



**Survey of the South Carolina
Shrimp Baiting Fishery, 2000**

The map shows the South Carolina coastline from Cape Hatteras in the north to Daytona Beach in the south. Dashed lines indicate the boundaries of North Carolina, South Carolina, Georgia, and Florida. Major cities are labeled: Cape Hatteras, Wilmington, Charleston, Savannah, Brunswick, Jacksonville, St. Augustine, and Daytona Beach. A compass rose is located in the upper left corner. The map is overlaid with a grid of latitude and longitude lines.

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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, 1997, 1998, 1999 and Low and Waltz 2000). 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 2000 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 package consisted of an introductory statement and a pre-addressed business reply postcard questionnaire (Fig. 1). The package was sent by first class mail to 25% (N = 3,984) of those individuals who purchased a 2000 permit. 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

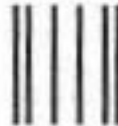
The effective mailout (after subtraction of nondeliverables) was 3,925 with a return rate (usable responses) of 37.9% (N = 1,487) postmarked by the cutoff date (December 15). The survey results were therefore based on information provided by 9.3% of the total population (N=15,929) of permit holders.

Distributions of the total permit holder populations by county of residence in the first year of permit sales, the previous season, and in the current year are shown in Table 1. The distributions of the 2000 permit holder population and survey population are compared in Table 2. As has been generally the case, the postseason return rates from noncoastal residents were slightly higher, but the overall distribution of the postseason sample group was comparable to that of the total population.

Participation

About 19.0% 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

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 your platform for shrimping.
 _____ boat only _____ dock only _____ boat and dock
4. Please indicate the number of trips you made in each area.
 _____ BEAUFORT _____ CHARLESTON
 _____ ST. HELENA SD. _____ BULLS BAY
 _____ WADMALAW/EDISTO IS. _____ GEORGETOWN
5. How many different people assisted you on boat trips? _____
6. What was your average catch per trip in quarts of whole shrimp? _____
7. What was your total catch for the season? _____ quarts
8. Do you have a saltwater recreational fishing license? _____
9. Do you support an increase in the saltwater license fee?
 _____ YES _____ NO IF NO, why not? _____
10. Is \$10.50 _____ too much _____ too little _____ OK



No
Postage
Necessary
if Mailed in the
United States

BUSINESS REPLY MAIL
 FIRST CLASS PERMIT NO. 1180 CHARLESTON, S.C.
 POSTAGE WILL BE PAID BY ADDRESSEE

S.C. MARINE RESOURCES DIVISION
 ATTN: SHRIMP BAITING SURVEY
 P.O. BOX 12559
 CHARLESTON, S.C. 29422-9909



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

County	1988	1999	2000
Abbeville	0.1	0.3	0.3
Aiken	2.0	3.9	3.9
Allendale	1.2	0.8	0.7
Anderson	0.2	0.6	0.7
Bamberg	1.5	1.2	1.1
Barnwell	1.3	2.0	1.9
Beaufort	10.3	10.0	10.4
Berkeley	9.4	8.7	8.1
Calhoun	0.4	1.1	1.0
Charleston	41.2	21.6	21.9
Cherokee	<0.1	<0.1	<0.1
Chester	<0.1	0.2	0.2
Chesterfield	<0.1	<0.1	0.1
Clarendon	0.1	0.7	0.8
Colleton	5.0	4.6	4.4
Darlington	0.1	0.7	0.8
Dillon	0	0.3	0.3
Dorchester	6.9	4.8	4.6
Edgefield	<0.1	0.4	0.5
Fairfield	0.1	0.3	0.3
Florence	0.2	1.9	2.0
Georgetown	2.4	5.8	5.9
Greenville	0.2	1.1	1.0
Greenwood	0.1	0.6	0.6
Hampton	4.0	2.7	2.5
Horry	0.3	3.4	3.7
Jasper	3.4	1.8	1.7
Kershaw	0.1	0.7	0.7
Lancaster	0	0.2	0.2
Laurens	0.1	0.4	0.4
Lee	0	<0.1	<0.1
Lexington	2.5	6.0	6.0
McCormick	<0.1	<0.1	<0.1
Marion	0.1	0.3	0.4
Marlboro	<0.1	<0.1	<0.1
Newberry	0.2	0.6	0.5
Oconee	<0.1	0.3	0.3
Orangeburg	4.0	4.0	3.8
Pickens	<0.1	0.3	0.4
Richland	1.4	3.4	3.3
Saluda	<0.1	0.4	0.4
Spartanburg	0.1	0.7	0.7
Sumter	0.3	1.1	1.2
Union	0.1	0.1	0.1
Williamsburg	0.4	1.0	1.0
York	0.1	0.6	0.7

Table 2. Distribution of permit holders and sample population.

Residence category	Total population		Sample population	
	N	%	N	%
North Coast				
Georgetown	944	5.9	70	4.7
Horry	597	3.7	51	3.4
Total	1541	9.7	121	8.1
Central Coast				
Berkeley	1285	8.1	114	7.7
Charleston	3483	21.9	332	22.3
Dorchester	733	4.6	84	5.6
Total	5501	34.5	530	35.6
South Coast				
Beaufort	1650	10.4	140	9.4
Colleton	708	4.4	59	4.0
Hampton	405	2.5	22	1.5
Jasper	265	1.7	21	1.4
Total	3028	19.0	242	16.3
Central Inland				
Aiken	621	3.9	61	4.1
Allendale	115	0.7	10	0.7
Bamberg	175	1.1	10	0.7
Barnwell	300	1.9	23	1.5
Lexington	952	6.0	99	6.7
Orangeburg	599	3.8	64	4.3
Richland	527	3.3	56	3.8
Total	3289	20.6	323	21.7
Other	2570	16.1	272	18.2
Total	15929		1487	

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 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 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. 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 distribution of seasonal effort by residential category is shown in Table 5.

The coastal area was divided into six geographical components (Fig. 2). The relative distribution of estimated effort in each area is indicated in Table 6. 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 7. 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 10.2 quarts of whole shrimp/trip.

Table 3. Estimated participation by residential category.

	North coast	Central coast	South coast	Central inland	Other	Total
Permits issued	1541	5501	3028	3289	2570	15929
% active permits	77.7	82.3	77.3	81.4	83.0	81.0
Number active	1197	4527	2341	2677	2133	12875
Aver. assistants	1.77	2.01	1.83	1.90	1.95	1.93
Total assistants	2119	9099	4284	5086	4159	24747
Participants	3316	13626	6625	7763	6292	37622
Percent of total	8.8	36.2	17.6	20.6	16.7	

Table 4. Estimated numbers of trips by residential category.

	North coast	Central coast	South coast	Central inland	Other	Total
Aver. trips/permit	4.39	5.25	5.33	4.12	4.18	4.75
% by month						
September	44	33	37	37	37	36
October	44	48	45	46	50	47
November	12	19	18	17	13	17
Estimated trips/month						
September	2312	7843	4617	4081	3299	22152
October	2312	11408	5615	5073	4458	28866
November	631	4516	2246	1875	1159	10427
Total	5255	23767	12478	11029	8916	61445
Percent of total	8.6	38.7	20.3	17.9	14.5	

Table 5. Distribution of seasonal effort in percentages of respondents by residential category.

Residential category	Trips/individual/season				
	1-4	5-10	11-15	16-20	>20
North Coast	72	19	5	2	1
Central Coast	57	33	7	1	2
South Coast	61	28	4	5	2
Central Inland	67	29	2	< 1	< 1
Other	68	26	4	< 1	< 1
Statewide	63	29	5	2	1

Table 6. Estimated number of trips by shrimping area.

Residence category	Beaufort	St. Helena	Wadmalaw/Edisto	Charleston	Bulls Bay	Georgetown
North Coast	13	0	67	0	4025	1150
Central Coast	422	812	3366	11072	8095	0
South Coast	8880	3381	51	115	51	0
Central Inland	4205	3243	1690	876	1004	11
Other	2062	1946	833	755	2769	551
Total	15582	9382	6007	12818	15944	1712
% of total	25.3	15.3	9.8	20.9	25.9	2.8

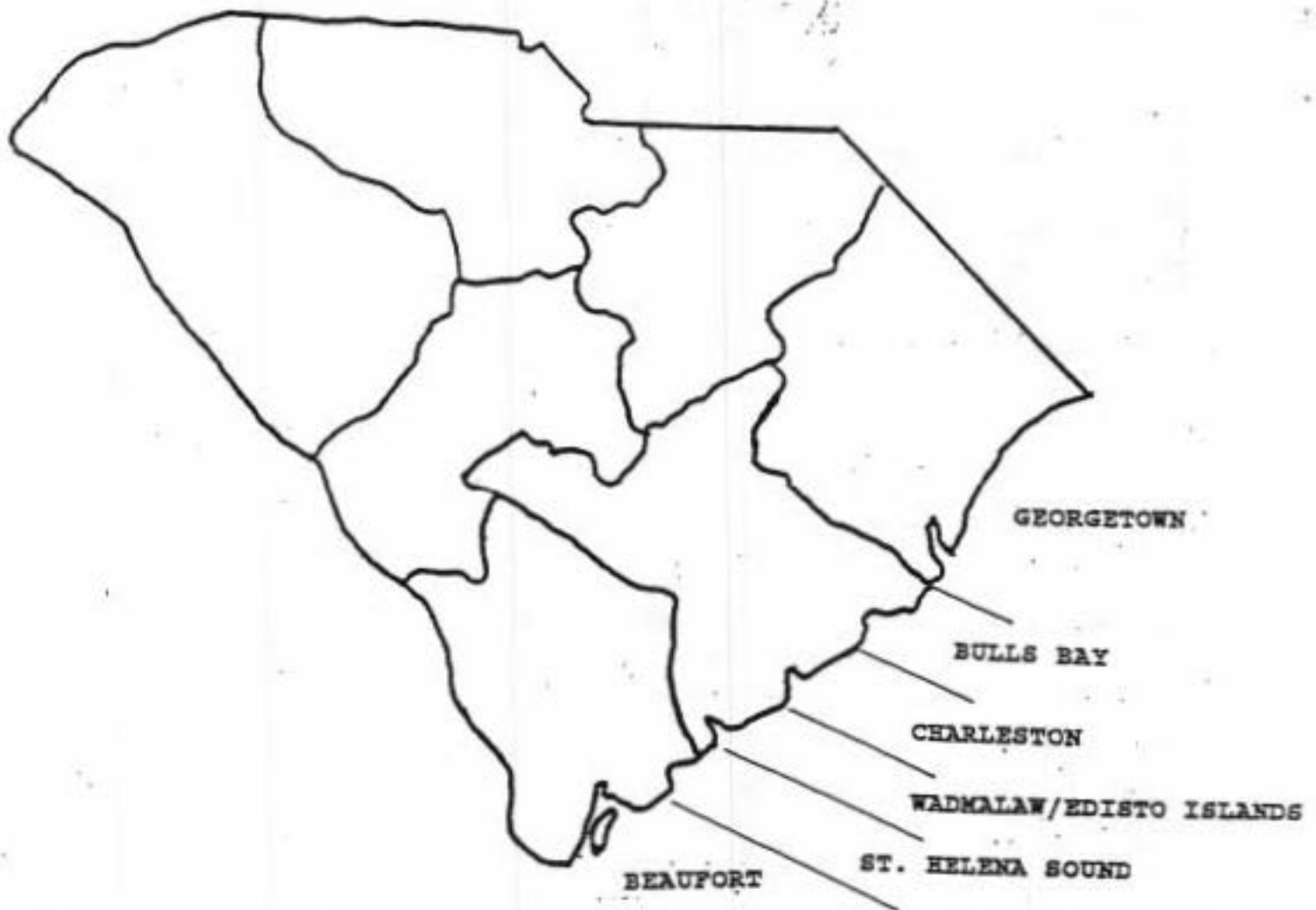


Fig. 2. Shrimp baiting areas.

- 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, and 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 7. CPUE (quarts of whole shrimp/trip) by residential category.

Residential category	CPUE							
	1993	1994	1995	1996	1997	1998	1999	2000
North Coast	26.5	17.9	29.0	13.3	25.4	21.4	20.0	10.6
Central Coast	22.3	21.7	27.0	18.7	23.3	19.2	19.5	10.7
South Coast	24.0	12.1	28.9	14.8	28.7	23.8	21.2	9.1
Central Inland	24.0	16.7	32.3	16.7	29.2	25.3	22.1	10.4
Other	24.4	19.9	29.0	16.3	28.5	20.9	23.7	9.9

Table 8. CPUE (quarts of whole shrimp/trip) by shrimping area.

Area	1993	1994	1995	1996	1997	1998	1999	2000
Beaufort	22.2	13.2	30.6	15.5	30.7	25.7	23.7	9.2
St. Helena	23.8	16.4	27.7	18.8	26.2	21.5	19.5	10.8
Wad./Edisto	22.5	16.1	25.6	17.1	22.4	21.5	17.6	8.8
Charleston	20.4	21.6	26.1	18.2	23.7	17.7	18.2	9.4
Bulls Bay	26.4	23.1	28.7	15.2	25.2	19.6	22.3	11.6
Georgetown	26.9	13.2	19.9	9.6	23.3	21.5	25.4	9.8

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
43.9	51.2	40.6	42.0	42.1

There are numerous ways to estimate the total catch, depending on the interest in its relative components. The simplest method is to multiply the statewide average CPUE (10.2 quarts/trip) by the estimated total number of trips (61,445). This figure is 626,739 quarts.

An 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	52,548
Central Coast	231,782
South Coast	95,045
Central Inland	112,434
Other	89,799
Total	581,608

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	5,255	10.6	55,703
Central Coast	23,767	10.7	254,307
South Coast	12,478	9.1	113,550
Central Inland	11,029	10.4	114,702
Other	8,916	9.9	88,268
Total			626,530

This approach produced somewhat higher values than the method using average season catch.

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

Shrimping area	Trips	CPUE	Catch (quarts)
Beaufort	15,582	9.2	143,354
St. Helena	9,382	10.8	101,326
Wadmalaw/Edisto	6,007	8.8	52,862
Charleston	12,818	9.4	120,489
Bulls Bay	15,944	11.6	184,950
Georgetown	1,712	9.8	16,778
Total	61,445		619,759

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 613,659 quarts. The conversion factor from quarts to pounds (whole weight) is 1.48. The weight equivalent of heads-on shrimp is 908,215 pounds. The conversion factor to heads-off weight is 0.649, giving an estimate of 589,432 pounds heads-off.

The distribution of season catches by residential category is shown in Table 9. A conservative estimate of the statewide average catch per active permit holder, based on reported season catches, was 45.3 quarts (67 pounds) of whole shrimp. Assuming that this was evenly divided between the permit holders and their assistants, the typical participant obtained about 23 pounds of whole shrimp. A higher value, 24 pounds, can be obtained by dividing the estimated total catch by the estimated number of participants.

The relative distribution of the fall white shrimp harvest is perceived 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 10. In-season commercial landings were defined as those during week 3 of September through week 2 of November. Total commercial landings included those from week one of August through the closure of the 1999 season. Combined total recreational and commercial landings are the baiting catch plus the total commercial landings as so defined.

DISCUSSION

Documentation of seasonal statistics began in 1987. Table 11 summarizes the data for each year's fishery.

The number of active permit holders was nearly identical to that in 1999. In both 1999 and 2000, the percentages of active permit holders were relatively low. The slight decline in 2000 participation was mainly attributable to somewhat fewer assistants.

Average individual effort was the lowest reported to date. The largest decline occurred in the Beaufort area, where effort

Table 9. Distribution of season catches (quarts of whole shrimp) in percentages of respondents by residential category.

Residential category	Catch/permit holder					
	<99	100-199	200-299	300-399	400-499	>500
North Coast	88	10	1	1	-	-
Central Coast	84	11	3	< 1	< 1	< 1
South Coast	90	7	3	< 1	-	-
Central Inland	88	10	1	< 1	-	-
Other	89	9	1	-	-	< 1
Statewide	87	10	2	< 1	< 1	< 1

Table 10. 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	212,164	86,369	146,389	71	59
St. Helena	149,962	264,937	870,309	36	15
Wad./Edisto	78,236	157,966	399,277	33	16
Charleston	178,324	140,719	313,128	56	36
Bulls Bay	273,726	296,840	503,723	48	35
Georgetown	24,831	283,440	619,456	8	4
Total	917,243	1,230,271	2,852,282	43	24

Table 11. 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 holder	NA	7.0	5.7	7.8	6.6	6.1
Total trips	40101	35609	31624	71153	71034	62459
Average qts./trip	28.5	22.1	26.5	25.6	21.3	25.4
Million lbs heads-on	1.80	1.16	1.25	2.75	2.14	2.35
Lbs/participant	83	65	73	79	62	74
	1993	1994	1995	1996	1997	1998
Permits issued	12984	13366	13919	14156	15488	17497
% active permits	91	86	89	85	91	87
Assts./permit	2.43	2.32	2.39	2.25	2.44	2.31
Participants	40620	38081	41971	38932	48544	50436
Trips/permit holder	6.8	6.0	6.5	5.7	6.6	6.0
Total trips	80709	70429	81632	68927	94154	92484
Average qts./trip	23.5	18.5	28.9	16.9	26.4	21.7
Million lbs heads-on	2.72	1.91	3.40	1.73	3.63	2.91
Lbs/participant	67	50	81	44	72	58
		1999	2000			
Permits issued		15895	15929			
% active permits		81	81			
Assts./permit		2.09	1.93			
Participants		39514	37622			
Trips/permit holder		5.1	4.8			
Total trips		66396	61445			
Average qts./trip		21.1	10.2			
Million lbs heads-on		2.02	0.91			
Lbs/participant		46	23			

decreased 28% from that in 1999. There were moderate increases in estimated effort for St. Helena Sound (15%) and the Charleston area (10%).

CPUE was the lowest since the start of this fishery. The statewide average catch/trip was down almost 40% from that in the worst previous season (1996). The shrimping was uniformly poor in all areas. The overall catch was also the lowest reported to date, less than 50% of last year's relatively poor landings.

As in 1999, weather was problematic. The summer drought continued with exceptionally hot weather in July. During late August and early September, there were heavy rains that probably flushed many shrimp out to sea; August trawler landings were unusually high. The 2000 season started off with several cold fronts, NE winds, and big tides, although there were no severe storms as in the previous year. After mid-October, the weather was generally pleasant, but the shrimp appeared to have been gone by then. A cold front from 8-10 October dropped nighttime temperatures below 50 degrees (F) and may have prompted some outmigration.

Commercial trawlers fared no better than the baiters. Due mainly to the large August landings, the trawlers' share of the overall fall harvest was 76% compared to 69% in 1999. In both years, baiters accounted for 43% of the total harvest during the baiting season.

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