6
Hampton	4.0	3.0	2.9	2.8
Horry	0.3	2.1	2.4	2.4
Jasper	3.4	1.9	1.9	1.9
Kershaw	0.1	0.5	0.5	0.6
Lancaster	0	0.1	0.1	0.2
Laurens	0.1	0.2	0.3	0.2
Lee	0	<0.1	<0.1	<0.1
Lexington	2.5	4.9	5.0	5.3
McCormick	<0.1	<0.1	<0.1	<0.1
Marion	0.1	0.1	0.2	0.2
Marlboro	<0.1	<0.1	<0.1	<0.1
Newberry	0.2	0.5	0.5	0.5
Oconee	<0.1	0.2	0.2	0.2
Orangeburg	4.0	3.6	3.6	3.6
Pickens	<0.1	0.2	0.2	0.3
Richland	1.4	2.8	3.0	3.0
Saluda	<0.1	0.3	0.3	0.3
Spartanburg	0.1	0.5	0.5	0.5
Sumter	0.3	0.9	1.0	0.9
Union	0.1	<0.1	<0.1	<0.1
Williamsburg	0.4	0.8	0.8	0.8
York	0.1	0.4	0.5	0.5

Table 2. Distribution of permit holders and sample population.

Residence category	Total population N	Total population %	Sample population N	Sample population %
North Coast				
Georgetown	861	5.6	77	5.1
Horry	377	2.4	41	2.7
Total	**1238**	**8.0**	**118**	**7.8**
Central Coast				
Berkeley	1509	9.7	134	8.8
Charleston	3967	25.6	383	25.2
Dorchester	833	5.4	76	5.0
Total	**6309**	**40.7**	**593**	**39.0**
South Coast				
Beaufort	1505	9.7	148	9.7
Colleton	754	4.9	74	4.9
Hampton	440	2.8	39	2.6
Jasper	294	1.9	24	1.6
Total	**2993**	**19.3**	**285**	**18.7**
Central Inland				
Aiken	579	3.7	64	4.2
Allendale	133	0.9	9	0.6
Bamberg	199	1.3	20	1.3
Barnwell	304	2.0	21	1.4
Lexington	821	5.3	80	5.3
Orangeburg	565	3.6	54	3.6
Richland	469	3.0	49	3.2
Total	**3070**	**19.8**	**297**	**19.5**
Other	**1878**	**12.2**	**228**	**15.0**
Total	**15488**		**1521**	

Table 3. Estimated participation by residence category.

	North coast	Central coast	South coast	Central inland	Other	Total
Permits issued	1238	6309	2993	3070	1878	15488
% active permits	92.4	89.7	91.9	91.6	93.9	91.3
Number active	1144	5659	2751	2812	1763	14129
Aver. assistants	2.41	2.46	2.40	2.43	2.44	2.44
Total assistants	2757	13921	6602	6833	4302	34415
Participants	3901	19580	9353	9645	6065	48544
Percent of total	8.0	40.3	19.3	19.9	12.5	

individual, the extent of such duplication was assumed to be negligible. The average numbers of assistants per permit holder in each residence category were multiplied by the estimated numbers of active permit holders to obtain the estimated total numbers of assistants. The total numbers of participants equalled the sums of the active permit holders and their assistants.

Effort

The average numbers of season trips per active permit holder were obtained by summing the numbers of trips reported in each residence category and dividing these figures by the numbers of respondents who reported trips. These means were then multiplied by the numbers of estimated active permit holders in the overall populations to obtain estimates of seasonal effort by residence cateogry (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. These were determined from the data provided by respondents who broke their seasonal effort down into complete monthly components. The estimated effort figures in the **Total** column were generated by adding these categorical figures.

The coastal area was divided into six geographical components (Fig. 2). The relative distribution of estimated effort in each area is indicated in Table 5. These figures were obtained by multiplying the total numbers of trips in each residence category by the percentages of effort reported in each area. Percentages were determined by summing all trips reported by area within each residence category, then dividing by the numbers associated with each area.

Catch Rates

Average seasonal catch rates are listed in Table 6. These were obtained by adding the reported catch per unit of effort (CPUE, in quarts of whole shrimp/trip) in each category and dividing by the numbers of observations. The CPUEs in Table 7 were calculated by summing the season CPUEs for each area and dividing these figures by the corresponding numbers of observations. 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 more than one area.

Because the residential stratification of the sample population was similar to that of the total permit holder population, an unbiased estimate of the average statewide CPUE can be obtained by calculating the mean of the CPUEs reported by the respondents. This value was 26.4 quarts of whole shrimp/trip.

Table 4. Estimated numbers of trips by residence category.

	North coast	Central coast	South coast	Central inland	Other	Total
Aver. trips/permit	7.0	6.8	8.1	5.7	5.3	6.6
% by month						
September	36	33	34	33	38	34
October	48	45	48	46	47	47
November	16	22	18	21	15	19
Estimated trips/month						
September	2883	12699	7576	5289	3551	31998
October	3844	17316	10696	7373	4392	43621
November	1281	8476	4011	3366	1401	18535
Total	**8008**	**38491**	**22283**	**16028**	**9344**	**94154**
Percent of total	9	41	24	17	9	

Table 5. Estimated number of trips by shrimping area.

Residence category	Beaufort	St. Helena	Wadmalaw/ Edisto	Charleston	Bulls Bay	George-town
North Coast	55	0	0	33	6230	1690
Central Coast	681	604	5208	21943	9933	122
South Coast	16756	4362	648	450	67	0
Central inland	8035	3375	2528	954	1125	11
Other	2483	1751	951	564	3064	531
Total	**28010**	**10092**	**9335**	**23944**	**20419**	**2354**
% of total	30	11	10	25	22	2

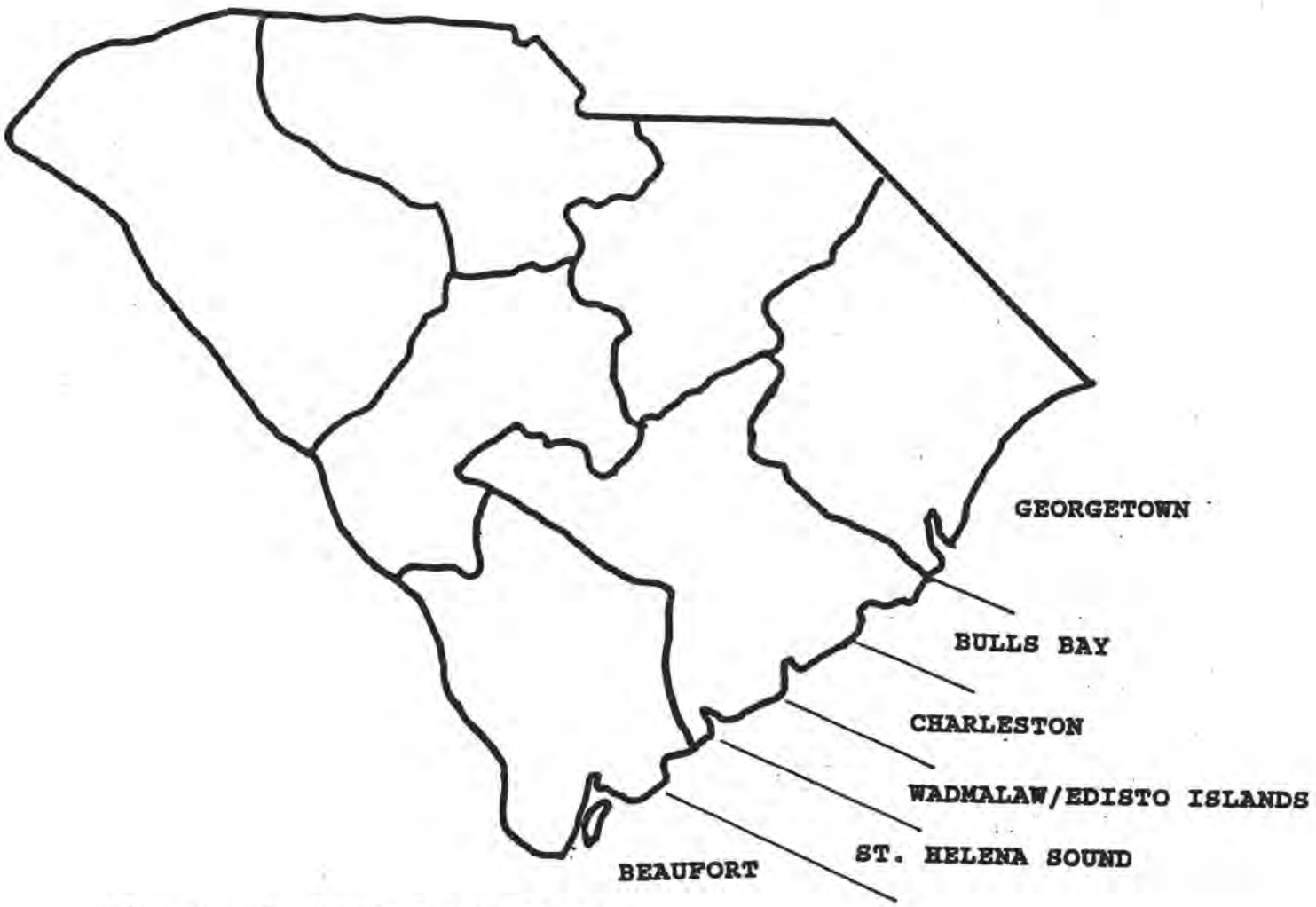

Fig. 2. Shrimp baiting areas.

BEAUFORT-from the Savannah River to the south end of St. Helena Island, including the Beaufort River
ST. HELENA SOUND- from the south end of St. Helena Island to the South Edisto River and southern end of Edisto Island
WADMALAW/EDISTO ISLANDS- from the South Edisto River to the Stono River (Edisto, Wadmalaw, Seabrook, Kiawah, Johns Islands)
CHARLESTON- from the Stono River to the north end of the Isle of Palms
BULLS BAY- from the north end of the Isle of Palms to the southern boundary of Georgetown County (near the Santee River)
GEORGETOWN- Georgetown and Horry Counties, including Winyah Bay

Table 6. CPUE (quarts of whole shrimp/trip) by residence category.

Residence category	CPUE 1991	1992	1993	1994	1995	1996	1997
North Coast	18.2	15.0	26.5	17.9	29.0	13.3	25.4
Central Coast	17.9	24.3	22.3	21.7	27.0	18.7	23.3
South Coast	24.1	26.3	24.0	12.1	28.9	14.8	28.7
Central Inland	24.6	30.3	24.0	16.7	32.3	16.7	29.2
Other	25.7	25.2	24.4	19.9	29.0	16.3	28.5

Table 7. CPUE (quarts of whole shrimp/trip) by shrimping area.

Area	1997 obs.	1991	1992	1993	1994	1995	1996	1997
Beaufort	306	24.4	28.7	22.2	13.2	30.6	15.5	30.7
St. Helena	103	25.0	29.7	23.8	16.4	27.7	18.8	26.2
Wad./Edisto	79	24.2	30.0	22.5	16.1	25.6	17.1	22.4
Charleston	213	14.1	23.4	20.4	21.6	26.1	18.2	23.7
Bulls Bay	189	22.5	20.3	26.4	23.1	28.7	15.2	25.2
Georgetown	24	10.5	14.4	26.9	13.2	19.9	9.6	23.3

Catch

The average season catches (quarts of whole shrimp) reported by respondents were as follows for various residence categories:

North Coast	Central Coast	South Coast	Central Inland	Other
154.0	152.1	234.0	160.9	143.4

There are numerous ways to estimate the total catch, depending on the interest in its relative components. One estimate can be derived from the average catch data above by multiplying them by the appropriate numbers of active shrimpers. This method produced the following estimates:

Residence category	Estimated catch (quarts)
North Coast	176,176
Central Coast	860,734
South Coast	643,734
Central Inland	452,451
Other	252,814
Total	**2,385,909**

The simplest CPUE-based method is to multiply the statewide average CPUE (26.4 quarts/trip) by the estimated total number of trips (94,154). This figure is 2,485,666 quarts.

Catches by residence category were also estimated by multiplying the estimated effort for each by the appropriate CPUE:

Residence category	Trips	CPUE	Catch (quarts)
North Coast	8,008	25.4	203,403
Central Coast	38,491	23.3	896,840
South Coast	22,283	28.7	639,522
Central Inland	16,028	29.2	468,018
Other	9,344	28.5	266,304
Total	**94,154**		**2,474,087**

In most cases, this produced slightly higher values than the method using average season catch.

Catches by shrimping area were obtained by multiplying the estimated effort in each by the correspoinding average CPUE:

Shrimping area	Trips	CPUE	Catch (quarts)
Beaufort	28,010	30.7	859,907
St. Helena	10,092	26.2	264,410
Wadmalaw/Edisto	9,335	22.4	209,104
Charleston	23,944	23.7	567,473
Bulls Bay	20,419	25.2	514,559
Georgetown	2,354	23.3	54,848
Total	**94,154**		**2,470,301**

There are trade-offs in probable accuracy and lack of bias associated with each approach and an intermediate value is a reasonable overall estimate. The average of the four estimates shown above is 2,453,991 quarts. The conversion factor from quarts to pounds (whole weight) is 1.48. The weight equivalent of heads-on shrimp is 3,631,907 pounds. The conversion factor to heads-off weight is 0.649, giving an estimate of 2,357,107 pounds heads-off.

The statewide average catch per active permit holder, based on reported season catches, was 168 quarts (249 pounds) of whole shrimp. Assuming that this was evenly divided between the permit holders and their assistants, the typical participant obtained about 72 pounds of whole shrimp.

The relative distribution of the fall white shrimp harvest is perceived by some parties as an allocation issue. Since 1992, a monitoring system for commercial landings has been in place that permits comparison of recreational and commercial landings for comparable area/time units. The baiting areas and corresponding commercial statistical zones are as follows:

Baiting area	Commercial zone
Beaufort (rivers, sound)	Hilton Head to Bay Point
St. Helena Sound	Bay Point to South Edisto River
Wadmalaw/Edisto Islands	South Edisto River to Stono Inlet
Charleston (rivers, harbor)	Stono Inlet to Dewees Inlet
Bulls Bay	Dewees Inlet to Cape Romain
Georgetown (rivers,bay)	Cape Romain to N.C. line, Winyah and Santee Bays

The comparison of baiting and commercial landings is shown in Table 8. In-season commercial landings were defined as those during week 2 of September through week 2 of November. Total commercial landings included those from week one of August through the closure of the 1997 season. Combined total recreational and commercial landings are the baiting catch plus the total commercial landings as so defined.

DISCUSSION

This was the tenth year of the permitted fishery. Table 9 lists catch and effort statistics for each year's fishery.

Since the inaugural year (1988), total permit sales have increased annually (except in 1992) and nearly tripled (Fig. 3). The principal difference in distribution of the current permit holder population vs the original one is that Charleston County residents now account for an appreciably lower percentage (25.6% in 1997 vs 41.2% in 1988). There has been relatively little change in the percentage contribution of the South Coast area (19.3% vs 22.7%). In absolute terms, the most growth has occurred in the inland counties. Although permit sales have increased 16% during

Table 8. Estimated shrimp baiting catches and reported commercial landings (all gears) by area, in thousands of pounds of whole shrimp.

Area	Baiting	Commercial		Percent baiting	
		In-season	Total	In-season	Total
Beaufort	1,273	148	337	90	79
St. Helena	391	694	1,617	36	19
Wad./Edisto	309	300	510	51	38
Charleston	840	322	540	72	61
Bulls Bay	762	357	673	68	53
Georgetown	81	837	1,202	9	6
Total	3,656	2,656	4,879	58	43

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

	1987	1988	1989	1990	1991	1992
Permits issued	NA	5509	6644	9703	12005	11571
% active permits	NA	92	82	94	89	87
Assts./permit	NA	2.50	2.14	2.79	2.24	2.15
Participants	21735	17749	17171	34662	34821	31812
Trips/permit	NA	7.0	5.7	7.8	6.6	6.1
Total trips	40101	35609	31624	71153	71034	62459
Mean CPUE	28.5	22.1	26.5	25.6	21.3	25.4
M lbs whole	1.80	1.16	1.25	2.75	2.14	2.35
Lbs/participant	83	65	73	79	62	74
% of total fall ldgs.	29	32	24	46	29	39

	1993	1994	1995	1996	1997
Permits issued	12984	13366	13919	14156	15488
% active permits	91	86	89	85	91
Assts./permit	2.43	2.32	2.39	2.25	2.44
Participants	40620	38081	41971	38932	48544
Trips/permit	6.8	6.0	6.5	5.7	6.6
Total trips	80709	70429	81632	68927	94154
Mean CPUE	23.5	18.5	28.9	16.9	26.4
M lbs whole	2.72	1.91	3.40	1.73	3.63
Lbs/participant	67	50	81	44	72
% of total fall ldgs.	44	34	33	35	43

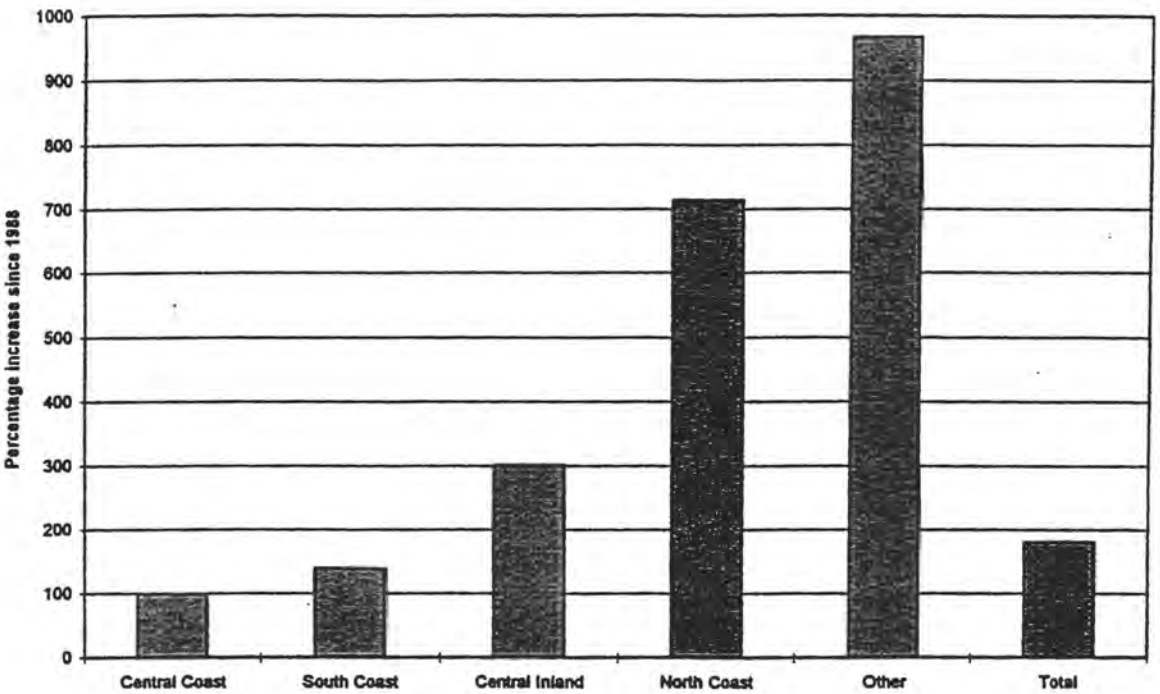

Fig. 3. Relative growth in permit sales.

the last three years, the distribution of the permit holders by county has remained virtually unchanged. This suggests that any future expansion will be relatively uniform in terms of geographic distribution.

The incremental growth in permit sales in 1997 (9.4%) was the largest since 1993. In contrast to the previous two years, weather predictions were favorable. An abundant fall crop of shrimp was also predicted. In-season permit sales were relatively strong, indicating that early season reports of good catches of large shrimp in most areas contributed to increased overall sales.

Climatic conditions generally favored bait shrimping activity. August was drier than normal, which curtailed shrimp outmigration into the ocean. The weather during September through the third week of October was generally good. In the final three weeks of the season, there were two cold fronts accompanied by heavy rain. By then, however, 80% of the seasonal effort has typically been expended.

Facilitated by good weather and good shrimping, there was record participation (N = 48,544), exceeding the previous record set in 1995 by 16%. Both the percentage of active permit holders and average number of assistants/permit holder were above average. Distribution of participation by residential category was similar to that in 1996.

Total effort (N = 94,154 trips) also surpassed the former record set in 1995 by 16%; the average trips/active permit holder were almost identical in both years. The 1997 area figures vs annual averages during 1990-93 and 1994-96 are shown in Fig. 4. Except for the Charleston and Georgetown areas, the 1997 effort appreciably exceeded previous levels. Since 1993, the greatest increases in effort have occurred in Bulls Bay (196 %) and the St. Helena Sound area (91%). The 1997 effort in the Wadmalaw/Edisto Islands area was 53% greater than that in 1993. The increase in the Beaufort area was 9%, while the Charleston and Georgetown areas experienced negative growth (-19% and -68%, respectively).

Catch rates in all areas were good (Fig. 5). The 1997 figure set a record in the Beaufort area and CPUEs were relatively high in the St. Helena Sound area and Bulls Bay. Shrimp in these areas were also reportedly large, while those in the Charleston area were mixed. Small shrimp were prevalent in Winyah Bay, according to anecdotal accounts and MRD sampling. A mild winter, good spring spawn, and nearly ideal summer growing conditions contributed to one of the most successful seasons in ten years.

The estimated catch (3.63 M pounds of whole shrimp) set a record, slightly exceeding the 1995 landings (3.40 M pounds). Although statewide CPUE (26.4 quarts/trip) was well above the 1988-1996 average (23.2), the direct causative factor was the high level

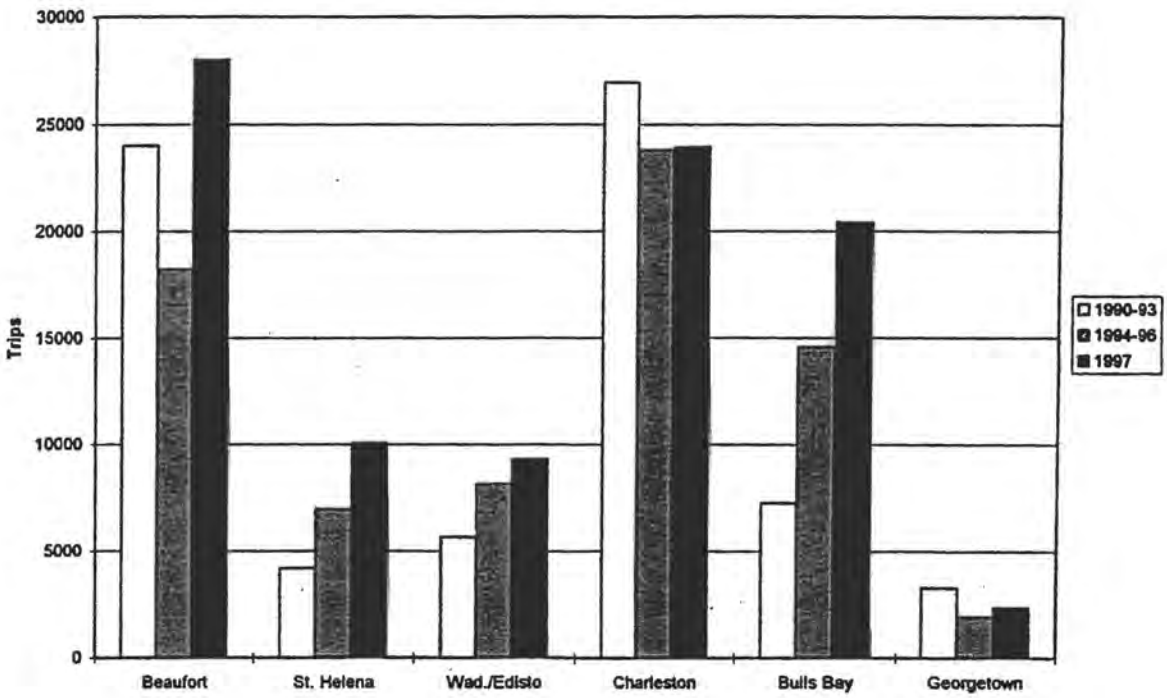

Fig. 4. Effort status by area.

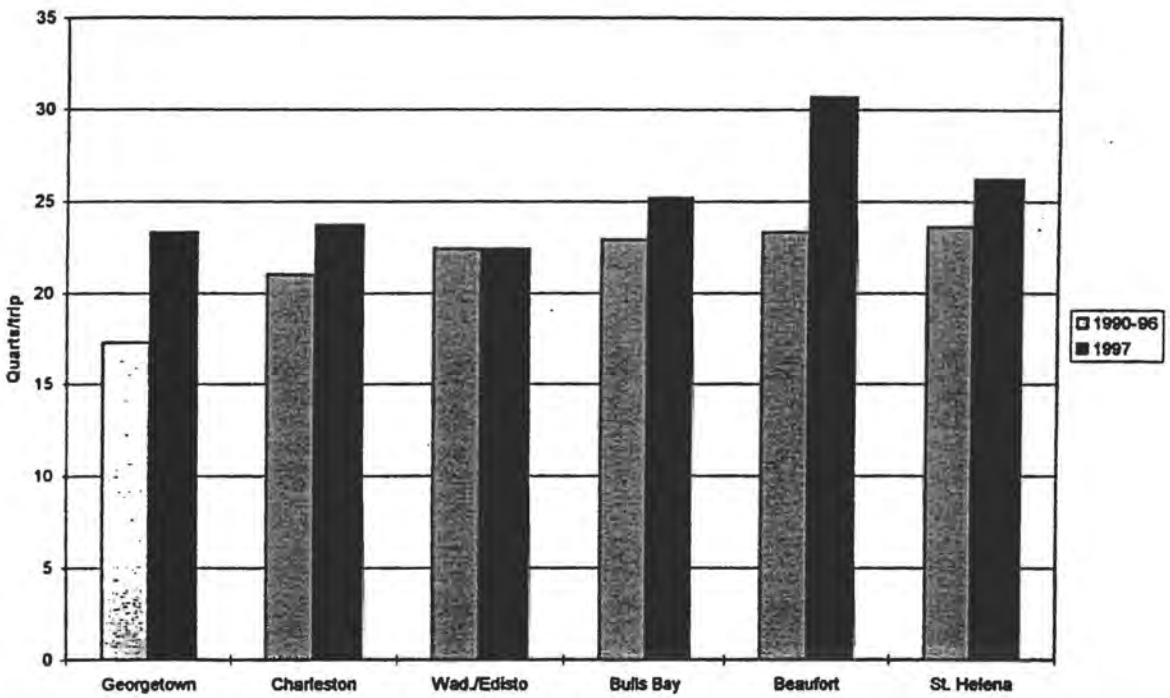

Fig. 5. Area catch rates.

of effort. Beaufort was re-established as the most productive area (Fig. 6) with 35% of the statewide landings. Although the Charleston area contributed 23% of the total catch, its relative status declined considerably by historical standards. Bulls Bay maintained its recent strong status with 21%, while the other areas showed mixed trends.

Allocation of the fall shrimp crop appears to be the main long-term, statewide issue associated with this fishery. No biological problems have been verified. Opinion polls of permit holders have consistently indicated that they are generally satisfied with the current management regime, although better enforcement has been a frequently cited need. The allocation issue has two aspects: 1) illegal commercialization of baited catches and 2) recreational vs commercial shares of the resource.

The illegal sales aspect has been extensively investigated and discussed. Although sales of baited shrimp are widely acknowledged, it has not been possible to define their magnitude and, therefore, the actual severity of the problem. There has been no evidence of significant participation by principal wholesale dealers or roadside vendors. Illegal sales are believed to be primarily attributable to a small group of intentional, habitual violators. These individuals have been very difficult to identify and prosecute. Legitimate shrimpers, while urging strict enforcement of existing laws and severe penalties for violators, have not been willing to endorse additional restrictions intended to curtail illegal sales. The result has been a tacit acceptance of the status quo situation.

Perhaps because shrimp abundance has been relatively high during most of the last decade, there have not been organized, strong protests from the commercial sector over legitimate recreational landings, even though baiting has obviously reduced the amount of shrimp available to ocean trawlers. By how much is not easy to determine. Although baiting effort has trended upward since 1990, there has not been a corresponding increase in the baiters' overall share of fall shrimp landings (Fig. 7).

Trends in specific areas have been variable. Fig. 8 shows the baiters' share of combined commercial and baiting landings of fall white shrimp by area. Other than the fact that the 1997 baiting share was comparatively large in most areas, there have been no consistent or uniform trends over the past five years.

The situation is basically similar for distribution of the harvest during the baiting season (Fig. 9). Bulls Bay is the only area where there has been a persistent increase in the baiting share. Statewide during the past five years, there has been roughly an even split of the in-season landings between the baiters and commercial shrimpers.

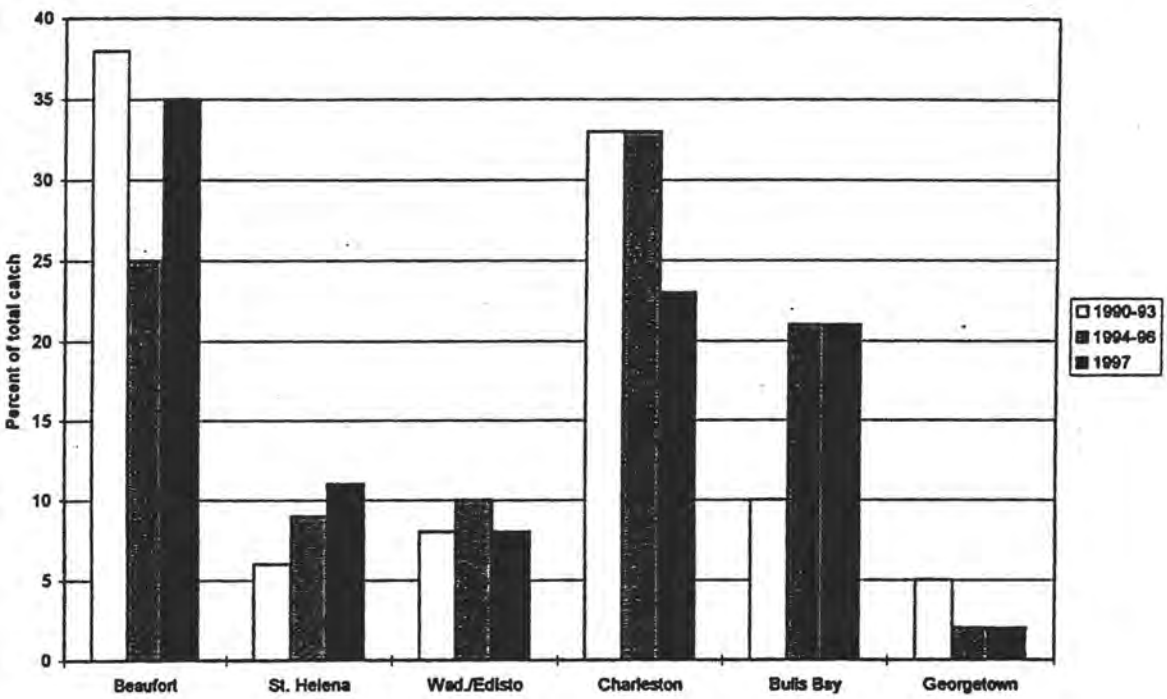

Fig. 6. Catch status by area.

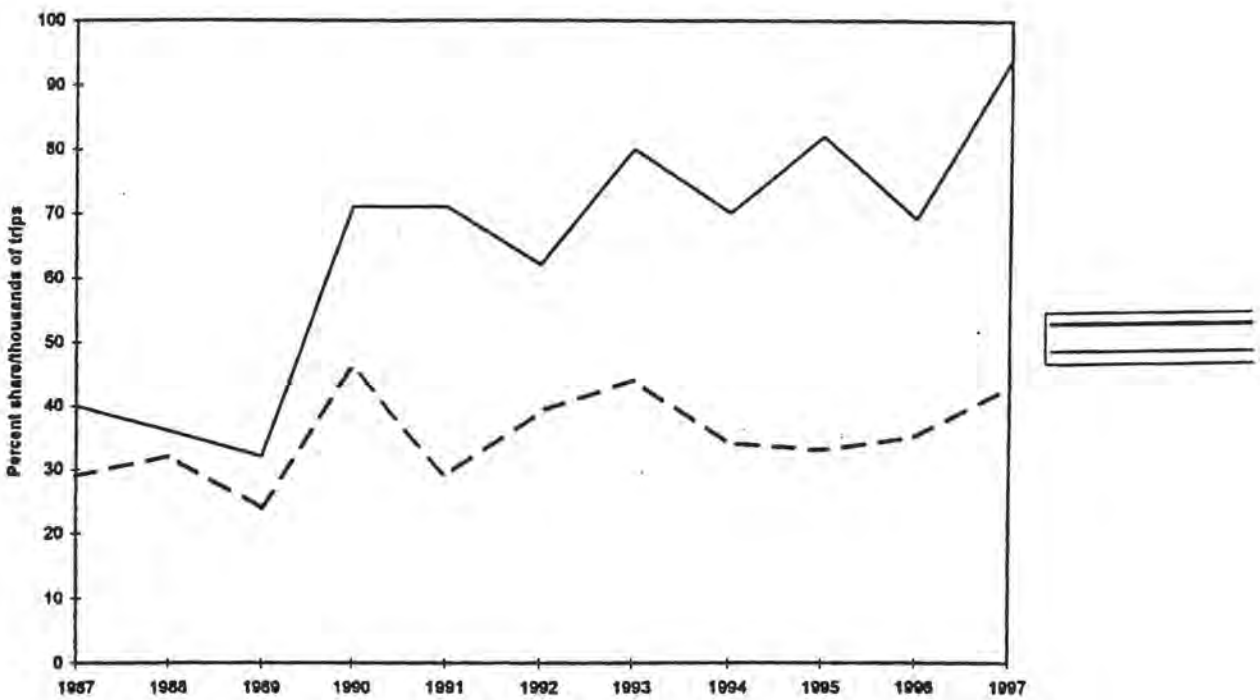

Fig. 7. Baiters' effort and share of total catch.

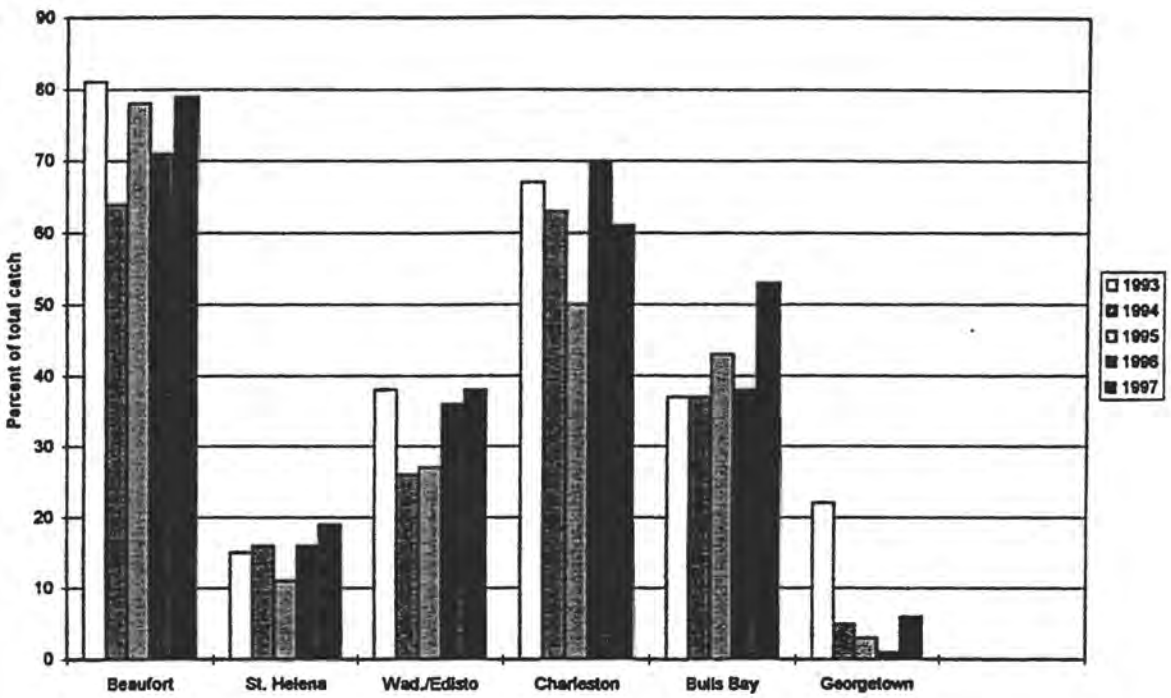

Fig. 8. Baiting share of total landings by area.

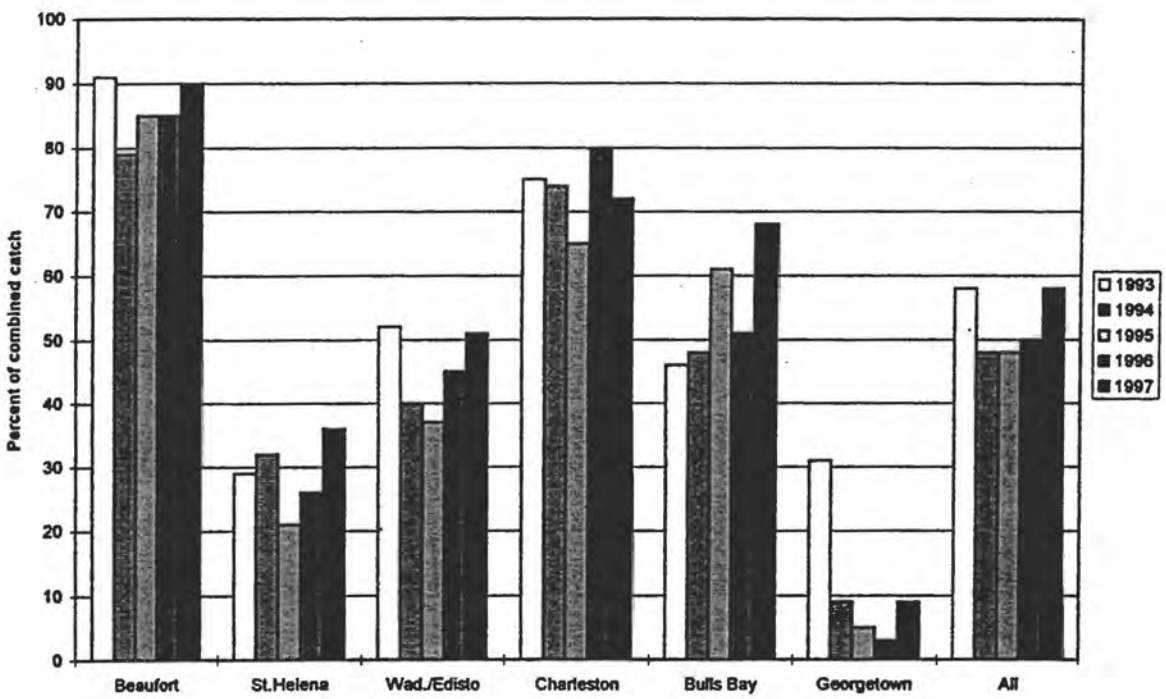

Fig. 9. Baiting share of in-season landings by area.

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