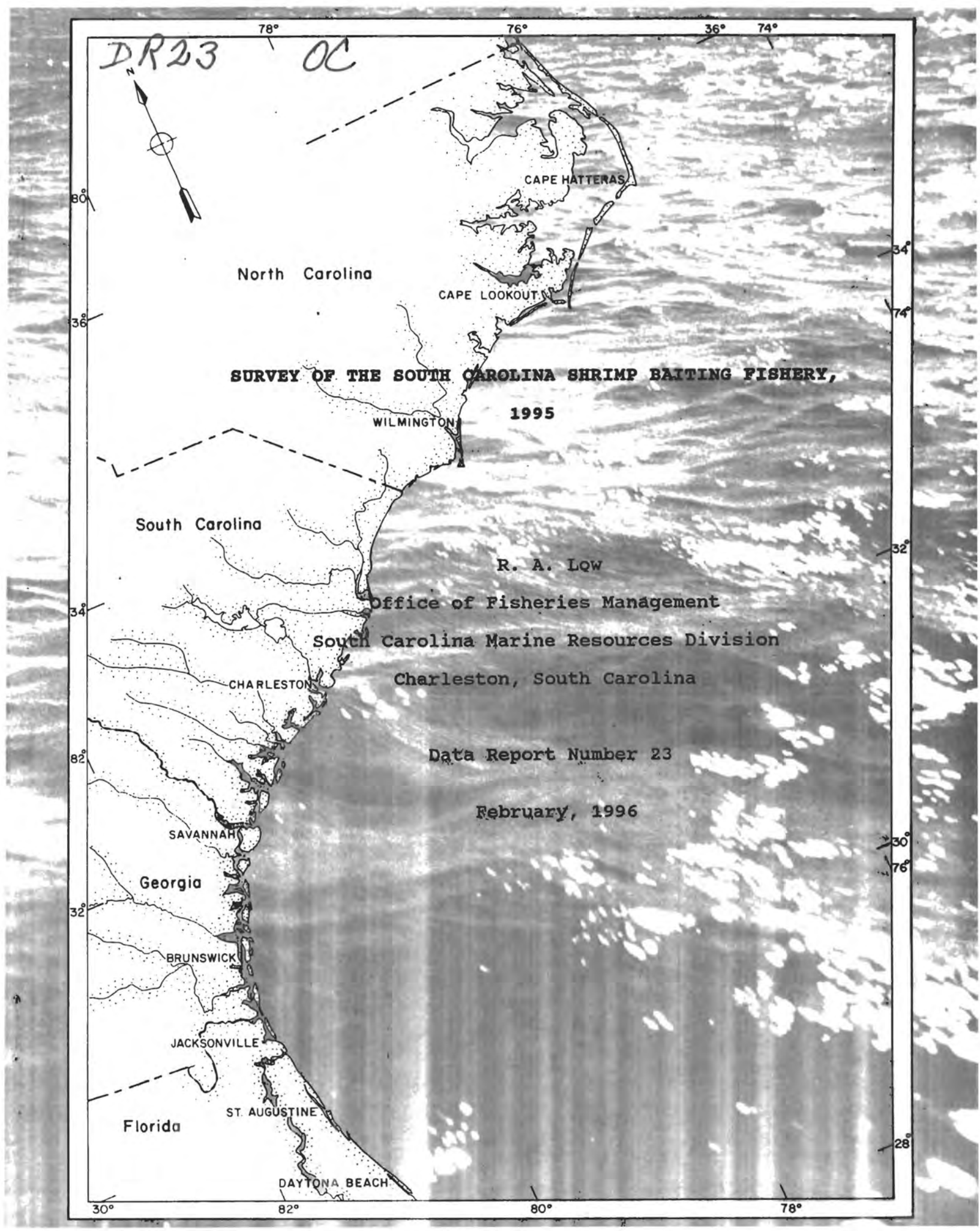

SURVEY OF THE SOUTH CAROLINA SHRIMP BAITING FISHERY, 1995

R. A. Low

Office of Fisheries Management

South Carolina Marine Resources Division

Charleston, South Carolina

Data Report Number 23

February, 1996

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ACKNOWLEDGMENTS

Mary Jo Clise and the Computer Services Section provided computer listings of permit holders and mailing labels. Joe Moran and Nan Jenkins of the Fisheries Statistics Section furnished information on commercial landings. The survey was funded with proceeds from sales of 1995 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 for each season from 1987, using various approaches to address several objectives and issues (Theiling 1988; Waltz and Hens 1989; Low 1990, 1991, 1992, 1993, 1994, and 1995; Liao 1993). These studies have obtained statistics on participation, effort, and catch for each year, in addition to information on demographics of participants, constituency opinions on management options and user group conflicts, and economic issues.

Data for the 1995 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 that conducted in 1994. The survey package consisted of an introductory statement and a self-addressed business reply postcard questionnaire (Fig. 1). The mailout was sent by first class mail to 3,479 permit holders (25% of the total population of 13,919) and was stratified according to area of residence in direct proportion to the distribution of permit holders. In each county, 25% of the permit holders were randomly selected for inclusion in the sample population.

Table 1 lists the numbers of permit holders and sample sizes by residence category and/or county after adjustment for nondeliverable mailings. In the introductory statement, permit holders were requested to submit their responses by December 15, in order to limit the length of the recall period. Questionnaires received after this date were not included in the sample.

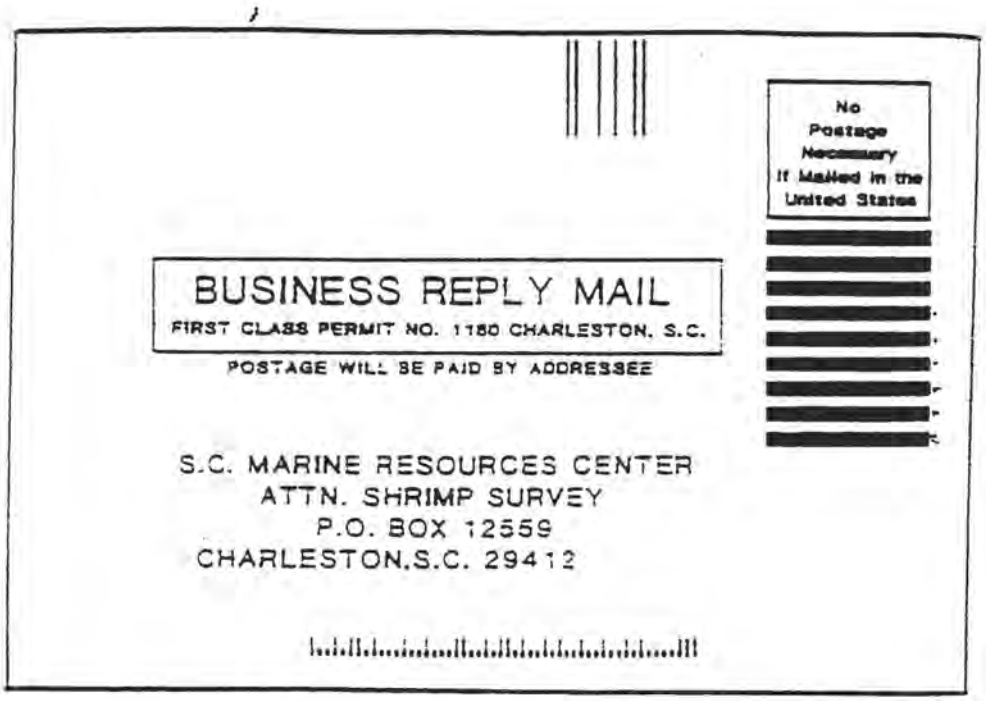
RESULTS

The file used to determine the mailout contained 13,917 entries (two less than the total population) and was also used for other applications. The figures contained in various tables are based on this file, i.e., a total population of 13,917.

Distribution of the sample population is indicated in Table 1. Although return rates from noncoastal counties tended to be slightly higher, the overall distribution of the sample population was representative of that of the total permit holder population.

Participation

About 11% of the sample population reported that they made no



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ATTN. SHRIMP SURVEY
P.O. BOX 12559
CHARLESTON,S.C. 29412

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 & S Edisto R.)
____CHAS., incl. harbor & area rivers
____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? _____ (in quarts of whole shrimp)

6. What was your total catch for the season? _____ quarts whole

7. Will you get a baiting permit next year?

____YES ____NO

Fig. 1. Survey questionnaire.

Table 1. Distribution of permit holders and sample population.

Residence category	Total population N	Total population %	Sample population N	Sample population % return	Sample population % of total
Northern Coastal					
Georgetown	801	5.8	78	40	5.1
Horry	291	2.1	36	51	2.4
Total	**1,092**	**7.8**	**114**	**43**	**7.5**
Central Coastal					
Berkeley	1,418	10.2	137	39	9.0
Charleston	3,569	25.6	347	39	22.7
Dorchester	790	5.7	101	52	6.6
Total	**5,777**	**41.5**	**585**	**41**	**38.3**
Southern Coastal					
Beaufort	1,411	10.1	152	44	9.9
Colleton	689	5.0	83	49	5.4
Hampton	411	3.0	33	32	2.2
Jasper	265	1.9	29	45	1.9
Total	**2,776**	**19.9**	**297**	**43**	**18.5**
Central Inland					
Aiken	514	3.7	70	55	4.6
Allendale	118	0.8	11	37	0.7
Bamberg	180	1.3	20	44	1.3
Barnwell	249	1.8	24	38	1.6
Lexington	680	4.9	90	54	5.9
Orangeburg	500	3.6	56	45	3.7
Richland	396	2.8	54	55	3.5
Total	**2,637**	**18.9**	**325**	**50**	**21.2**
Other	**1,635**	**11.7**	**207**	**51**	**13.5**
Total	**13,917**		**1,528**	**45**	

trips using their permit and tags. The estimated numbers of active permit holders (Table 2) 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 respondent, 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 category (Table 3). 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 the 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 4. 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.

The distribution of effort in terms of average number of trips/permit holder is shown in Fig. 3. Noncoastal residents averaged somewhat fewer trips than did coastal residents with Southern Coastal area permit holders having the highest average effort. About 15% of the respondents reported more than 10 trips for the season.

Catch Rates

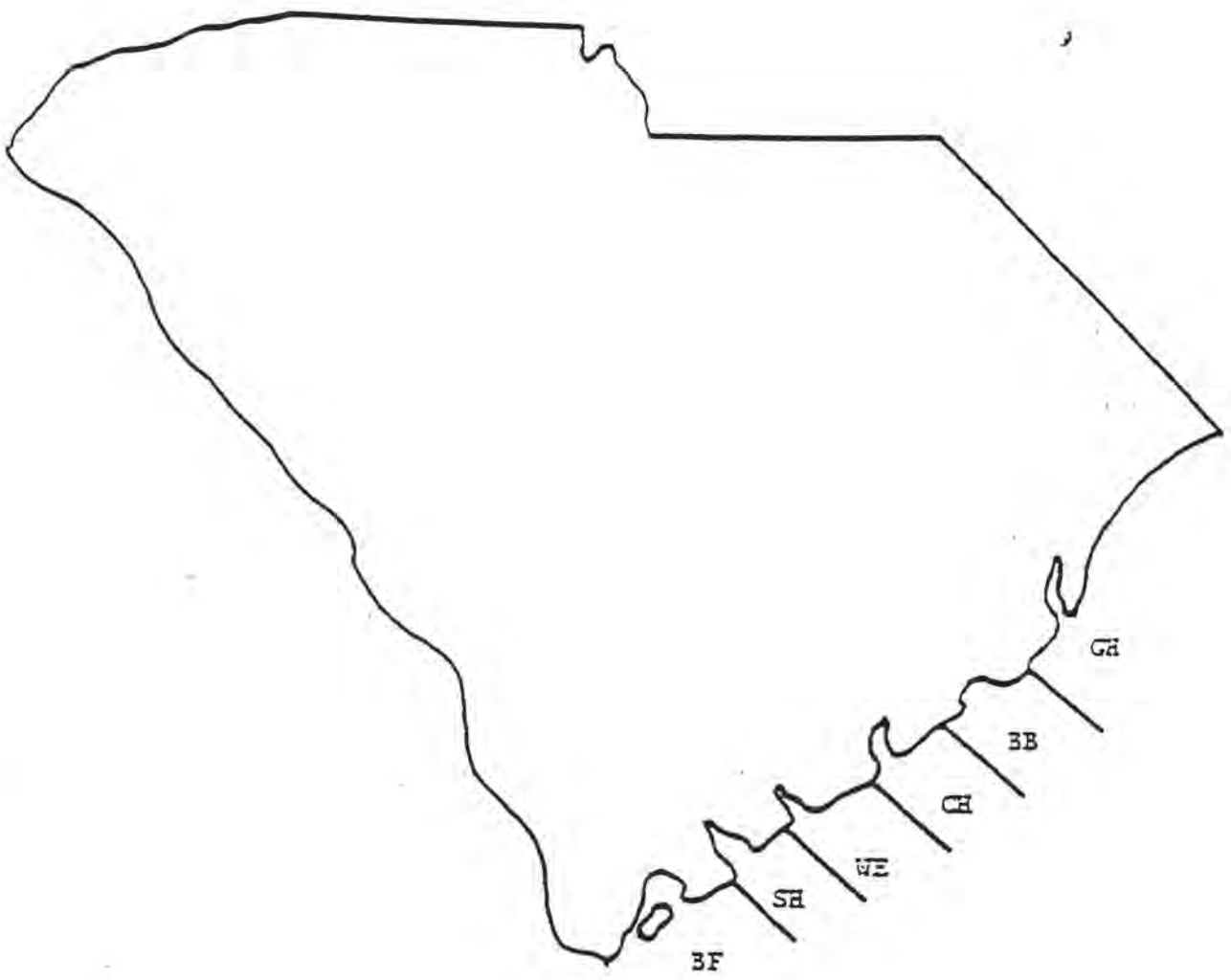
Average seasonal catch rates for the last five years are listed in Table 5. These were obtained by adding the reported catch per unit of effort (CPUE), in quarts of whole shrimp/trip, in each category and dividing by the numbers of observations. The CPUEs in Table 6 were calculated by summing the season catch estimates for each area and dividing these figures by the

Table 2. Estimated participation by residence category.

	Northern Coastal	Central Coastal	Southern Coastal	Central Inland	Other	Total
Permits issued	1,092	5,777	2,776	2,637	1,635	13,917
% active permits	81.6	89.1	87.2	91.7	89.9	88.8
Active permits	891	5,145	2,421	2,418	1,469	12,344
Average assistants/ active permit	2.22	2.47	2.50	2.30	2.25	2.39
Total assistants	1,978	12,724	6,053	5,571	3,301	29,627
Total participants	2,869	17,869	8,474	7,989	4,770	41,971
Percent of total	6.8	42.6	20.2	19.0	11.4	

Table 3. Estimated number of trips by residence category.

	Northern Coastal	Central Coastal	Southern Coastal	Central Inland	Other	Total
Average trips/permit	6.0	7.2	8.3	5.1	4.6	6.5
% total by month						
September	40	33	39	35	38	36
October	47	49	48	51	50	49
November	13	18	13	14	12	15
Estimated trips/month						
September	2,136	12,139	7,750	4,383	2,574	28,982
October	2,487	18,209	9,693	6,358	3,352	40,099
November	723	6,632	2,678	1,674	844	12,551
Total	**5,346**	**36,980**	**20,121**	**12,415**	**6,770**	**81,632**
Percent of total	7	45	25	15	8	



BF- BEAUFORT, including Calibogue and Port Royal Sounds, Broad River
SH- St. HELENA SOUND, including Coosaw, Combahee, and Ashepoo Rivers
WE- WADMALAW/EDISTO ISLANDS, including N. and S. Edisto Rivers
CH- CHARLESTON METRO, including the harbor, Kiawah, Stono, Folly, Ashley, Cooper, and Wando Rivers
BB- BULLS BAY, including the McClellanville area
GH- GEORGETOWN, including Santee and Winyah Bays and Horry County waters

Fig. 2. Shrimp baiting areas.

Table 4. Estimated number of trips by shrimping area.

Residence category	Beaufort	St. Helena	Wadmalaw Edisto	Charleston	Bulls Bay	Georgetown
N. Coastal	57	0	0	47	4,171	1,071
C. Coastal	780	329	6,018	18,783	10,998	72
S. Coastal	15,416	3,662	709	266	59	9
C. Inland	6,195	1,832	2,223	966	1,141	58
Other	1,937	767	952	379	2,251	484
Total	**24,385**	**6,590**	**9,902**	**20,441**	**18,620**	**1,694**
% of total	30	8	12	25	23	2

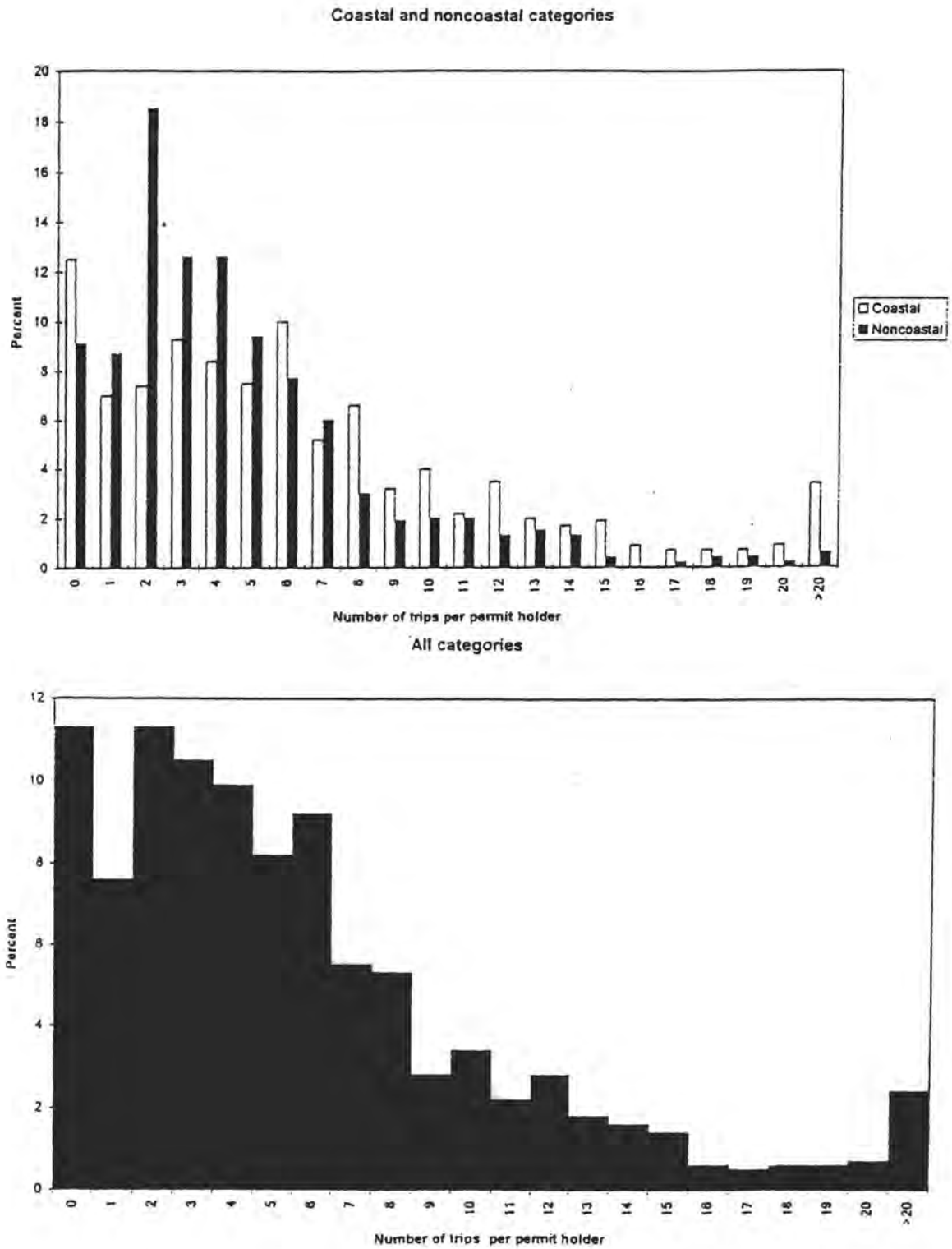


Fig. 3. Distribution of average effort per permit holder.

Table 5. CPUE by residence category.

Residence category	CPUE 1995	1994	1993	1992	1991
Northern Coastal	29.0	17.9	26.5	15.0	18.2
Central Coastal	27.0	21.7	22.3	24.3	17.9
Southern Coastal	28.9	12.1	24.0	26.3	24.1
Central Inland	32.3	16.7	24.0	30.3	24.6
Other	29.0	19.9	24.4	25.2	25.7

Table 6. CPUE by shrimping area.

Area	No. of 1995 observations	1995	1994	1993	1992	1991
Beaufort	326	30.6	13.2	22.2	28.7	24.4
St. Helena	65	27.7	16.4	23.8	29.7	25.0
Wadmalaw/Edisto	107	25.6	16.1	22.5	30.0	24.2
Charleston	192	26.1	21.6	20.4	23.4	14.1
Bulls Bay	194	28.7	23.1	26.4	20.3	22.5
Georgetown	24	19.9	13.2	26.9	14.4	10.5

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 more than one area.

The distribution of average seasonal CPUE is indicated in Table 7.

The residential stratification of the sample population was comparable to that of the total permit holder population. An unbiased estimate of the average statewide CPUE can then be obtained by calculating the mean of the CPUEs reported by respondents. This is an average of ratios statistic, which is preferable to the ratio of averages for expansions because it is unweighted by the distribution of effort and conforms better to normality assumptions. For the 1995 season, this value was 28.9 quarts of whole shrimp/trip.

Catch

There are numerous ways to estimate the total catch, as described in previous reports. The examples shown here were selected to provide estimates for the various categories of interest.

The average of ratios CPUE was multiplied by the estimated total number of trips to obtain a total catch estimate. This figure is 2,359,165 quarts of whole shrimp (28.9 quarts/trip x 81,632 trips).

Catches by shrimping area were obtained by multiplying the average CPUE for each area by the estimated number of trips in the area:

Area	Trips	CPUE	Catch(quarts)
Beaufort	24,385	30.6	746,181
St. Helena	6,590	27.7	182,543
Wadmalaw/Edisto	9,902	25.6	253,491
Charleston	20,441	26.1	533,510
Bulls Bay	18,620	28.7	534,394
Georgetown	1,694	19.9	33,711
Total	**81,632**		**2,283,830**

The catches by residence category were estimated by multiplying the effort estimates for each by the mean CPUEs:

Table 7. Distribution of average CPUE by residential category (in percentages of respondents).

CPUE	North Cst.	Central Cst.	South Cst.	Central Inl.	Other
0-4	6.5	6.3	5.8	4.9	7.1
5-9	3.3	4.5	4.7	3.5	2.2
10-15	16.3	11.6	9.7	6.3	9.9
16-20	7.6	13.1	14.0	6.6	11.0
21-25	14.1	12.9	9.7	10.1	16.5
26-30	4.3	14.7	13.6	14.9	11.5
31-35	5.4	7.3	5.4	6.6	3.3
36-40	15.2	16.3	15.2	18.4	15.4
41-44	2.2	1.8	0.8	2.4	2.2
45-48	25.0	11.6	21.0	26.4	20.9

Table 8. Distribution of season catches (quarts of whole shrimp) in percentages of respondents by residence category.

	Catch					
Residency category	< 99	100-199	200-299	300-399	400-499	>500
Northern Coastal	47	23	9	12	5	4
Central Coastal	38	23	17	9	5	7
Southern Coastal	30	26	18	8	8	10
Central Inland	39	33	16	7	3	3
Other	51	31	9	4	3	2
Statewide	39	27	15	8	5	6

Residence category	Trips	CPUE	Catch (quarts)
Northern Coastal	5,346	29.0	155,034
Central Coastal	36,980	27.0	998,460
Southern Coastal	20,121	28.9	581,497
Central Inland	12,415	32.3	401,005
Other	6,770	29.0	196,330
Total	**81,632**		**2,332,326**

An alternative method of generating estimates by residence category is to multiply the average seasonal catches reported by respondents in each by the numbers of active permit holders. These figures are slightly lower than those derived using the above procedure with a total estimated catch of 2,267,799 quarts.

Several other procedures can be used with results falling within the 2.2 - 2.4 M quarts range defined above. There are trade-offs in probable accuracy and lack of bias associated with each approach and an intermediate value of 2.3 M quarts is probably the most reasonable choice. The conversion factor from quarts of whole shrimp to pounds whole weight is 1.48. The 1995 estimated baiting catch was therefore approximately 3.404 M pounds of whole shrimp, equivalent to 2.213 M pounds of heads-off product.

The distribution of catches per permit holder is listed in Table 8. The statewide average catch per permit holder was about 184 quarts (272 pounds) of whole shrimp. Assuming that this was evenly divided between the permit holders and their assistants, the typical participant obtained about 81 pounds of whole shrimp.

In recent years, the relative distribution of the fall white shrimp harvest has become an allocation issue. Since 1992, a monitoring system for commercial landings has been in place that permits comparison of recreational and commercial landings for reasonably comparable areas and time intervals. The baiting areas and corresponding commercial statistical zones are as follows:

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

The comparison of baiting and commercial landings (for all gears) is shown in Table 9. 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 1 of

Table 9. Estimated shrimp baiting catches and reported commercial landings (all gears) by area, in pounds of whole shrimp.

Area	Baiting	Commercial In-season	Commercial Total	Combined
Beaufort	1,104,348	190,155	317,610	1,421,958
St. Helena Sd.	270,164	1,031,217	2,185,935	2,456,099
Wadmalaw/Edisto Is.	375,167	647,813	1,033,832	1,408,999
Charleston metro	789,595	433,788	801,235	1,590,830
Bulls Bay	790,903	495,458	1,030,862	1,821,765
Georgetown	49,892	930,112	1,555,973	1,605,865
Total	3,380,069	3,728,543	6,925,447	10,305,516

Area	Percent distribution In-season	Percent distribution Total combined
Beaufort	85	78
St. Helena Sd.	21	11
Wadmalaw/Edisto Is.	37	27
Charleston metro	65	50
Bulls Bay	61	43
Georgetown	5	3
Total	48	33

August through the close of the 1995 season in January.

Comparisons between areas are influenced by factors such as the relative sizes of the recreational population and trawler fleet, proximity of population centers and trawler docks, accessibility of inland waters, and extent of inland waters vs trawlable coastal waters.

DISCUSSION

The 1994/1995 winter was unusually mild with a record overwintering population of white shrimp. Spawning appeared to be exceptional and a very good fall harvest was projected.

Rainfall during August was heavy and appreciable outmigration occurred after mid-month. Commercial trawl landings for the month were nearly 1 M pounds heads-on, well above normal and reminiscent of the 1991 season.

After the baiting season opened, recreational landings in most areas appeared to be very good for most of September. The weather was very windy, but without excessive rain. Sizes of shrimp in most areas were mixed. Exceptions were Bulls Bay, where relatively large shrimp predominated, and Winyah Bay, in which very small shrimp were observed during MRD sampling. The remainder of the season was characterized by relatively windy weather and highly variable shrimping success in most areas.

Major parameter characteristics of the 1995 season are compared to those from recent years in Table 10. Total permit sales were the highest to date, exceeding the previous record (in 1994) by 4%. Distribution by county remained very similar to that in previous years, although the gradual trend of a slight relative increase in noncoastal participation continued.

The overall percentage of active permit holders was comparable to that in recent years. Activity among noncoastal permit holders was somewhat above average, perhaps in response to reports of good shrimping. The total estimated participation was slightly above the previous record set in 1993.

Estimated total effort also increased slightly above the previous high established in 1993. Compared to the 1994 season, the most significant change was a 44% increase in the number of trips by residents of the Southern Coastal area. In 1994, effort by this group was unusually low, presumably due to poor shrimping. Effort by the Northern Coastal group decreased from the 1994 level with slight to moderate increases in the other residential categories.

The percentage of overall effort expended in the Charleston area (25%) was the lowest to date, while that in Bulls Bay was the

Table 10. Season comparisons of participation, effort, and catch parameters.

	1991	1992	1993	1994	1995
Permits issued	12,005	11,571	12,984	13,366	13,919
Percent active permits	89	87	91	86	89
Assistants/permit	2.24	2.15	2.43	2.32	2.39
Total participants	34,821	31,812	40,620	38,081	41,971
Trips/permit	6.6	6.1	6.8	6.0	6.5
Total no. of trips	71,034	62,459	80,709	70,429	81,632
Quarts/trip	21.3	25.4	23.5	18.5	28.9
Total catch (M pounds)	2.14	2.35	2.72	1.91	3.40
Pounds/participant	62	74	67	50	81
% of total landings	29	39	44	34	33

highest. Effort in the Beaufort area was well above that last year and about at the long-term average, both in numbers of trips and relative percentage. Effort in the Wadmalaw/Edisto area continued an increasing trend, while that in the Georgetown area dropped substantially and was minimal. The small size of shrimp in Winyah Bay may have directed effort to Bulls Bay.

Catch rates in all major areas were the highest to date. Beaufort and Bulls Bay were the most productive areas in terms of CPUE. CPUE trends in the southern sounds areas have been very similar in recent years (Fig. 4), while those in the northern coastal areas have been much more variable (Fig. 5).

The continuation of shrimp baiting in Bulls Bay has become a controversial issue with wildlife advocates arguing that this activity disturbs birds and other wildlife in the refuge. The importance of Bulls Bay to shrimp baiters is a relevant factor. As indicated in Fig. 5, the average catch rate in Bulls Bay has tended to be the highest of the three northern shrimping areas. The average size of the shrimp there has also tended to be larger. These factors have contributed to the growing popularity of Bulls Bay indicated in Fig. 6, with the amount of effort now close to that in the Charleston metro area. As a result, Bulls Bay has become an increasingly important contributor to the statewide baiting catch and in 1995 replaced Charleston in the second position (Fig. 7).

The overall distribution of the fall white shrimp harvest between recreational and commercial users was nearly identical to that in 1994. During the baiting season, the baiters took 48% of the combined catch. For the entire fall harvest, the baiters' share was 33%, nearly identical to their average annual share since 1987.

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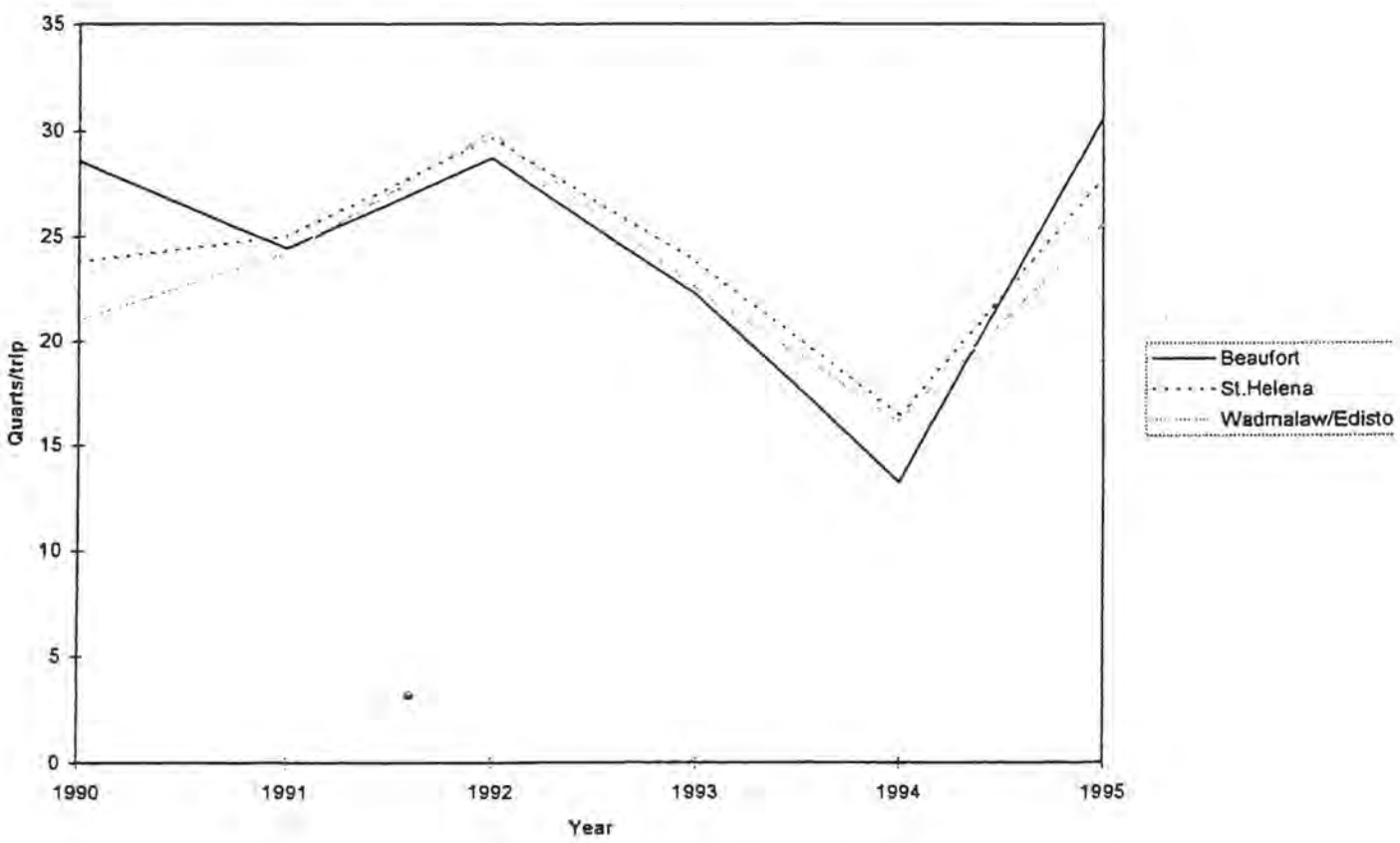

Fig. 4. Trends in CPUE in the southern sounds area.

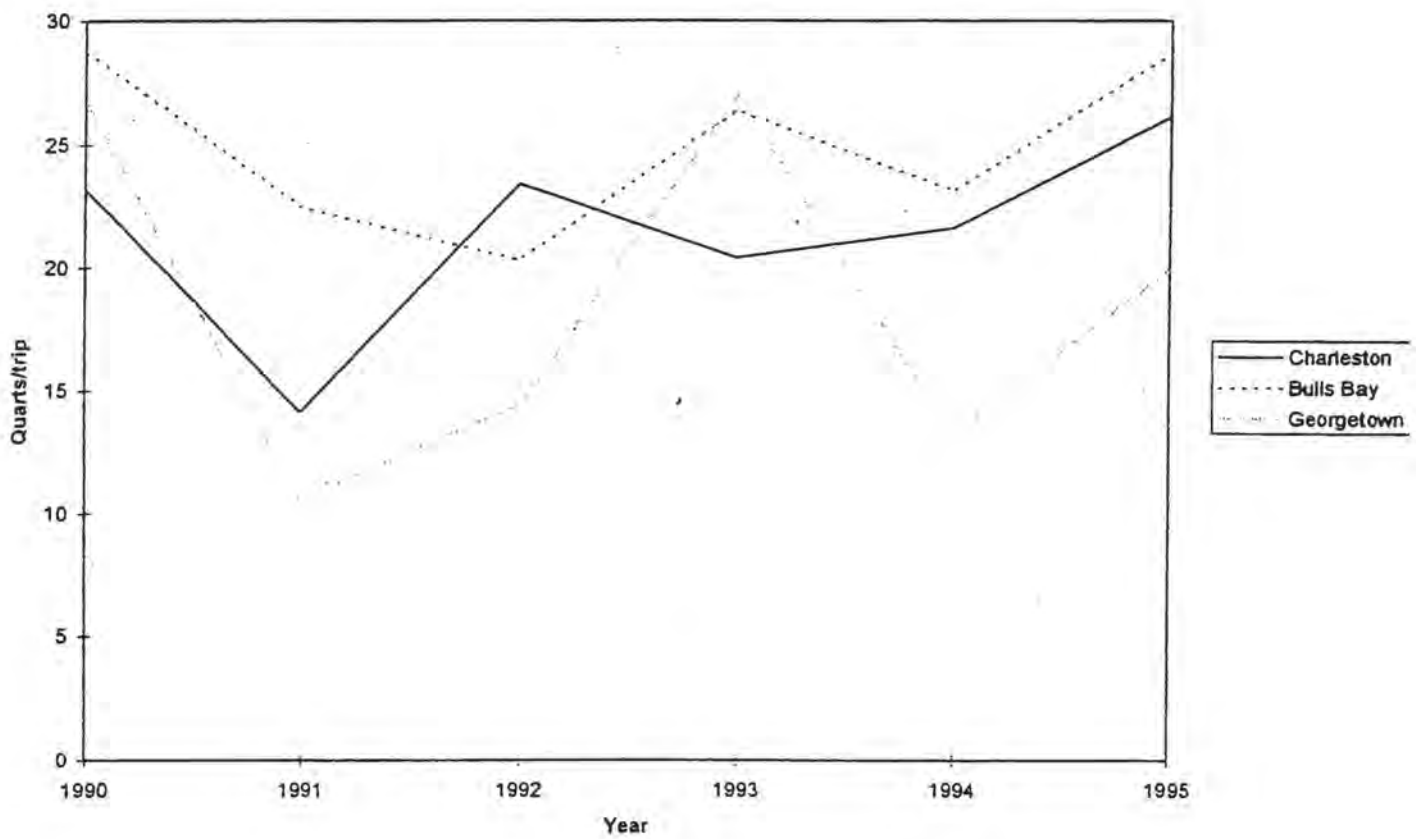

Fig. 5. Trends in CPUE in the northern coastal area.

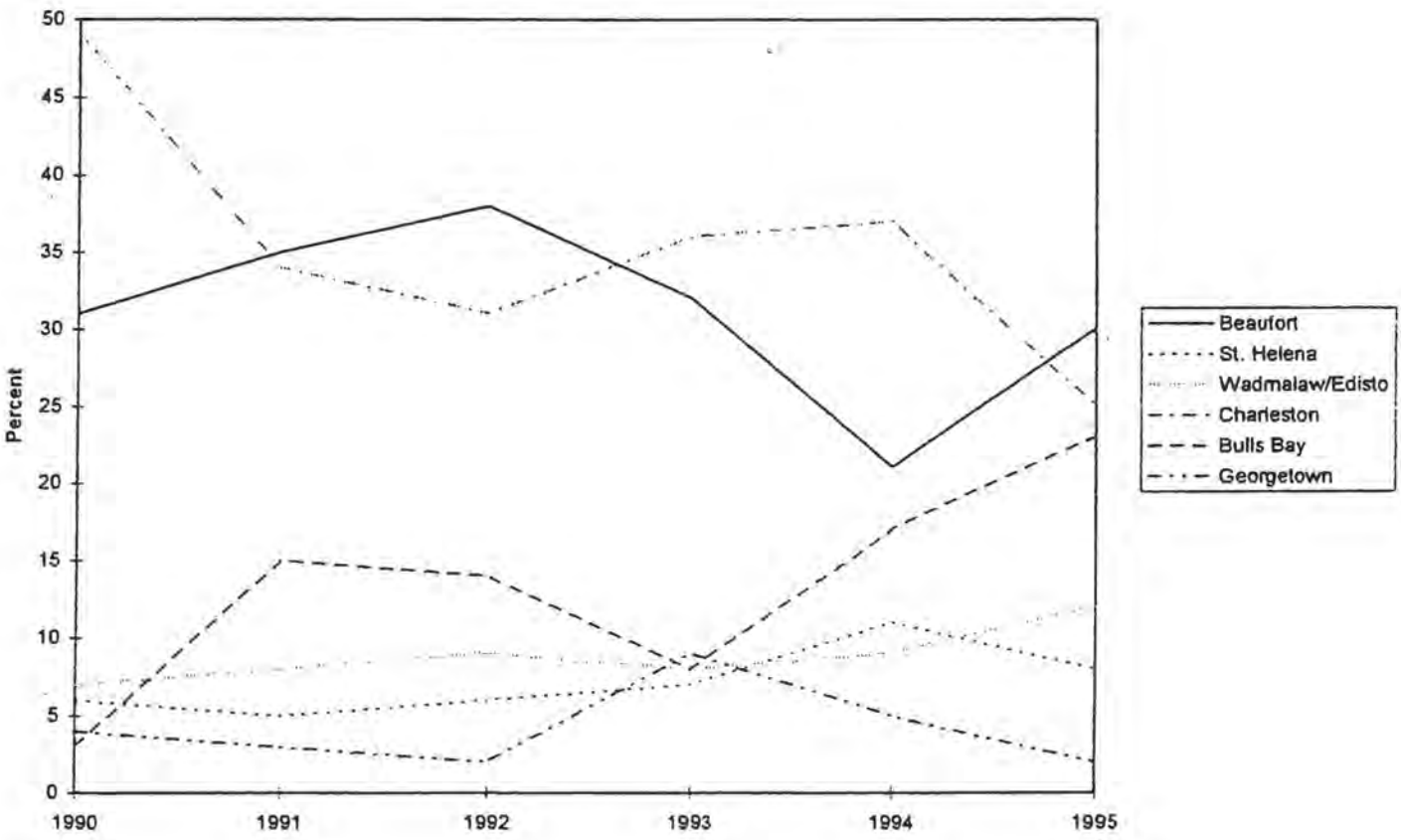

Fig. 6. Trends in relative distribution of effort by area.

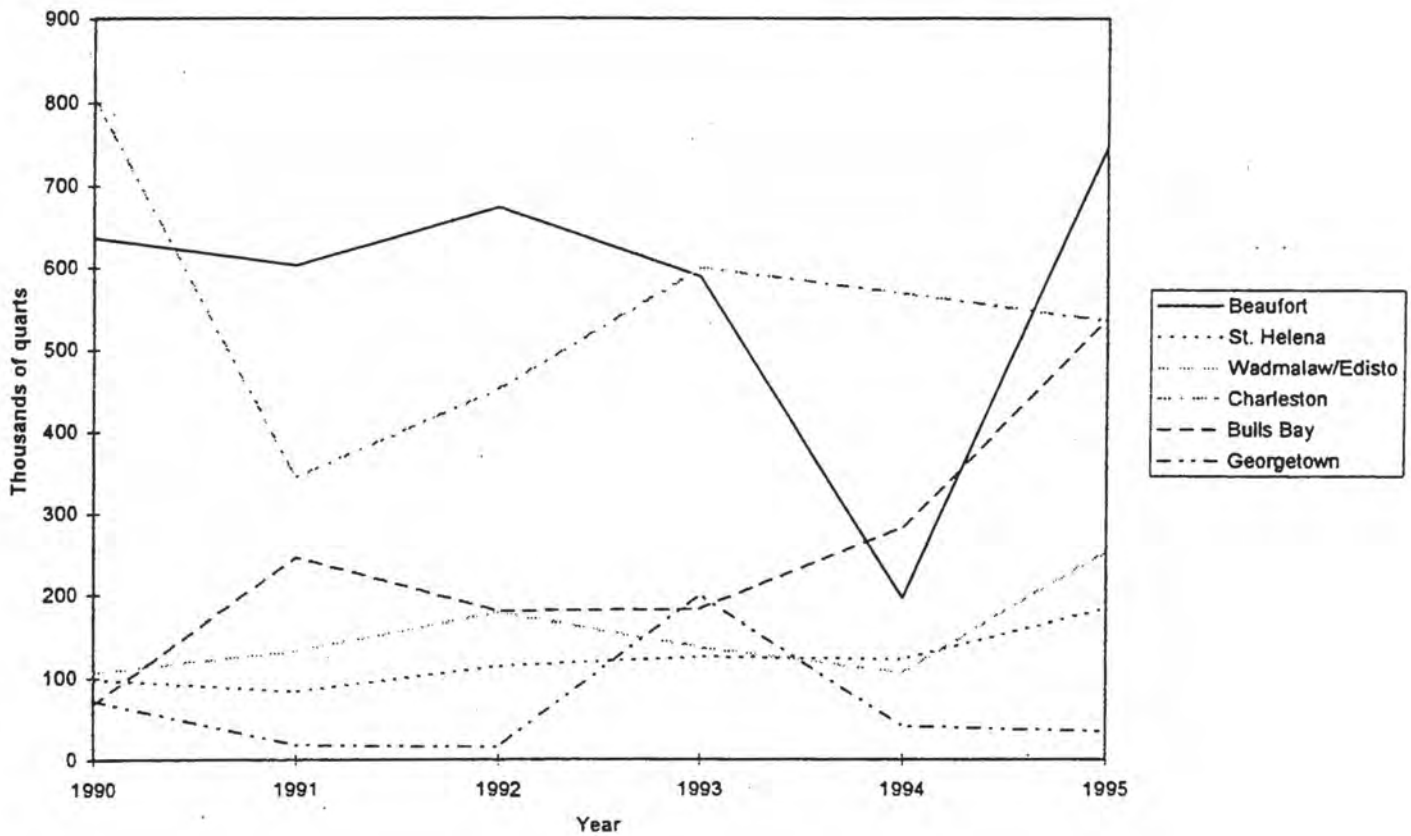

Fig. 7. Trends in catch by area.

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