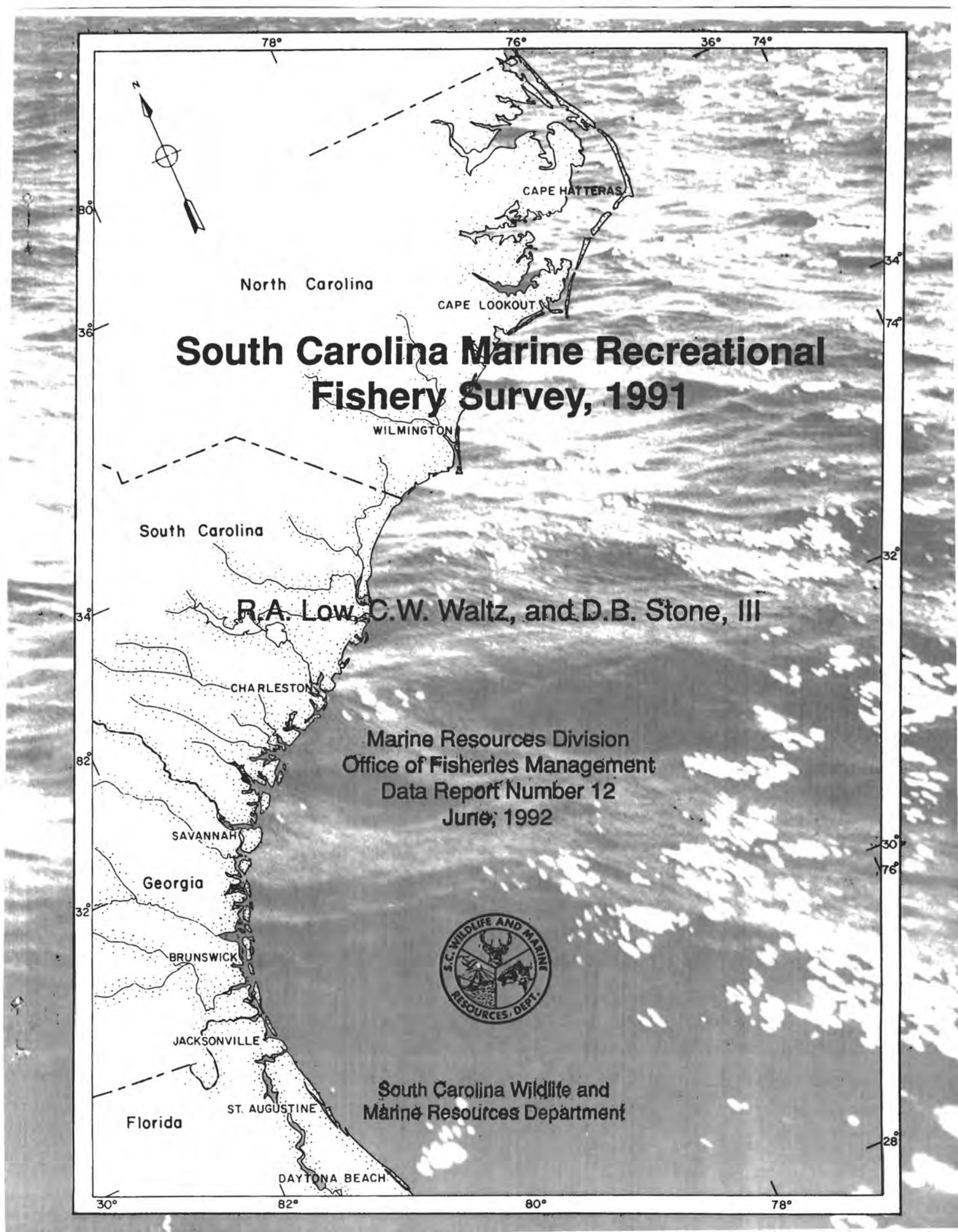

South Carolina Marine Recreational Fishery Survey, 1991

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Marine Resources Division
Office of Fisheries Management
Data Report Number 12
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South Carolina Wildlife and
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INTRODUCTION

The Fisheries Statistics Program (FSP) of the Marine Resources Division (MRD) is responsible for the collection, compilation, analysis, and distribution of fishery-dependent data for marine fisheries. The principal instrument used to obtain such information for recreational fisheries is the Marine Recreational Fishery Statistics Survey (MRFSS) conducted annually in cooperation with the National Marine Fisheries Service (NMFS). This is a generalized survey that was initiated in 1979.

In South Carolina, the MRFSS is conducted during March through December. A telephone poll of coastal households is conducted by CIC Research, Inc. to obtain information on participation and effort. An on-site intercept survey (creel census) is employed to collect catch, effort, and demographic data. MRD has performed this function since July, 1987. Fishermen interviewed include those fishing from shore or man-made shore facilities (e.g. docks, bridges, and piers), charterboats, and private boats. Headboat anglers are not interviewed because catch and effort data for the headboat fishery are collected during an independent NMFS survey. Fishermen using gear other than hook and line are seldom encountered. MRFSS results therefore do not pertain to activities such as gill netting, gigging, and spearfishing by divers.

Additional catch and effort data are collected in a State Finfish Survey (SFS) using procedures similar to those of the MRFSS. During 1991, most of this survey effort was directed toward private boat fishermen fishing in estuarine areas.

This report describes procedures and results of these surveys in 1991. Information for previous years is contained in a series of similar reports identified in the References section.

METHODOLOGY

MRFSS procedures for the telephone and intercept surveys were described by Essig et al. (1991) and Low and Waltz (1988). Fundamental procedures have remained the same since 1987 although there have been minor modifications to the questions annually. FSP staff conducted the 1991 MRFSS at 15 sites utilized by shore-based anglers, 7 charterboat docks, and 17 public boat ramps or landings (Table 1). The sampling schedule, provided by the NMFS intercept survey contractor (KCA Research, Inc.), was based on historical usage patterns by fishing mode (shore, charterboat, private boat) and sampling wave (two-month intervals beginning with March-April). Site assignments reflected relative usage rates with the most heavily utilized locations receiving selection priority. Assignments for the private boat mode were divided approximately equally between Beaufort County, Charleston County, and the Georgetown/Horry County area. About 60% of the sampling effort was assigned to weekend days with most interview periods between 1000 and 1700 hours. There was no night sampling in 1991.

On a scheduled sampling day, the creel clerk proceeded to the assigned site. If the clerk determined that the assigned location would be unproductive, he proceeded to the nearest alternative location for that mode. The clerk usually remained at the site

Table 1. Site list for the 1991 MRFSS by county and mode.

County	Shore	Charterboat	Private boat
Beaufort	Broad River pier, Broad River	Harbor Town Marina, Hilton Head	Broad River landing, Broad River
	C.C. Haigh pier, Pinckney Is.	Shelter Cove Marina, Hilton Head	E.C. Glenn landing, Chechessee River
	Paradise pier, Hunting Is.	Hudson's Seafood dock, Hilton Head	C.C. Haigh landing, Pinckney Is.
			H.E. Trask landing, Victoria Bluff
			Russ Pt. landing, Hunting Id.
			Sam's Point, Lucy Creek
Charleston	Breach Inlet, Isle of Palms	Wild Dunes Yacht Club, Isle of Palms	Buck Hall landing, Awendaw
	Limehouse pier, Johns Is.	Bohicket Marina, Seabrook Is.	Folly R. landing, Folly Beach
	Bowens Is. dock, Bowens Is.		Remley Pt. landing, Mt. Pleasant
	Remley Pt. pier, Mt. Pleasant		Shem Creek landing, Mt. Pleasant
	Crosby's pier, Folly Beach		Wappoo Cut landing, Charleston
	Dawhoo R. pier, Edisto Island		Sol Legare landing, Battery Is.
	Church Creek bridge, Johns Is.		Limehouse landing, Johns Is.
	County Park, Folly Beach		
Georgetown	South Murrells Inlet jetty, Huntington Beach State Park	Capt. Dick's Marina, Murrells Inlet	Murrells Inlet ramp, Murrells Inlet
		Voyager's View Marina, Murrells Inlet	Capt. Dick's Marina, Murrells Inlet
			Boulevard landing, Georgetown
Horry	Cherry Grove Pier, Cherry Grove Beach		Hwy. 17 ramp, Cherry Grove Beach
	Surfside Pier, Surfside Beach		
	Springmaid Pier, Myrtle Beach		

until the day's MRFSS interview quota was obtained or further effort appeared unwarranted. SFS sampling followed similar procedures except that site assignments were determined by the FSP. SFS sampling was targeted at private boat anglers fishing in estuarine waters for red drum and spotted seatrout, therefore most of this interviewing was done at sites frequented by such fishermen. Locations visited in the SFS are listed in Table 2.

MRFSS interviews were conducted in accordance with procedures and guidelines described in KCA's Intercept Interviewer Training Manual (1991 edition), using the appropriate survey forms. Except for shore fishermen, anglers interviewed had completed their fishing trip. Up to half of the daily quota of beach/bank fishermen within the shore mode could be based on incomplete trips. An MRFSS interview pertained to an individual fisherman with all members of a fishing party usually being interviewed (there were some exceptions with charterboat groups). An SFS interview generally applied to a group of anglers and constituted a trip interview rather than an individual one. Responses in both surveys were voluntary and all information was confidential as to personal identity.

Information obtained included the number of anglers in the party, hours spent fishing, area fished, targeted species, and residency of the respondent. In addition, the SFS obtained cost data for private boat fishing trips and information on reporting of recaptures of tagged red drum. Catch data consisted of the number of fish caught by species and their disposition (i.e., retained, discarded dead, released alive, given away, used for bait, etc.). Up to 20 fish of priority species were measured and/or weighed per catch (individual or group aggregate). In cases where catches were pooled for a fishing party (e.g. on charterboats) and anglers didn't recall how many fish they had caught individually, the group catch was divided by the number of fishermen to obtain catch rates. It should be emphasized that the numbers and kinds of fish not inspected by the creel clerks (e.g. released and discarded catches) could not be verified.

FSP staff coded and edited MRFSS interview forms and forwarded them to KCA for further processing. In the 1991 survey, FSP staff also compiled summary data from the raw forms prior to submitting them to KCA in order to check upon accuracy of wave summary data later provided by KCA and/or NMFS. KCA provided wave summaries of the intercept survey data and CIC Research, Inc. furnished similar compilations of information from the telephone survey. NMFS provided preliminary wave estimates of participation and number of trips (effort) by coastal residents, non-coastal residents, and out of state residents. NMFS also supplied estimates of the total numbers of fish caught by species by wave based on expansions of creel census catch rates for the total numbers of trips. All data from the SFS were processed by the FSP.

RESULTS

Essig et al. (1991) described considerations pertinent to interpretation of results from the MRFSS, e.g. sources of variation and their implications, potential elements of bias, and possible

Table 2. Site list for the 1991 SFS by county.

Beaufort	Colleton	Charleston	Georgetown	Horry
Broad R. landing, Broad River	Bennetts Point landing, Bennetts Point	Remley Pt. landing, Mt. Pleasant	Murrells Inlet landing, Murrells Inlet	Hwy. 17 ramp, Cherry Grove Beach
E.C. Glenn landing, Chechessee R.		Paradise landing, Mt. Pleasant	Boulevard landing, Georgetown	Surfside Pier, Surfside Beach
C.C. Haigh landing, Pinckney Is.		Detco landing, Mt. Pleasant	South Is. Ferry landing, Georgetown	
H.E. Trask landing, Victoria Bluff		Shem Creek landing, Mt. Pleasant	Capt. Dick's Marina, Murrells Inlet	
Russ Pt. landing, Hunting Is.		Buck Hall landing, Awendaw		
Johnson Creek landing, Hunting Is.		R.E. Ashley landing, McClellanville		
Port Royal landing, Port Royal		City Marina, Charleston		
Shelter Cove Marina, Hilton Head		Wappoo Cut landing, Charleston		
		Sol Legare landing, Battery Is.		
		Folly R. landing, Folly Beach		
		Limehouse landing, Johns Is.		
		Toogoodoo landing, Toogoodoo Creek		
		Cherry Pt. landing, Wadmalaw Is.		
		Crosby's Dock, Folly Beach		

effects of data adjustments. Most of these apply to the South Carolina survey results and are mentioned where appropriate.

Survey Logistics

A total of 1,019 interviews were collected during the MRFSS, of which 52% were in the private boat mode, 26% in the shore mode, and 22% in the charterboat mode. The average amount of survey effort required per interview was higher in all waves in 1991 compared to 1990. Averaged over the entire year, a shore interview represented 0.58 hour of effort in 1991 as opposed to 0.47 hour in the previous year, although the numbers of interviews obtained in each year were nearly equal (261 in 1991 vs 266 in 1990). The average charterboat interview in 1991 also required substantially more effort (0.60 hour) than in 1990 (0.26 hour). The average private boat angler interview required only slightly more effort in 1991 (0.47 hour) than in the previous year's survey (0.45 hour).

Annual Overview

A total of 3,300 coastal households provided interviews in the phone survey. The survey asked these respondents if a household member had gone salt water fishing during the previous two months (i.e., in that wave). Table 3 compares the results in 1991 with those from the previous four years. The type of fishing is indicated in Table 4 and the area of fishing in Table 5. During wave 6, 3.4% of the households interviewed had a member who also had gone shellfish gathering during that period. Time of week and time of day of fishing are indicated in Table 6.

About 54% of all fishermen interviewed in the MRFSS were residents of South Carolina coastal counties and 13% were from noncoastal counties (Table 7). One-third of the fishermen were from out of state.

Total participation was estimated at 439,000 fishermen. Out of state anglers (241,000) were the largest group (55%), about 28% (125,000) were coastal residents, and 17% (73,000) were noncoastal residents. Participation was very low in wave 2 when local anglers comprised the majority of fishermen and peaked during waves 4 and 5. Total effort was estimated at 1.496 M trips, distributed by wave and residential category as indicated in Table 8. Coastal residents contributed 60% of the effort, out of state anglers 28%, and non-coastal residents 12%.

About 73% of the anglers interviewed had spent their trip fishing in state waters (55% in inland areas and 18% in the nearshore ocean zone) (Table 9). Of the 27% who had fished in the FCZ, most (72%) were charterboaters. In the shore mode, 58% of the fishermen had fished in the nearshore ocean area (primarily from Grand Strand piers) and the remainder inland. Practically all (88%) of the charterboat fishermen went offshore with only 8% fishing in estuarine waters. About 80% of the private boat fishermen interviewed had fished estuarine areas and 5% had fished in the nearshore ocean zone. The remaining 15% had fished in the FCZ.

Table 10 shows the average duration of fishing trips by wave and mode and the average number of days fished per angler during the previous 12 months. Figures in the latter category varied

Table 3. Percentage of coastal households containing a member who went salt water fishing in the last two months (i.e., during the indicated wave) and average number of marine anglers per household contacted (including nonfishing households).
Source: CIC Research, Inc.

Year	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
			% households with fisherman		
1991	5.6	8.7	9.2	8.4	7.6
1990	5.8	7.6	5.6	6.7	5.7
1989	7.5	5.5	7.1	5.7	5.1
1988	7.0	6.7	10.2	NA	NA
1987	5.9	9.4	8.8	9.1	8.4
			Fishermen per household		
1991	0.092	0.145	0.152	0.135	0.121
1990	0.103	0.081	0.118	0.095	0.079

Table 4. Percentage of coastal households engaging in type of fishing (of respondents indicating fishing activity). Source: CIC Research, Inc.

Type of fishing	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Number of respondents	84	520	699	498	294
Pier, dock	13.1	11.3	8.7	8.6	25.2
Bridge, causeway	0	0	2.4	0	0
Jetty, breakwater	4.8	0	2.0	0	0
Headboat	3.6	0.4	1.9	0.2	0
Charterboat	1.2	5.0	1.7	3.4	0
Private boat	72.6	61.2	70.2	77.3	67.7

Table 5. Percentage of respondents fishing in indicated area.
Source: CIC Research, Inc.

Area	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Number of respondents	84	520	699	498	294
Ocean	38.1	41.5	51.2	61.6	63.3
Sound	25.0	4.2	5.2	12.9	6.1
Bay	11.9	14.6	29.2	4.8	4.1
River	25.0	39.6	14.4	20.7	26.5

Table 6. Time of week and time of day of fishing, in numbers of respondants to the phone survey. Source: CIC Research, Inc.

Wave	Weekday	Weekend	00/03	03/06	06/09	09/12	12/15	15/18	18/21	21/24
2	35	49	0	0	---6-	-------	--62---	-----	--3---	-----
3	332	165	2	0	1	109	71	105	149	21
4	353	346	0	6	2	25	143	215	111	190
5	169	320	10	1	0	19	107	253	64	35
6	120	174	0	0	6	62	35	117	14	60

Table 7. Numbers of fishermen by residency category interviewed in the MRFSS creel census. C - coastal, NC - noncoastal, OOS - out of state. Source: KCA final wave reports

	Shore			Charterboat			Private boat		
Wave	C	NC	OOS	C	NC	OOS	C	NC	OOS
2	28[a]	1	9[a]	0	1	10[a]	36	5	3
3	25	5	35	9	4	29	94	16	26
4	26	9	20	17	10	18	85	25	26
5	25	12	21	10	12	70	85	2	19
6	23	9	13	5	8	27	81	16	5
Total	127	36	98	41	35	154	381	64	83

[a]Corrected by FSP.

Table 8. Estimated trips in the South Carolina marine recreational fishery in 1991 (from preliminary data provided by NMFS).

Wave	Mode	Coastal residents	Non-coastal residents	Out of state	Total
2	Shore	19,823	684	8,886	29,393
	Charterboat	0	0	0	0
	Private boat	63,641	1,591	4,773	70,005
3	Shore	101,776	20,355	142,487	264,618
	Charterboat	1,968	874	6,340	9,182
	Private boat	116,885	19,895	34,817	171,597
4	Shore	72,783	25,194	55,987	153,964
	Charterboat	3,221	1,895	3,410	8,526
	Private boat	158,753	46,692	52,295	257,740
5	Shore	45,041	21,620	37,834	104,495
	Charterboat	2,070	2,485	14,493	19,048
	Private boat	134,174	3,157	29,992	167,323
6	Shore	45,748	15,249	24,780	85,777
	Charterboat	338	541	1,824	2,703
	Private boat	122,041	22,325	7,442	151,808
Annual	All	888,262	182,557	425,360	1,496,179

Table 9. Numbers of fishermen interviewed in the MRFSS who had fished in inland (estuarine), nearshore ocean (0-3 miles offshore), and offshore ocean (FCZ, 3-200 miles offshore) areas, by wave and mode. Source: KCA final wave reports.

	Inland			Nearshore ocean			Offshore ocean	
Wave	Shore	Charter boat	Private boat	Shore	Charter boat	Private boat	Charter boat	Private boat
2	21	0	42	17	0	0	6	2
3	25	2	96	40	0	14	40	28
4	31	5	94	24	2	9	38	35
5	22	12	95	36	2	1	78	10
6	11	0	98	34	3	1	37	3
Total	110	19	425	151	7	25	199	78

Table 10. Duration of fishing trips and average numbers of trips fished in the last 12 months, by wave and mode. Source: KCA final wave reports.

	Hours fished						Days in last 12 months					
	Shore		Charter boat		Private boat		Shore		Charter boat		Private boat	
Wave	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$	N	$\bar{x}$
2	42	3.55	6	7.83	44	3.88	43	71	11[a]	8[a]	40	57
3	65	4.95	42	7.02	137	5.40	54	54	38	2[a]	124	42
4	55	4.58	45	6.57	138	4.97	55	32	42	8	132	23
5	58	4.70	92	7.48	106	4.76	56	30	92	<1	103	31
6	45	5.12	40	4.94	102	5.05	45	29	40	1	101	32

[a]Corrected by FSP

Table 11. Targeted species identified in the MRFSS by those anglers who designated a particular species (i.e., not including "any"). Figures are percentages of responses by mode category.

Species	Shore	Rank	Charterboat	Rank	Private boat	Rank	Total	Rank
K. mackerel	13	4	80	1	10	4	29	1
S. trout	2	10	4	4	27	1	17	2
Red drum	12	5	3	5	19	3	13	3(tie)
Flounders	15	2	-	-	19	2	13	3(tie)
Spot	42	1	-	-	4	9	9	5
S. mackerel	10	6	11	2	6	8	8	6
Cobia	-	-	1	8	8	5	5	7
Sheepshead	1	12	-	-	7	6	4	8
Sharks	-	-	-	-	6	7	3	9
Kingfishes	14	3	-	-	1	11	3	10
B. sea bass	-	-	3	6	4	10	3	11
Bluefish	4	7	3	7	1	15	2	12

appreciably depending on the time of year but responses in wave 6 can be considered a proxy for the calendar year. The figures shown for charterboat anglers in waves 2 and 4 are misleading. In each wave, most of the anglers indicated little or no previous effort but a few respondents reported very high effort(e.g. 100 days for one individual, 85 for another). These extremely high estimates elevated the means far above the level representative for most respondents, at most only a few days the past 12 months.

Because of its stratified design, the MRFSS provided the least biased evaluation of species preferences. About 29% of the total number of anglers interviewed indicated "any" as their targeted species. The percentage of nonselective anglers was highest (55%) in the shore mode. About 22% of the private boat fishermen and 16% of the charterboat respondents reported no individual species preference.

Choices of fishermen who designated species are shown by mode in Table 11. Ranks within modes are based on overall lists and some species not listed were within the top 12 in some modes. These are mentioned where appropriate under the individual mode activity summaries.

Overall, the most popular species in 1991 was the king mackerel, ranked no lower than fourth in any mode. This species was the overwhelming choice of charterboat anglers and those private boat fishermen who fished in the ocean. A surprisingly large group of pier fishermen also targeted it.

Inshore gamefish, i.e., spotted seatrout and red drum (so designated by state law), ranked second and third, respectively, overall. The spotted seatrout was the most preferred target of private boat anglers by a substantial margin although sought by few anglers in the other modes. The red drum had more widespread appeal with other groups in addition to being the third most popular species with private boat anglers. Flounders were targeted by substantial numbers of private boat and shore fishermen. Spot was the dominant choice of shore (primarily pier) fishermen. These species have consistently been the most popular targets in the state's marine recreational fishery since the MRFSS was initiated (1979).

Spanish mackerel have become increasingly popular in all modes in recent years due to increased abundance. Cobia was targeted by large numbers of private boat fishermen in Beaufort County during May and June. Sheepshead have consistently ranked eighth in overall popularity in recent surveys with a relatively small but dedicated following of private boat and shore anglers. Kingfishes remained a highly preferred choice of shore anglers, particularly pier fishermen.

Catch

The total catch in 1991 (Table 12) was estimated at 3,423,000 fish, a 60% increase from the previous year but only 62% of the 1986-1990 average. About 21% of the catch were released alive. Landings by wave are shown in Table 13 and those by fishing zone in Table 14. About 56% of the total catch was made in estuarine areas and 78% came from waters under state jurisdiction. Offshore pelagics represented less than 1% of the overall landings. These

Table 12. Estimated total catch (in thousands of fish) by South Carolina marine recreational anglers in 1991 (from preliminary data provided by NMFS). NR indicates none reported. Totals are not necessarily additive due to rounding.

Category	Retained/discarded dead	Released	Total
Offshore Pelagics			
Dolphin	8	NR	8
Little tunny	1	1	2
Tunas/other	2	NR	2
Offshore Bottomfish			
Black sea bass	455	51	506
Other sea basses	3	8	11
Groupers	8	NR	8
Vermilion snapper	9	NR	9
Other snappers	1	NR	1
Red porgy	16	NR	16
Other porgies	7	NR	7
Grunts	11	1	12
Triggerfish	3	1	4
Coastal Pelagics			
King mackerel	89	1	90
Spanish mackerel	105	18	123
Bluefish	32	14	46
Crevalle jack	4	2	6
Blue runner	NR	NR	NR
Amberjacks	3	1	4
Barracuda	2	1	3
Inshore Sportfish			
Red drum	103	79	182
Spotted seatrout	370	44	414
Weakfish	14	0	14
Flounders	146	33	179
Inshore Bottomfish			
Kingfishes	221	22	243
Spot	495	94	589
Croaker	84	19	103
Black drum	4	NR	5
Sheepshead	158	NR	158
Pompano	21	4	25
Miscellaneous			
Sharks	157	94	251
Skates/rays	NR	17	17
Catfishes	24	106	130
Toadfish	NR	35	35
Searobins	NR	4	4
Pigfish	2	NR	2
Pinfish	19	42	61
Mullet	NR	NR	NR
Puffers	2	11	13
Other	80	30	110

Table 13. Estimated landings by species category and wave, in thousands of fish. NR indicates either none reported or less than 1,000 fish. Source: preliminary NMFS data.

Category	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Offshore Pelagics					
Dolphin	NR	8	NR	NR	NR
Little tunny	NR	NR	NR	1	NR
Tunas/other	NR	1	NR	NR	NR
Offshore Bottomfish					
Black sea bass	1	110	36	4	355
Other sea basses	NR	11	NR	NR	NR
Groupers	NR	1	3	4	NR
Vermilion snapper	NR	5	NR	4	NR
Other snappers	NR	1	NR	NR	NR
Red porgy	NR	16	NR	NR	NR
Other porgies	NR	7	3	NR	NR
Grunts	NR	9	NR	3	NR
Triggerfish	NR	1	NR	3	NR
Coastal Pelagics					
King mackerel	2	29	31	26	4
Spanish mackerel	NR	57	44	23	NR
Bluefish	5	21	7	12	2
Crevalle jack	NR	NR	2	4	NR
Amberjacks	NR	NR	NR	4	NR
Barracuda	NR	1	2	NR	NR
Inshore Sportfish					
Red drum	21	9	43	66	44
Spotted seatrout	NR	9	130	31	244
Weakfish	2	NR	7	NR	5
Flounders	6	58	86	33	5
Inshore Bottomfish					
Kingfishes	1	54	28	61	98
Spot	73	220	128	130	38
Croaker	7	14	54	16	13
Black drum	NR	1	2	NR	2
Sheepshead	NR	39	43	22	55
Pompano	NR	NR	14	11	NR
Miscellaneous					
Sharks	5	90	136	19	NR
Skates/rays	NR	14	3	NR	NR
Catfishes	9	50	43	27	NR
Toadfish	3	12	NR	21	NR
Searobins	NR	NR	NR	4	NR
Pigfish	NR	NR	NR	2	NR
Pinfish	NR	7	36	17	NR
Puffers	NR	3	6	4	NR
Other	1	4	83	22	22

Table 14. Estimated catch by fishing zone, in thousands of fish. Source NMFS.

Category	Inshore	Nearshore ocean	Offshore ocean
Offshore Pelagics			
Dolphin	0	2	6
Little tunny/bonito	0	0	2
Tunas/other	0	0	2
Offshore Bottomfish			
Black sea bass	37	13	456
Other sea basses	1	0	9
Groupers	3	3	2
Vermilion snapper	0	0	9
Other snappers	0	0	1
Red porgy	0	0	16
Other porgies	1	0	6
Grunts	0	0	11
Triggerfish	0	2	2
Coastal Pelagics			
King mackerel	2	5	82
Spanish mackerel	16	45	62
Bluefish	24	22	1
Crevalle jack	4	0	2
Amberjacks	0	0	4
Barracuda	0	0	3
Inshore Sportfish			
Red drum	172	10	0
Spotted seatrout	377	15	21
Weakfish	9	6	0
Flounders	122	34	32
Inshore Bottomfish			
Kingfishes	92	151	0
Spot	291	298	0
Croaker	79	22	2
Black drum	3	0	2
Sheepshead	157	1	0
Pompano	0	25	0
Miscellaneous			
Sharks	222	19	10
Skates/rays	17	0	0
Catfishes	130	0	0
Toadfish	33	2	0
Searobins	0	4	0
Pigfish	2	0	0
Pinfish	16	42	2
Puffers	10	2	0
Other	110	11	5
Total	1,930	748	745

catches were probably somewhat underestimated because tournament anglers were rarely encountered. Landings of dolphin, the major contributor, were the lowest in recent years. Practically all of the offshore pelagic catch was reported in wave 3.

Offshore bottomfish represented 17% of the total numerical catch, most of them landed during waves 3 and 6. As usual, black sea bass represented most of the catch of this group. This species accounted for 15% of the total landings. About 10% were released, a very low percentage compared to previous years.

Coastal pelagic species, particularly mackerels, were the principal targets of most ocean anglers and accounted for 8% of the total landings. Mackerels comprised most of the catch with waves 3-5 being the peak period of production. About 15% of the Spanish mackerel were released as well as approximately one-third of the bluefish.

Inshore sportfish is an arbitrary classification for the most popular estuarine species. In aggregate, this group represented 23% of the 1991 landings. About 43% of the red drum and 11% of the spotted seatrout were released. Landings of both species occurred mainly during the second half of the year. Most of the flounder catch was made during waves 3 and 4 with about 18% of the fish released.

As is usually the case, inshore bottomfish comprised the largest component (33%) of the landings. Spot was the principal species, representing 17% of the total landings. Catches of this species were more seasonally dispersed than usual.

Most of the shark catch was made in the summer. About 37% of the 1991 catch were released, an unusually low percentage. Sharks represented about 7% of the total annual landings.

Miscellaneous species (catfishes, pinfish, toadfishes, etc.) represented a much smaller portion (12%) of the overall catch than normal, due primarily to very low landings of pinfish.

Shore Mode

Sample distribution data for the MRFSS are summarized in Table 15. Coastal residents represented 49% of the fishermen interviewed, out of state residents 38%, and noncoastal residents 13%. An additional 37 SFS interviews were collected on an opportunistic basis, mainly at landings that also had piers or docks used by shore anglers. Nearly all were obtained at Charleston County locations. The Horry County (Grand Strand) piers provided 51% of the MRFSS interviews and almost one-third (31%) were from Surfside Pier. Most of the other fishermen interviewed were fishing from docks or bridges. Very few surf fishermen were intercepted.

The distribution of shore interviews by time of week was relatively equal (55% weekday, 45% weekend) overall but the proportions varied considerably between waves (Table 16). Practically all fishermen were intercepted in the afternoon. Although the piers operated 24 hours a day during most of the season, no nighttime sampling was conducted and only a few anglers were interviewed before noon.

A total of 309 anglers were interviewed during both surveys. About 48% were intercepted in the Georgetown/Horry County area (nearly all on the Grand Strand piers), 37% in Charleston County,

Table 15. Survey logistics for the MRFSS shore mode.

Wave	County	Sites	Interviews	Survey hours[a]	Hours per interview[a]
2	Charleston	4	30		
	Georgetown	1	6		
	Horry	1	2		
	Total	6	38	27.00	0.71
3	Beaufort	1	4		
	Charleston	5	22		
	Horry	3	39		
	Total	9	65	42.50	0.65
4	Beaufort	3	17		
	Charleston	3	14		
	Georgetown	1	5		
	Horry	2	19		
	Total	9	55	26.25	0.48
5	Beaufort	2	18		
	Horry	2	40		
	Total	4	58	18.25	0.31
	Charleston	3	11		
6	Horry	3	34		
	Total	6	45	37.25	0.83
Annual	Beaufort	3	39		
	Charleston	8	77		
	Georgetown	1	11		
	Horry	3	134		
	Total	15	261	151.25	0.58

[a]Source: KCA final wave reports

Table 16. Time of week and time of day distribution of MRFSS shore interviews. Source: KCA final wave reports. Figures are numbers of interviews.

			Time of day			
Wave	Weekend	Weekday	0900-1200	1200-1500	1500-1800	1800-2100
2	26	12	8	12	23	0
3	25	40	4	29	31	1
4	38	17	0	25	30	0
5	11	47	5	21	32	0
6	17	28	0	34	11	0
Total	117	144	17	121	127	1

and 15% in Beaufort County. Results shown for the Georgetown/Horry area can be considered applicable to the Grand Strand pier fishery.

Species preferences are listed in Table 17. Most shore fishermen (55%) interviewed in the MRFSS indicated that they were fishing for "anything." The most popular species statewide was spot, sought by 19% of the MRFSS respondents. From 5% to 7% of the anglers each targeted kingfishes, king mackerel, Spanish mackerel, flounders, and red drum. Other species attracted little attention. In Beaufort County, about 72% of the anglers interviewed in the MRFSS were fishing for anything. About 57% of the fishermen in Charleston County had no preference. Of those that did, spot was the choice of nearly three-fourths. In the Georgetown/Horry area, half of the anglers indicated no preference. Of the remaining fishermen, about 32% were fishing for spot, with king mackerel, kingfishes, Spanish mackerel, and flounders each being targeted by 15%-20% (some indicated two choices so the percentages were not additive).

The estimated total catch was 1.008 M fish and was distributed by wave as indicated in Table 18. Shore anglers accounted for about 29% of the total 1991 landings. As usual, inshore bottomfishes comprised the majority (66%) of the mode landings. Spot was the most numerous species and accounted for 41% of the overall shore landings. Kingfishes, another popular target, contributed 16%. The shore catch (all from the ocean piers) represented almost 37% of the total landings of Spanish mackerel.

Catch and effort data for fishermen interviewed during both surveys are summarized in Table 19. About 52% of all shore anglers interviewed had caught nothing, nearly the same failure rate as in 1990. In both Charleston County and the Georgetown/Horry area, the success rate was 50% while only 37% of the anglers in Beaufort County had caught at least one fish. There was relatively little difference in statewide success rates by wave although the percentage of unsuccessful anglers was lowest in wave 6. The average catch rate (fish per trip) was lowest but most consistent in Charleston County. In the other areas, it was highly variable between waves. The overall average in Charleston County was somewhat lower than in 1990 (1.29 fish per trip) while that in the Georgetown/Horry area was above the 1990 index (1.50). The 1991 statewide average was slightly higher than in the preceding year (1.34 fish per trip).

Charterboat Mode

All interviews were obtained in the MRFSS. The majority (67%) of the fishermen interviewed were from out of state. Coastal residents represented 18% and noncoastal residents 15%. Sample distribution of data are provided in Table 20. Although the distribution of sampling effort by area was rather even in terms of docks and boats included, about 57% of the total statewide sample was obtained from the Georgetown/Murrells inlet area and 47% came from one marina. There was very little coverage in wave 2 (when few boats were operating and the required level of sampling effort was prohibitive) and 40% of the mode total was obtained in wave 5 when the least amount of survey effort per interview was required. The 31 boats included in the survey represented about 27% of the

Table 17. Target species of shore-based fishermen, in numbers of anglers designating each species.

	MRFSS					SFS
Species	Beaufort	Charleston	Georgetown	Horry	Total	Total
		Wave 2				
Any		17	4		21	9
Spot		9		2	11	4
Red drum		2	1		3	
Croaker		3			3	
Catfish		3			3	
S. trout			1		1	2
Weakfish			1		1	
Kingfishes		1			1	
		Wave 3				
Any	4	13		16	33	1
Spot		9		3	12	1
K. mackerel				7	7	1
S. Mackerel				6	6	1
Kingfishes				5	5	
Flounder				2	2	
Sheepshead				1	1	1
Bluefish				1	1	2
Sharks						
S. trout						
		Wave 4				
Any	10	12	4	7	33	1
Spot	2	2		5	9	1
K. mackerel				5	5	
S. mackerel				4	4	
Flounder	1			2	3	
Kingfishes	2				2	
Croaker	2				2	
Bluefish	2				2	
Red drum			1		1	
		Wave 5				
Any	14			23	37	3
Flounder	4			7	11	
Spot				4	4	
Kingfishes				4	4	1
K. Mackerel				3	3	
S. mackerel				2	2	
Bluefish				2	2	
Red drum				2	2	
		Wave 6				
Any		2		16	20	4
Spot		4		9	13	1
Red drum		6		2	8	2
Kingfishes				4	4	
Flounder				1	1	
S. trout		1			1	1
		Annual				
Any	25	44	8	64	144	18
Spot	3	24		23	49	7
Flounder	5			12	17	
Kingfishes	2	1		13	16	1
K. mackerel				15	15	1
Red drum		8	2	4	14	2
S. mackerel				12	12	1
Bluefish	2			3	5	
Croaker	2	3			5	
Catfish		3			3	
S. trout		1	1		2	3
Weakfish			1		1	
Sheepshead				1	1	
Sharks						1

Table 18. Estimated catch in the shore mode by wave, in thousands of fish. Source: NMFS

Category	2	3	4	5	6	Total
Offshore Bottomfish						
Black sea bass	1	0	0	0	4	5
Groupers	0	0	3	0	0	3
Coastal Pelagics						
King mackerel	1	0	3	0	0	4
Spanish mackerel	0	45	0	0	0	45
Bluefish	2	20	0	2	2	26
Inshore Sportfish						
Red drum	1	0	6	5	10	22
Spotted seatrout	0	0	0	0	31	31
Flounders	0	12	17	9	0	38
Inshore Bottomfish						
Kingfishes	1	37	11	14	97	160
Spot	31	216	95	27	38	407
Croaker	1	0	48	14	6	69
Pompano	0	0	14	11	0	25
Miscellaneous						
Sharks	0	8	22	2	0	32
Skates/rays	0	4	3	0	0	7
Catfishes	3	0	34	18	0	55
Toadfish	1	0	0	2	0	3
Searobins	0	0	0	4	0	4
Pigfish	0	0	0	2	0	2
Pinfish	0	4	36	0	0	40
Puffers	0	0	6	2	0	8
Other	1	0	6	15	0	22

Table 19. Shore mode catch and effort for interviewed fishermen (MRFSS and SFS) by wave and area. Catches are in numbers of fish.

	Wave 2	3	4	5	6	Total
			Beaufort County			
Number of anglers	0	7	17	20	2	46
Total hours fished		31.0	47.0	68.0	5.5	151.5
Anglers with no catch		5	9	14	1	29
Spot		0	0	0	3	3
Kingfishes		0	0	2	0	2
Flounders		0	2	1	0	3
Other fish		1	37	12	1	51
Total catch		1	39	15	4	59
Fish per angler		0.14	2.29	0.75	2.00	1.28
			Charleston County			
Number of anglers	50	23	21	3	18	115
Total hours fished	157.5	145.0	77.5	7.0	70.0	457.0
Anglers with no catch	23	14	13	1	7	58
Spot	28	13	15	0	13	69
Kingfishes	4	1	0	1	0	6
Flounders	0	1	1	0	0	2
Other fish	13	7	5	3	19	47
Total catch	45	22	21	4	32	124
Fish per angler	0.90	0.96	1.00	1.33	1.78	1.08
			Georgetown/Horry Counties			
Number of anglers	8	42	24	40	34	148
Total hours fished	31.5	250.0	143.5	216.5	172.0	813.5
Anglers with no catch	5	20	12	21	16	74
Spot	37	30	19	15	7	108
Kingfishes	0	7	4	6	51	68
Flounders	0	2	3	4	0	9
Other fish	2	20	20	30	24	96
Total catch	39	59	46	55	82	281
Fish per angler	4.88	1.40	1.92	1.38	2.41	1.90
			Statewide			
Number of anglers	58	72	62	63	54	309
Total hours fished	189.0	426.0	268.0	291.5	247.5	1422.0
Anglers with no catch	28	39	34	36	24	161
Spot	65	43	34	15	23	180
Kingfishes	4	8	4	9	51	76
Flounders	0	3	6	5	0	14
Other fish	15	28	62	45	44	194
Total catch	84	82	106	74	118	464
Fish per angler	1.45	1.14	1.71	1.18	2.19	1.50

Table 20. Survey logistics for the MRFSS charterboat mode.

Wave	County	Sites	Boats	Interviews	Survey hours[a]	Hours per interview[a]
2	Beaufort	1	1	1		
	Georgetown	2	2	10		
	Total	3	3	11	26.25	2.39
3	Beaufort	2	3	10		
	Charleston	2	6	12		
	Georgetown	2	5	20		
	Total	6	14	42	30.00	0.71
4	Beaufort	2	5	10		
	Charleston	1	5	8		
	Georgetown	2	6	27		
	Total	5	16	45	27.50	0.61
5	Beaufort	3	7	24		
	Charleston	1	1	4		
	Georgetown	2	9	64		
	Total	6	17	92	36.75	0.40
6	Beaufort	2	6	17		
	Charleston	1	1	6		
	Georgetown	2	4	17		
	Total	5	11	40	18.00	0.45
Annual	Beaufort	3	12	68		
	Charleston	2	9	30		
	Georgetown	2	10	132		
	Total	7	31	230	138.50	0.60

[a]Source: KCA final wave reports.

Table 21. Time of week and time of day distribution of MRFSS charterboat interviews. Source: KCA final wave reports. Figures are numbers of interviews.

			Time of day			
Wave	Weekend	Weekday	0900-1200	1200-1500	1500-1800	1800-2100
2	5	6	0	0	6	0
3	23	19	0	7	31	4
4	15	30	0	26	18	1
5	31	61	0	39	53	0
6	18	22	0	17	20	3
Total	92	138	0	89	128	8

estimated total fleet.

The majority of the charterboat interviews were obtained on weekdays (Table 21). Half-day trips (usually three hours or less fishing time) in the morning generally returned shortly before noon while most all-day and afternoon half-day outings docked between 1600 and 1800 hours. This scheduling obviously determined the intercept times.

A total of 316 anglers were covered by the interviews (230 interviewed plus 86 others in their fishing parties). Five percent had fished in inland waters, primarily for red drum and spotted seatrout. Most of this activity occurred in Beaufort County. One percent fished in the nearshore ocean zone, mostly in Beaufort County. The vast majority statewide (94%) had spent their trips in the FCZ.

Compared to previous years, relatively few charterboat fishermen were nonselective as to species sought (i.e., targeted anything). About 75% of the offshore anglers specifically targeted king mackerel, a considerably larger percentage than in the previous year (43%) (Table 22). Most of this group fished out of the Georgetown/Horry area, where 89% of all charterboat anglers directed their effort at kings. About half (53%) of the Charleston County charterboat anglers targeted kings and nearly one-third (31%) of the Beaufort County fishermen sought them. Spanish mackerel were almost exclusively targeted by Beaufort County anglers (31% of this overall group). Other ocean pelagic species (dolphin, wahoo, and tunas) were primarily sought by Charleston County fishermen (20% of those interviewed). None of the charterboat anglers interviewed in the MRFSS had targeted billfishes.

Few fishermen in any area pursued black sea bass and other offshore bottomfish as their first priority (about 8% of the Georgetown/Horry area anglers did). Many fishermen did, however resort to these species as a secondary choice when fishing for mackerels, etc. was slow.

The estimated total charterboat catch is indicated in Table 23. Mode landings represented about 5% of the overall catch. The principal species were king mackerel (33%) and black sea bass (15%). Inshore sportfish were more prominently represented than in past years. Charterboats accounted for about 57% of the overall king mackerel catch.

Catch and effort data for those anglers included in interview results are listed in Table 24. The numbers of anglers were not always equivalent to the totals interviewed. Not all fishermen in some groups were interviewed but the catch/effort data applied to the entire fishing party. Only 9% of the fishermen failed to catch a fish during their trip compared to 35% in 1990. The overall catch rate of mackerels and other offshore pelagic species in aggregate was 2.00 fish per (ocean) angler. In 1990, this index was 1.4 fish per angler.

Many Beaufort County anglers fished on half-day trips so the average trip duration (4.5 hours fished) for this group was considerably less than in the other areas. Many of these outings were directed primarily at Spanish mackerel, which represented about 17% of the total reported catch here. In terms of total numbers of fish landed, black sea bass dominated with 43% of the total, all

Table 22. Target species of charterboat fishermen, in numbers of anglers designating each species.

Species	County			MRFSS Total
	Beaufort	Charleston	Georgetown	
		Wave 2		
Any	5			5
K. mackerel			4	4
S. mackerel	2			2
		Wave 3		
K. mackerel	4	4	9	17
Any		5	9	14
S. mackerel	7			7
Wahoo		2	1	3
Yellowfin tuna		3		3
Dolphin		1	2	3
Cobia	2			2
Grouper	1			1
B. sea bass			1	1
Bottomfish			1	1
		Wave 4		
K. mackerel	4	6	27	37
S. mackerel	7	1		8
Bluefish	5			5
Any	1		1	2
S. trout		1		1
		Wave 5		
K. mackerel	9	4	61	74
Bottomfish			6	6
Red drum	6			6
S. trout	6			6
Any	5			5
S. mackerel	3			3
Wahoo			3	3
Tarpon	1			1
		Wave 6		
K. mackerel	4	2	17	23
Any	11			11
B. sea bass	2		2	4
S. mackerel	2			2

Table 23. Estimated catch in the charterboat mode by wave, in thousands of fish. Source: NMFS.

Category	2	3	4	5	6	Total
Offshore Pelagics						
Dolphin	0	2	0	0	<1	2
Little tunny/bonito	0	<1	<1	1	<1	3
Tunas/other	0	1	0	<1	0	2
Offshore Bottomfish						
Black sea bass	0	9	0	1	13	23
Other sea basses	0	<1	0	0	<1	<1
Groupers	0	1	0	<1	0	2
Snappers	0	6	0	4	<1	10
Red porgies	0	3	0	0	0	3
Other porgies	0	1	0	0	<1	1
Grunts	0	2	0	2	0	4
Triggerfish	0	1	0	1	0	2
Coastal Pelagics						
King mackerel	0	9	12	26	4	51
Spanish mackerel	0	3	3	9	0	15
Bluefish	0	0	1	<1	0	2
Crevalle jack	0	0	0	2	0	2
Amberjacks	0	<1	0	0	<1	1
Barracuda	0	1	<1	<1	0	2
Inshore Sportfish						
Red drum	0	0	0	14	0	14
Spotted seatrout	0	0	<1	8	0	9
Flounders	0	0	0	1	0	<1
Miscellaneous						
Sharks	0	1	<1	1	0	3
Pinfish	0	1	0	1	<1	2
Other	0	<1	<1	1	<1	3

Table 24. Catch and effort data for charterboat anglers interviewed in the MRFSS. Catches are in numbers of fish.

Category	Wave 2	3	4	5	6	Total
			Beaufort County			
No. of anglers	7	18	14	26	17	82
Total hours fished	28.0	114.0	59.0	120.0	51.0	372.0
Anglers with no catch	1	1	3	8	7	20
King mackerel	2	7	4	2	3	18
Spanish mackerel	25	21	9	19	0	74
Other pelagics	1	3	7	13	0	24
Black sea bass	0	0	0	0	190	190
Other bottomfish	2	23	0	0	4	29
Total catch	28	56	23	133	197	437
			Charleston County			
No. of anglers	0	23	19	4	2	48
Total hours fished	0	211.0	163.5	24.0	10.0	408.5
Anglers with no catch	0	0	0	0	2	2
King mackerel	0	11	22	5	0	38
Spanish mackerel	0	3	7	0	0	10
Other pelagics	0	20	2	0	0	22
Black sea bass	0	0	0	0	0	0
Other bottomfish	0	0	0	0	0	0
Total catch	0	35	32	5	0	72
			Georgetown/Horry Counties			
No. of anglers	10	35	51	70	20	186
Total hours fished	93.0	305.0	368.0	600.0	136.0	1502.0
Anglers with no catch	0	0	3	3	0	6
King mackerel	25	49	98	150	55	377
Spanish mackerel	0	1	14	5	0	20
Other pelagics	0	8	5	3	4	20
Black sea bass	0	75	0	7	13	95
Other bottomfish	4	103	0	47	5	159
Total catch	29	240	117	213	78	677
			Statewide			
No. of anglers	17	76	84	100	39	316
Total hours fished	121.0	630.0	590.5	744.0	197.0	2282.5
Anglers with no catch	1	1	6	11	9	28
King mackerel	27	67	124	157	58	433
Spanish mackerel	25	25	30	24	0	104
Other pelagics	1	31	14	16	4	66
Black sea bass	0	75	0	7	203	285
Other bottomfish	6	126	0	47	9	188
Total catch	57	331	172	351	275	1186

landed during wave 6. King mackerel represented only 4% of the reported catch by Beaufort County charterboaters. About 24% caught no fish. The average catch rate of pelagics (including mackerels) by ocean fishermen was 1.59 fish per angler compared to 0.9 in 1990.

Most Charleston County anglers fished all day in the FCZ for mackerels and other offshore pelagics, which in aggregate accounted for practically all of their reported catch. King mackerel represented 53% of the total landings. Only 4% of the fishermen caught nothing and the average pelagic catch rate was 1.49 fish per angler vs 1.1 in 1990.

Anglers in the Georgetown/Horry area comprised the majority (59%) of the charterboat sample population and contributed 66% of the reported total effort. They were the most successful group: only 3% failed to catch a fish. King mackerel accounted for 55% of their total reported landings while black sea bass and other offshore bottomfish contributed 38%. The pelagic catch rate was 2.17 fish per angler compared to 1.8 in 1990.

Nearly 86% of the total amount of time expended by charterboat anglers consisted of ocean (troll) fishing for anything or was specifically targeted at mackerels (primarily kings). Success for the pillar species of this fishery, king mackerel, was highly variable between areas though somewhat more consistent between seasons than in recent years. Table 25 summarizes the 1991 results. The overall statewide catch rate (1.56 fish per angler) was substantially higher than in 1990 (0.63) and the percentage of unsuccessful anglers (25%) was much lower (66% in 1990).

The catch rate was uniformly the lowest in Beaufort County, as has been typically the case, though far above the previous year's index. Relatively few anglers (27%) succeeded in catching a king on their trip. Charleston County fishermen fared a great deal better in 1991 (0.95 kings per angler vs 0.07 in 1990). About 65% managed to land at least one compared to 5% of those interviewed in 1990. As usual, fishermen in the Georgetown/Horry area were the most successful. Although fishing was good there throughout the season, the fall (waves 5 and 6) fishery was the most productive. This was also the case in 1990. In this period, the 1991 average catch rate was 2.22 kings per angler compared to 2.12 in the previous year. During the entire year, only 9% of the Georgetown/Horry charterboaters were unsuccessful compared to 22% in 1990.

About 14% of the charterboat anglers fishing in the ocean had visited artificial reefs (compared to 21% in 1990). Their effort (i.e., hours fished) represented 8% of the ocean total (vs 14% in the previous year). Site-specific information is summarized in Table 26. Table 27 compares annual reef and nonreef catch and effort data by county.

Most of the reef usage occurred in Beaufort County, where 48% of the ocean fishermen had fished reefs (vs 37% in 1990). Their effort represented 37% of the county's ocean total. The reef fishermen accounted for 77% of the county's total charterboat landings, including 54% of the pelagic catch and 89% of the bottomfish. The catch rate of pelagic species (fish per hour) was 0.55 for reef anglers vs 0.27 for those who had not fished the reefs.

In Charleston County, 11% of the fishermen reported fishing on

Table 25. Charterboat fishing success for king mackerel. Anglers include those ocean fishermen targeting anything or mackerels.

Wave	Total anglers	Hours fished	King mackerel	Anglers with no catch	Kings per angler
			Beaufort County		
2	5	20.0	2	3	0.40
3	10	70.0	7	4	0.70
4	9	36.0	4	7	0.44
5	12	57.0	2	10	0.17
6	15	41.0	3	13	0.20
Total	51	224.0	18	37	0.35
			Charleston County		
2	----------	----------	----no sampling----------	----------	----------
3	16	130.0	11	11	0.69
4	18	159.5	22	1	1.22
5	4	24.0	5	0	1.25
6	2	10.0	0	2	0
Total	40	323.5	38	14	0.95
			Georgetown/Horry Counties		
2	10	93.0	25	0	2.50
3	30	245.0	49	5	1.63
4	51	367.5	97	3	1.90
5	66	570.0	150	6	2.27
6	20	136.0	55	2	2.75
Total	177	1411.5	376	16	2.12
			Statewide		
2	15	113.0	27	3	1.80
3	56	445.0	67	20	1.20
4	78	563.0	123	11	1.58
5	82	651.0	157	16	1.91
6	37	187.0	58	17	1.57
Total	268	1959.0	432	67	1.61

Table 26. Artificial reef sites fished by charterboat anglers

Site	Anglers	Hours fished	Target spp./anglers	Catch
FishAmerica	2	8.0	K. mackerel/2	4 K. mackerel
Navy/Savannah towers	15	60.0	Any/5 S. mackerel/2 Mackerels/8	2 K. mackerel 46 S. mackerel 1 Blackfin tuna 1 Lizardfish 1 Rock sea bass 3 Barracuda
Fripp Island (Tire Reef)	13	34.0	Any/11 Black sea bass/2	190 Black sea bass 3 Red snapper 1 Amberjack
Kiawah (4 KI)	2	10.0	K. mackerel/2	0
Ten-Mile	6	51.0	K. mackerel/6	10 K. mackerel 1 S. mackerel

Table 27. Annual reef and nonreef catch and effort data for charterboat fishermen.

Category	County	Reef fishermen	Nonreef fishermen
	Beaufort		
Number of anglers		30	33
Total hours fished		102.0	175.5
Species targeted/ no. of anglers		Any/16 Mackerels/8 K. mackerel/2 S. mackerel/2 B. sea bass/2	K. mackerel/11 S. mackerel/11 Mackerels/2 Grouper/6 Any/3
Catch by species in nos. of fish		196 Bottomfish 46 S. mackerel 6 K. mackerel 3 Barracuda 1 Blackfin tuna	24 S. mackerel 23 Bottomfish 12 K. mackerel 9 Jacks 3 Sharks 1 Barracuda 1 Bluefish 1 Bonito
	Charleston		
Number of anglers		5	42
Total hours fished		24.0	380.0
Species targeted/ no. of anglers		K. mackerel/5	K. mackerel/24 Any/7 Wahoo-tunas/7 Mackerels/4
Catch by species in nos. of fish		4 K. mackerel 3 S. mackerel 1 Shark	34 K. mackerel 12 Dolphin 7 S. mackerel 4 Barracuda 2 Wahoo 2 Tunas
	Georgetown/Horry		
Number of anglers		6	180
Total hours fished		51.0	1451.0
Species targeted/ no. of anglers		K. mackerel/6	K. mackerel/140 Any/15 King-bottom/11 Bottomfish/5 Wahoo-dolphin/2 King-dolphin/2 Wahoo/3 Mackerels/2
Catch by species in nos. of fish		10 K. mackerel 1 S. mackerel	382 K. mackerel 236 Bottomfish 19 S. mackerel 9 Bonito 6 Dolphin 5 Sharks 2 Wahoo 2 Barracuda 1 Tuna

reefs compared to 22% in 1990. Their effort represented 6% of the county total. They accounted for 12% of the total catch, practically all of which was pelagic species. The reef user catch rate was 0.29 fish per hour compared to 0.16 for the nonreef anglers.

As in the previous year, very few (3%) of the Georgetown/Horry area fishermen used the reefs. Their effort represented 3% of the total charterboat hours fished there. The reef pelagic catch rate was 0.22 vs 0.29 fish per hour for nonreef users.

Statewide, charterboat reef fishermen caught 12% of the mode's pelagic catch and 43% of the bottomfish. Most of the reef catch of pelagic species consisted of Spanish mackerel (18% of all fish landed) while king mackerel comprised 91% of the nonreef pelagic landings. For king mackerel, the reef catch was 0.11 fish per hour compared to 0.25 for the nonreef group. In 1990, the average catch of pelagic species was 0.72 fish per angler for reef users and 1.66 for nonreef fishermen. The 1991 figures were 1.80 and 2.08, respectively. These statistics are somewhat misleading, however, because the average reef fisherman fished only 4.3 hours compared to 7.9 for his nonreef counterpart. When measured in fish per hour, the reef fisherman's catch rate of pelagic species was better (0.52) than that of the nonreef angler (0.29). The most numerous species landed by reef anglers was black sea bass (72% of all fish caught).

Private Boat Mode

Sampling data for the MRFSS are summarized in Table 28. About 72% of the 528 fishermen interviewed were coastal residents. Out of state residents comprised 16% of the sample population and the remaining 12% were noncoastal residents. Despite the intent to obtain roughly equal sample sizes by area, this design could not always be met with wave 6 the most significant exception. Although 17 sites were included out of the more than 40 coastal public ramps or landings, many of the interviews were attributable to only one or two popular locations in each area. In Beaufort County, 39% of the interviews were obtained at the Broad River landing and 30% at E.C. Glenn. About 46% of the Charleston County sample was collected at Remley Point. The Murrells Inlet ramp provided 79% of the interviews in Georgetown and Horry Counties and 26% of the statewide sample.

Most of the private boat fishermen interviewed in the MRFSS phone poll had originated their trips from public access points, particularly during wave 6. Table 29 indicates the distribution of effort by point or origin.

An additional 652 interviews (representing 1,488 anglers) were obtained in the SFS (Table 30). Eight percent were obtained in Beaufort County, 40% came from Georgetown County, and 51% were collected in Charleston County. As in the MRFSS, a relatively small number of locations provided most of the interviews with the Murrells Inlet ramp accounting for 24% of this survey's total. The Broad River landing provided 40% of the Beaufort County sample. Sol Legare ramp accounted for 24% of the Charleston County total and Wappoo Cut 29%. Boulevard and South Island Ferry landings each contributed 20% of the Georgetown County sample. In aggregate, interviews from these six sites represented 70% of the statewide SFS

Table 28. Survey logistics for the MRFSS private boat mode.

Wave	County	Sites	Interviews	Survey hours[a]	Hours per interview[a]
2	Beaufort	1	14		
	Charleston	3	13		
	Georgetown	1	17		
	Total	5	44	40.25	0.91
3	Beaufort	2	45		
	Charleston	2	44		
	Georgetown	1	43		
	Horry	1	6		
	Total	6	138	47.00	0.34
4	Beaufort	5	43		
	Charleston	5	51		
	Georgetown	1	39		
	Horry	1	8		
	Total	12	141	66.00	0.48
5	Beaufort	2	35		
	Charleston	1	29		
	Georgetown	3	40		
	Total	6	104	38.25	0.36
6	Beaufort	4	26		
	Charleston	4	58		
	Georgetown	1	17		
	Total	9	101	58.00	0.57
Annual	Beaufort	6	163		
	Charleston	7	195		
	Georgetown	3	156		
	Horry	1	14		
	Total	17	528	249.50	0.47

[a]Source: KCA final wave reports

Table 29. Private boat access by point of origin, in percentages of trips in the indicated wave.

	Public			Private		
Wave	Ramp	Boat Slip	Moored at dock	Personal dock	Locked marina	Unlocked marina
2	70.5	0	19.7	9.8	0	0
3	38.7	6.3	9.7	35.2	1.6	3.1
4	52.7	5.5	6.3	5.1	28.1	2.0
5	67.8	3.4	2.3	15.8	0.8	9.9
6	80.4	0	0	6.5	8.6	4.5

Table. 30. Site visits and interviews obtained in the SFS (private boat mode only).

Wave	County	Site	Visits	Interviews
2	Beaufort	E.C. Glenn	1	2
	Colleton	Bennetts Point	1	1
	Charleston	R.E. Ashley	2	5
		Buck Hall	1	2
		Remley Point	3	5
		City Marina	1	3
		Wappoo Cut	7	19
		Folly River	3	4
		Limehouse	1	1
	Georgetown	Murrells Inlet	1	3
		Boulevard	2	15
	Total		23	60
3	Beaufort	Broad River	2	6
		E.C. Glenn	1	1
		C.C. Haigh	1	3
		Shaltar Cove Marina	2	2
	Charleston	Buck Hall	1	3
		Paradise	1	0
		Remley Point	4	18
		City Marina	1	5
		Wappoo Cut	4	15
		Folly River	1	1
		Sol Legare	1	8
		Limehouse	1	0
	Georgetown	Murrells Inlet	3	18
		South Island Ferry	2	10
		Boulevard	2	11
	Total		27	101
4	Beaufort	Broad River	3	4
		E.C. Glenn	2	6
		C.C. Haigh	4	9
		Port Royal	1	0
		Russ Point	2	0
		H.E. Trask	1	0
	Charleston	R.E. Ashley	4	15
		Buck Hall	1	3
		Remley Point	5	25
		Shem Creek	2	11
		Wappoo Cut	10	24
		Folly River	4	7
		Sol Legare	1	2
		Crosby's	1	1
		Limehouse	3	4
	Georgetown	Murrells Inlet	10	55
		South Island Ferry	6	27
		Boulevard	3	15
	Total		63	208
5	Charleston	R.E. Ashley	1	4
		Wappoo Cut	3	10
		Folly River	2	6
		Sol Legare	10	57
		Limehouse	5	25
	Georgetown	Capt. Dick's	1	1
		Murrells Inlet	5	37
		South Island Ferry	1	3
		Boulevard	1	4
	Horry	Hwy. 17 Cherry Grove	1	4
	Total		30	151
6	Beaufort	Broad River	2	11
		C.C. Haigh	3	5
		Johnson Creek	1	3
	Charleston	Detco	1	5
		Remley Point	2	0
		Wappoo Cut	6	29
		Folly River	2	2
		Sol Legare	2	11
		Limehouse	3	0
		Cherry Point	1	1
		Toogoodoo	3	0
	Georgetown	Murrells Inlet	3	42
		South Island Ferry	2	13
		Boulevard	2	10
	Horry	Hwy. 17 Cherry Grove	1	0
	Total		34	132

sample.

Distribution of MRFSS interviews by time of week varied according to wave (Table 31). During waves 2-4, the weekday:weekend counts were roughly equivalent. During waves 5 and 6, the numbers of interviews were heavily skewed toward the weekends. Overall, about 55% of the MRFSS interviews were obtained on weekends. Practically all of the fishermen in both the MRFSS and SFS were intercepted during the afternoon. The average number of days fished during the past 12 months varied considerably depending on the wave in which the respondents were interviewed. Responses in wave 6 can be considered representative of the average angler's effort during the calendar year. In 1991, this was about 32 trips.

The distribution of participation by area fished was similar in both surveys so the results were combined (Table 32). The majority of the fishermen (74%) had fished on inland waters. Thirteen percent fished in the nearshore ocean zone and 13% in the FCZ. The relative level of estuarine activity was greatest in Beaufort County, where 92% of the anglers fished in inland areas, 1% in the nearshore ocean zone, and 7% in the FCZ. Most Charleston County fishermen (80%) had also fished estuarine waters. About 12% fished nearshore ocean areas (primarily around the Charleston jetties) and 8% had gone into the FCZ. Usage of inland waters was relatively lower in the Georgetown/Horry area, where only 62% of the anglers had fished there. About 17% had fished in the nearshore ocean zone mostly around the jetties at Murrells Inlet and Winyah Bay. The remaining 21% had fished in the offshore ocean area.

The estimated total private boat catch is listed in Table 33. Mode landings accounted for 66% of the overall recreational hook and line catch. The most numerous components were black sea bass (21%), spotted seatrout (17%), sharks (10%), and spot (8%). Flounders and red drum each represented about 7%. In aggregate, inshore sportfish comprised 30%.

Most (64%) of the offshore fishermen were interviewed in the Georgetown/Horry area. The most popular species sought was the king mackerel, targeted by 49% of all offshore anglers. About 17% had targeted black sea bass, 12% dolphin, and 10% Spanish mackerel. Nearly 18% of all offshore private boat fishermen failed to catch a fish. For those who were successful, black sea bass made up 60% of the catch. This species and other reef bottomfish combined accounted for two-thirds of the overall catch. King mackerel represented 13%. The average catch rate for all species combined was 4.2 fish per angler. For those fishermen who targeted and/or caught king mackerel, the average catch was 1.00 king per angler. For black sea bass, the average catch rate was 10.18 fish per angler. Offshore fishing parties spent about $45 on average for their trip (for the entire group).

About 22% of the offshore ocean anglers reported fishing at artificial reefs. The relative usage rate was highest in Beaufort County, where 60% of the offshore fishermen interviewed had used reef sites. About 24% of the anglers in the Georgetown/Horry area fished the reefs there. Only 8% of the offshore fishermen interviewed in Charleston County had visited the reefs.

Site-specific information from both surveys is listed in Table 34 (cost data are from the SFS only). The species most frequently

Table 31. Time of week and time of day distribution of MRFSS private boat interviews. Source: KCA final wave reports. Figures are numbers of interviews.

			Time of day			
Wave	Weekend	Weekday	0900-1200	1200-1500	1500-1800	1800-2100
2	24	20	2	8	34	0
3	68	70	3	57	77	1
4	66	72	1	94	43	0
5	62	44	1	46	59	0
6	72	30	2	43	57	0
Total	292	236	9	248	270	1

Table 32. Areas fished by private boat anglers.

County	Inland/ estuarine	Nearshore ocean	Offshore ocean Artificial reef	Nonreef	Total
		MRFSS			
Beaufort	149	3	6	2	160
Charleston	162	21	3	22	208
Georgetown/Horry	93	25	3	48	169
Total	404	49	12	72	537
		SFS			
Beaufort	99	0	6	6	111
Charleston	572	85	3	48	708
Georgetown/ Horry	429	119	38	83	669
Total	1,100	204	47	137	1,488
		Combined			
Beaufort	248	3	12	8	271
Charleston	734	106	6	70	916
Georgetown/ Horry	522	144	41	131	838
Total	1,504	253	59	209	2,025

Table 33. Estimated catch in the private boat mode by wave, in thousands of fish. Source: NMFS.

Category	2	3	4	5	6	Total
Offshore Pelagics						
Dolphin	0	6	0	0	0	6
Offshore Bottomfish						
Black sea bass	0	101	36	3	338	478
Other sea basses	0	10	0	0	0	10
Groupers	0	0	0	3	0	3
Snappers	0	0	0	0	0	0
Red porgy	0	12	0	0	0	12
Other porgies	0	6	0	0	0	6
Grunts	0	7	0	0	0	7
Triggerfish	0	0	0	0	0	0
Coastal Pelagics						
King mackerel	0	19	16	0	0	35
Spanish mackerel	0	9	41	14	0	64
Bluefish	3	1	6	9	0	19
Crevalle jack	0	0	2	0	0	2
Amberjacks	0	0	0	3	0	3
Barracuda	0	0	2	0	0	2
Inshore Sportfish						
Red drum	20	9	37	47	34	147
Spotted seatrout	0	9	130	23	213	375
Weakfish	2	0	7	0	0	9
Flounders	6	46	69	24	5	150
Inshore Bottomfish						
Kingfishes	0	17	17	47	1	82
Spot	42	4	33	103	0	182
Croaker	6	14	6	2	7	35
Black drum	0	1	2	0	1	4
Sheepshead	0	39	43	22	55	159
Miscellaneous						
Sharks	5	81	114	16	0	216
Skates/rays	0	10	0	0	0	10
Catfishes	6	50	9	9	0	74
Toadfish	2	12	0	19	0	33
Pinfish	0	2	0	16	0	18
Puffers	0	2	0	2	0	4
Other	0	4	76	6	22	108

Table 34. Artificial reef sites fished by private boat anglers (MRFSS and SFS combined).

Site	Anglers	Hours fished	Average trip cost	Target spp./ no. of anglers	Catch
FishAmerica	6	45.0	$25.00	Flounder/6 S. trout/3	23 Flounder 12 Spotted seatrout 2 Weakfish 1 S. mackerel 1 Black drum
Savannah Tower	3	24.0	$40.00	K. mackerel/3	2 S. mackerel 1 Barracuda
Fripp Dry Dock	3	3.0	-	Any/3	1 Cobia
Capers (R8)	6	43.5	$25.00	K. mackerel/3 B. sea bass/3	7 B. sea bass
Paradise	13	82.0	$15.33	K. mackerel/5 B. sea bass/5 S. trout/2 S. mackerel/1	57 B. sea bass 20 Toadfish 6 Spadefish 6 Pigfish 6 Spotted pinfish 6 White grunt 6 Croaker 4 S. mackerel 2 Red porgy 2 K. mackerel
Ten-mile	11	57.0	$22.50	K. mackerel/9 B. sea bass/2	79 B. sea bass 9 K. mackerel
Pawleys	5	28.5	$26.66	K. mackerel/3 B. sea bass/2	12 B. sea bass 3 K. mackerel 1 Flounder
Vermilion	5	35.0	$135.00	B. sea bass/3 Cobia/2	25 B. sea bass 1 K. mackerel
C. of Richmond	4	24.0	$75.00	B. sea bass/4	12 B. sea bass 2 K. mackerel 2 Triggerfish 2 Sharks
Unknown (Georgetown County)	3	20.0	-	B. sea bass/3	9 B. sea bass

targeted by reef fishermen were king mackerel (by 39% of the anglers) and black sea bass (by 37%). The latter dominated the landings, representing 62% of the total reported reef catch. Mackerels represented 7% as did reef bottomfish other than black sea bass. The overall average catch of reef fishermen was 5.5 fish per angler. Nineteen percent of the anglers had caught nothing. Fishermen either targeting king mackerel or catching them averaged 0.65 kings per angler. Reef anglers targeting black sea bass and/or catching this species averaged 7.14 apiece. The average reef trip cost about $35 for the entire group.

Catch and effort data for nonreef anglers are summarized in Table 35. They represented 78% of the offshore private boat fishermen and accounted for 79% of the effort. Their principal target was king mackerel, sought by 52% of the anglers. Other popular species and percentages targeting them were dolphin (15%), Spanish mackerel (12%), and black sea bass (11%).

About 18% of the nonreef fishermen were unsuccessful. Black sea bass comprised the majority (59%) of the landings with mackerels representing 25% (16% king, 9% Spanish). Reef bottomfish excluding sea bass comprised around 8%. The overall average catch rate was 3.75 fish per angler. Fishermen targeting and/or catching king mackerel averaged 1.07 per angler. Black sea bass fishermen averaged 12.49 per angler. Nonreef parties spent an average of $52 for their trip.

Nearly all of the nearshore ocean fishermen were intercepted in Charleston County and the Georgetown/Horry area (Table 36). Most had been fishing around jetties (i.e., those at the entrances to Winyah Bay, Murrells Inlet, and Charleston Harbor). Practically all of the Charleston County group had been fishing at the Charleston Harbor entrance jetties. General fishery characteristics were similar regardless of geographic area (excluding Beaufort County). The typical fishing party spent slightly less than $20 on their trip and about 40% of the anglers were unsuccessful. Sheepshead was the most popular target species, sought by 26% of the overall group, as well as the largest component of the catch (29% of all fish caught). Other frequently targeted species were king mackerel (by 15% of all anglers), red drum (also by 15%), and flounders (by 9%). Red drum and flounders also figured prominently in the overall catch with each representing 11%. Although seldom targeted, black sea bass contributed substantially (10%). Mackerels also represented about 10%. Anglers in the Georgetown/Horry area had a higher catch rate (1.53 fish per angler vs 1.08 for Charleston County fishermen) and the average overall catch rate was 1.34 fish per angler.

Most of the private boat anglers interviewed had fished in inland (estuarine) areas. Table 37 summarizes fishery characteristics for this group statewide. The cost per trip is the amount spent by the group regardless of the number of participants.

About 26% of the fishermen expressed no species preference and were fishing for anything. Fishermen were most likely to be targeting a particular species in wave 6 when the spotted seatrout was sought by half of the anglers. This was the most popular species for the entire year as well with about 21% of the anglers indicating it as their preference. Close behind was the red drum, targeted by 19%, although seasonality of preference was less

Table 35. Catch and effort data for private boat offshore nonreef fishermen interviewed in the MRFSS and SFS. Figures for target species are the numbers of anglers indicating that preference.

	Beaufort	Charleston	Georgetown/Horry
No. of anglers	8	70	131
Hours fished	25.0	523.5	815.5
Anglers with no catch	0	5	32
Average cost per trip	$70	$45	$53
Target species			
K. mackerel	2	9	97
Dolphin	-	31	-
S. mackerel	-	3	22
B. sea bass	-	12	11
Any	-	6	7
Sharks	6	3	-
Bottomfish	-	5	-
Mackerels	-	4	-
Wahoo	-	3	-
Amberjack	-	-	3
Red drum	-	-	2
Spot	-	-	1
Catch in nos. of fish			
B. sea bass	-	378	84
K. mackerel	-	16	110
S. mackerel	-	17	52
Sharks	6	10	2
Dolphin	-	16	-
Reef bottomfish	-	25	34
Other	1	23	9

Table 36. Catch and effort data for private boat nearshore ocean fishermen interviewed in the MRFSS and SFS. Figures for target species are the numbers of anglers indicating that preference.

	Beaufort	Charleston	Georgetown/Horry
No. of anglers	3	106	144
Hours fished	18.5	527.0	718.0
Anglers with no catch	1	43	58
Average cost per trip	-	$19.61	$19.66
Target species			
Sheepshead	-	37	30
Any	-	30	17
Red drum	1	9	27
K. mackerel	-	8	29
Flounders	-	3	19
Sharks	2	7	7
S. trout	-	3	7
Spot	-	-	9
Mackerels	-	5	-
Black drum	-	4	-
S. mackerel	-	-	2
Weakfish	-	-	2
Kingfishes	-	1	-
Catch in nos. of fish			
Sheepshead	-	40	59
Flounders	-	7	32
Red drum	-	4	33
B. sea bass	-	30	5
Spot	-	2	25
K. mackerel	-	1	19
Croaker	-	3	13
S. mackerel	-	5	10
Sharks	4	2	1
Other	-	21	24

Table 37. Catch and effort data for inland private boat fishermen interviewed statewide (MRFSS and SFS). Figures for target species are the numbers of anglers indicating that preference. Catch is in numbers of fish.

	Wave					
	2	3	4	5	6	Total
Anglers	131	243	373	379	302	1428
Hours fished	528.0	1154.0	1449.0	2129.0	1418.5	6678.5
Anglers with no catch	57	76	111	119	94	457
$/trip	39.88	16.85	16.26	16.31	14.60	16.89
Target spp.						
Any	34	55	94	133	56	372
S. trout	13	27	46	62	154	302
Red drum	48	27	41	93	58	267
Flounders	19	47	80	20	15	181
Spot	6	6	9	49	25	95
Sheepshead	2	14	21	10	7	54
Cobia	4	38	2	-	-	44
Sharks	7	15	17	-	-	39
Kingfishes	-	18	2	9	4	33
Others	6	7	20	18	5	56
Catch						
Inshore sportfish						
Red drum	46	23	55	147	102	373
S. trout	15	26	134	231	438	844
Weakfish	-	2	-	53	-	55
Flounders	15	75	115	18	28	251
Inshore bottomfish						
Kingfishes	1	36	16	154	28	235
Spot	61	54	155	398	322	990
Croaker	11	20	13	132	57	233
Black drum	-	1	3	-	1	5
Sheepshead	-	51	94	17	77	239
Other						
Sharks	3	136	65	23	-	227
Cobia	-	2	-	-	-	2
Bluefish	7	3	9	10	-	29
S. mackerel	-	1	7	11	-	19
Miscellaneous	20	122	169	58	49	418

pronounced than for trout. The other principal species sought were flounders (by 13% of the fishermen) and spot (by 7%). Flounders were targeted primarily during May-August while spot was principally sought during the fall.

The most abundant species in the reported statewide catch was spot, which comprised 25% of the total landings. Spotted seatrout was second with 22% while red drum placed third with 10%. The other significant species were flounders, sheepshead, kingfishes, croaker, and sharks, each representing approximately 6% of the overall catch of interviewed anglers. Spot, spotted seatrout, red drum, croakers, and kingfishes were caught primarily in the fall while most of the flounder and sharks were landed in the summer. There was no pronounced seasonality in the sheepshead landings.

Fishing success as measured by the percentage of anglers catching fish was quite consistent during most of the year and between areas. In wave 2, about 56% of the fishermen caught something. During the rest of the year, about two-thirds were successful. The average catch rate increased as the year progressed and was highest in wave 6 (3.65 fish per angler). For the year overall, it was 2.75 fish per angler. To obtain this, the average fishing group expended about 4.7 hours of effort and $17 in direct expenses on their trip.

Fishery characteristics by county are summarized in Tables 38-40. The smallest number of anglers was interviewed in Beaufort County. These fishermen generally spent the least amount of time fishing (4.3 hours) and the most amount of money (about $22) on their trips. Their favorite target was spotted seatrout (sought by 21% of the anglers). The other most popular species were cobia (17%), red drum (12%), sharks (11%), and sheepshead (9%). Seatrout were primarily sought during wave 6 while cobia attracted a large following during wave 3.

Sharks were the most numerous component of the reported catch, especially during wave 3 (many were taken as incidental catches while fishing for cobia). Overall, sharks accounted for 24% of the reported total landings. Spotted seatrout comprised 23%, with most of the catch occurring in wave 6. Sheepshead were a prominent component during most of the year and made up 15% of the annual reported landings. About 13% consisted of undesirable miscellaneous species such as catfishes and toadfishes.

About 34% of the Beaufort County fishermen were unsuccessful during their trip with fishing the least productive in wave 2. The average catch rate was 3.36 fish per angler overall and peaked in wave 4 at 4.19.

The largest number of anglers was interviewed in Charleston County. These fishermen averaged 4.8 hours per trip and the average trip cost about $14, the lowest average expenditure of the three geographic groups. Most of the fishermen interviewed had fished in Charleston Harbor, Wando River, and the Folly/Kiawah/Stono River area.

About 28% indicated no species preference (i.e., were fishing for anything). The most frequently targeted species was the spotted seatrout, sought by 30% of the fishermen. About 23% targeted red drum and 6% were after flounders. Spotted seatrout dominated the landings, comprising one-third of the total. Inshore bottomfish

Table 38. Catch and effort data for inland private boat fishermen interviewed in Beaufort County (MRFSS and SFS combined). Figures for target species are the numbers of anglers indicating that preference. Catch is in numbers of fish.

	2	3	4	5	6	Total
Anglers	20	69	58	37	62	246
Hours fished	63.5	336.5	251.5	150.0	260.5	1062.0
Anglers with no catch	13	23	13	14	21	84
$/trip	-	39.60	20.00	-	13.39	22.20
Target spp.						
S. trout	1	-	10	4	37	52
Any	2	10	13	9	12	46
Cobia	4	38	-	-	-	42
Red drum	1	-	4	9	15	29
Sharks	7	13	8	-	-	28
Sheepshead	-	4	6	8	3	21
Flounders	5	-	4	3	-	12
Spadefish	-	-	8	-	-	8
Kingfishes	-	5	-	-	-	5
B. sea bass	-	2	-	-	3	5
Crevalle jack	-	-	-	4	-	4
Bluefish	-	-	-	3	-	3
Spot	-	-	-	-	1	1
Catch						
Sharks	3	130	57	10	-	200
S. trout	-	1	52	12	124	189
Sheepshead	-	34	51	7	34	126
Catfish	4	45	2	1	-	52
Kingfishes	-	8	3	15	13	39
Red drum	2	-	17	6	14	39
Spadefish	-	-	37	-	-	37
Spot	-	-	11	8	9	28
B. sea bass	-	5	-	-	19	24
Toadfish	1	10	-	10	-	21
Rays	-	18	-	-	-	18
Flounders	-	-	9	1	5	15
Croaker	4	-	-	-	10	14
Bluefish	-	2	2	1	-	5
Pinfish	-	2	-	1	-	3
Cobia	-	2	-	-	-	2
Puffers	-	2	-	-	-	2
S. mackerel	-	-	-	2	-	2
Gar	-	-	-	1	-	1
Bank sea bass	-	1	-	-	-	1
Unidentified	-	-	2	-	7	9
Total catch	14	260	243	75	235	827

Table 39. Catch and effort data for inland private boat fishermen interviewed in Charleston County (MRFSS and SFS combined). Figures for target species are the numbers of anglers indicating that preference. Catch is in numbers of fish.

	Wave					
	2	3	4	5	6	Total
Anglers	73	115	180	232	134	734
Hours fished	298.0	581.5	649.0	1386.5	624.0	3539.0
Anglers with no catch	33	32	56	70	38	229
$/trip	20.00	10.56	15.39	15.23	12.58	14.10
Target Spp.						
S. trout	8	27	36	55	97	223
Any	23	33	41	95	10	202
Red drum	31	19	22	65	32	169
Flounders	2	17	18	4	2	43
Sheepshead	2	10	11	2	2	27
Kingfishes	-	12	2	9	2	25
Spot	4	2	2	5	-	13
Sharks	-	2	9	-	-	11
Crevalle jack	-	-	4	2	-	6
Croaker	3	-	-	-	1	4
Weakfish	-	-	-	3	-	3
B. sea bass	-	3	-	-	-	3
Cobia	-	-	2	-	-	2
Tarpon	-	-	2	-	-	2
Shad	2	-	-	-	-	2
Black drum	-	1	-	-	-	1
Bluefish	1	-	-	-	-	1
Catfish	-	-	1	-	-	1
Catch						
S. trout	15	25	79	189	216	524
Red drum	27	14	20	102	36	199
Kingfishes	1	28	6	139	9	183
Spot	33	32	11	76	-	152
Croaker	7	17	9	107	4	144
Sheepshead	-	17	35	8	26	86
Weakfish	-	2	-	53	-	55
Catfish	2	28	5	14	-	49
Flounders	2	16	20	4	5	47
Sharks	-	6	7	13	-	26
Pinfish	9	-	10	3	-	22
Bluefish	2	1	5	7	-	15
B. sea bass	-	6	-	3	-	9
Rays	3	-	-	3	-	6
Ladyfish	-	1	-	3	-	4
S. mackerel	-	1	-	2	-	3
Black drum	-	1	1	-	-	2
Skates	-	1	-	1	-	2
Crevalle jack	-	-	1	-	-	1
Toadfish	-	-	-	1	-	1
Total catch	101	196	209	728	296	1530

Table 40. Catch and effort data for inland private boat fishermen interviewed in Georgetown and Horry Counties (MRFSS and SFS combined). Figures for target species are the numbers of anglers indicating that preference. Catch is in numbers of fish.

	Wave					
	2	3	4	5	6	Total
Anglers	38	59	135	110	106	448
Hours fished	166.5	236.0	548.5	592.5	534.0	2077.5
Anglers with no catch	11	21	42	35	35	144
$/trip	9.08	15.29	16.60	19.38	17.18	16.55
Target spp.						
Flounders	12	30	58	13	13	126
Any	9	12	40	29	34	124
Spot	2	4	7	44	24	81
Red drum	16	8	15	19	11	69
S. trout	4	-	-	3	20	27
S. mackerel	-	1	5	5	1	12
Sheepshead	-	-	4	-	2	6
Kingfishes	-	1	-	-	2	3
Striped bass	-	-	-	-	2	2
Catch						
Spot	28	22	133	314	313	810
Flounders	13	59	86	13	18	189
Red drum	17	9	18	39	52	135
S. trout	-	-	3	30	98	131
Pinfish	-	-	104	-	-	104
Croaker	-	3	4	25	43	75
Sheepshead	-	-	8	2	17	27
S. mackerel	-	-	7	7	-	14
Kingfishes	-	-	7	-	6	13
White perch	-	-	-	-	12	12
B. sea bass	-	-	2	8	1	11
Catfish	-	3	2	2	3	10
Bluefish	5	-	2	2	-	9
Toadfish	1	-	2	-	2	5
Striped bass	-	-	-	-	5	5
Black drum	-	-	2	-	1	3
Lizardfish	-	-	1	2	-	3
Puffers	-	-	-	2	-	2
Porgy	-	-	-	2	-	2
Sharks	-	-	1	-	-	1
Rays	-	-	1	-	-	1
Crevalle jack	-	-	-	1	-	1
Total catch	64	96	383	449	571	1563

(kingfishes, spot, and croaker) accounted for 31% while red drum represented 13%. Sheepshead made up about 6% (catches at the jetties were counted in the nearshore ocean component). Seatrout catches were greatest in waves 5 and 6 while landings of inshore bottomfish and red drum showed pronounced peaks in wave 5. Sheepshead landings were relatively dispersed seasonally.

About 69% of the Charleston County anglers caught at least one fish during their trip. The failure rate was highest in wave 2 and very consistent during the remainder of the year. The lowest catch rate was in wave 4 and for the year overall fishermen averaged 2.08 fish per angler, substantially less than in the other areas. This was somewhat compensated for by the fact that the incidence of "trash" fish was the lowest (5% of the landings).

Fishermen in the Georgetown/Horry County area had fished mostly around Murrells and North Inlets. Their trips averaged 4.6 hours and cost about $17. The species most likely to have been targeted were flounders (by 28% of the anglers) with summer and southern flounder both prominent in the landings. About 28% of the anglers also indicated no preference. Spot and red drum were the other most preferred species, targeted by 18% and 15% of the anglers, respectively. Spotted seatrout were not nearly as popular as in the rest of the state, being sought by only 6% of the fishermen.

Spot represented the majority (52%) of the landings. Other significant contributors were flounders (12%), red drum (9%), and spotted seatrout (8%). Miscellaneous unwanteds contributed 8% due to a strong showing of pinfish.

The percentage of successful anglers (68% overall) was comparable to that elsewhere. Fishermen here had the highest average catch rate (3.49 fish per angler), particularly during waves 5 and 6 when large catches of spot were common.

Evaluation of species-specific catch rates is complicated by the multi-species composition of catches and the substantial level of nondirected effort (i.e., that target at "anything"). Primary state management interest is directed at red drum and spotted seatrout. Both species are designated game fish and support the private boat fishery in inland (estuarine) areas. Tables 41 and 42 summarize directed catch and effort data for these species. "Directed effort" was defined as a trip in which the angler(s) either targeted the species or caught at least one of it. Table 43 indicates the amount of private boat inland effort directed at each species by area and wave.

About 26% of the statewide inland trips by private boat anglers were directed at red drum. The relative level of effort was highest in Charleston County (32% of all trips). Although overall effort in wave 2 was the lowest, the highest percentage of trips was targeted at red drum during this wave. About 38% of the fishermen failed to catch a red drum on their trip. As measured by this criterion, fishermen were most successful in the Georgetown/Horry area (where 80% caught at least one fish) and least fortunate in Beaufort County (where only 36% landed a red drum). The average statewide catch rate for the year was 1.06 red drum per angler-trip, with anglers in the Georgetown/Horry area doing the best (1.5 per trip compared to 0.9 in both Charleston and Beaufort Counties).

Directed effort for spotted seatrout was much more seasonal

Table 41. Catch and effort data of private boat inland anglers for red drum.

	MRFSS	SFS	Combined Surveys
		Beaufort County	
Anglers	27	17	44
Fish	30	9	39
Fish/angler	1.1	0.5	0.9
% w/o fish	-	-	64%
		Charleston County	
Anglers	35	201	236
Fish	25	189	214
Fish/angler	0.7	0.9	0.9
%w/o fish	-	-	39%
		Georgetown/Horry Counties	
Anglers	21	67	88
Fish	29	107	136
Fish/angler	1.4	1.6	1.5
% w/o fish	-	-	20%
		Statewide Total	
Anglers	83	285	368
Fish	84	305	389
Fish/angler	1.0	1.1	1.1
% w/o fish	-	-	38%

Table 42. Catch and effort data of private boat inland anglers for spotted seatrout.

	MRFSS	SFS	Combined surveys
		Beaufort County	
Anglers	38	27	65
Fish	111	88	199
Fish/angler	2.9	3.3	3.1
% w/o fish	-	-	34%
		Charleston County	
Anglers	81	208	289
Fish	132	446	578
Fish/angler	1.6	2.1	2.0
% w/o fish	-	-	17%
		Georgetown/Horry Counties	
Anglers	5	36	41
Fish	0	143	143
Fish/angler	0	4.0	3.5
% w/o fish	-	-	27%
		Statewide Total	
Anglers	124	271	395
Fish	243	677	920
Fish/angler	2.0	2.5	2.3
% w/o fish	-	-	21%

Table 43. Private boat inland effort (angler-trips) directed at red drum and spotted seatrout by wave and area.

	Wave					
	2	3	4	5	6	Total
			Beaufort County			
Total trips	20	69	58	37	62	246
Red drum trips	2	0	14	9	19	44
S. trout trips	1	0	17	8	39	65
			Charleston County			
Total trips	73	115	180	232	134	734
Red drum trips	35	32	48	80	41	236
S. trout trips	15	39	60	72	103	289
			Georgetown/Horry Counties			
Total trips	38	59	135	110	106	448
Red drum trips	17	8	22	24	17	88
S. trout trips	4	0	4	10	23	41
			Statewide			
Total trips	131	243	373	379	302	1428
Red drum trips	54	40	84	113	77	368
S. trout trips	20	39	81	90	165	395

with wave 6 being the principal fishing period. Overall, about 28% of the trips statewide were directed at this species. The relative level of effort was highest in Charleston County and very low in the Georgetown/Horry area. Statewide during the year, about 79% of the fishermen caught at least one trout on their trip. As measured by this standard, success was highest in Charleston County and lowest in Beaufort County. The overall annual catch rate was 2.3 spotted seatrout per angler-trip. Average catch per effort was highest in the Georgetown/Horry area despite the low level of interest in this species there. Charleston County anglers were the most avid pursuers but fared the least well.

Length Composition

The total number of red drum measured was 319, including 45 from the MRFSS and 274 from state sampling. Sample sizes and mean lengths by wave and areas are shown in Table 44. Very few fish were observed in Beaufort County. There was little difference in average size between waves and areas and the overall mean statewide for the year was 42.0 cm (about 16.5 in). Fig. 1 illustrates the length distribution. About 25% of the fish were below the minimum size limit (35.6 cm or 14.0 in). The majority (52%) were between 36 and 46 cm (roughly 14 to 18 in). and about 21% were from 46-69 cm (18-27 in). Only 3% exceeded 70 cm.

A total of 605 spotted seatrout were measured (167 from the MRFSS and 438 in the SFS). Their average length was 36.6 cm (14.4 in). Sample distribution is indicated in Table 45 and length frequency composition is shown in Fig. 2. The fish averaged slightly larger during the spring season with very little difference in size between areas.

Due to identity problems, the flounder sample could not be reliably partitioned between summer and southern flounders although the latter presumably represented at least 70%. Of the total sample (N = 246), about 13% were from the MRFSS. The average size was 35.4 cm (just under 14 in) and about 3% of the fish were below the 12.0 in minimum size limit (Fig. 3).

Length distribution of Spanish mackerel is indicated in Fig. 4. About 3% fell below the 12.0 in fork length minimum size limit. About 44% of the sample was measured in the MRFSS. The king mackerel sample included 135 fish from the MRFSS and 140 from state sampling. Their length distribution is shown in Fig. 5.

Other species measured in sufficient numbers to permit reliable estimates of mean size and size distribution were sheepshead (Fig. 6) and black sea bass (Fig. 7).

DISCUSSION

Survey Logistics

MRFSS interviews were reduced by 37% in 1991 compared to the 1990 total, the second such consecutive reduction. The 1991 MRFSS sample size was 1X, the minimum NMFS quota, after several years of expanded sample sizes. MRD concluded that the relatively insignificant improvement in statistical reliability at the regional level associated with larger sample sizes was insufficient justification for the increased expense, particularly when primary

Table 44. Sample distribution and mean sizes of red drum measured in the MRFSS and SFS. Lengths are in cm.

County	Wave 2	3	4	5	6	Total
Beaufort	0	0	3	3	8	14 = N 39.9 = X̄
Charleston	19	14	21	76	29	159 = N 43.1 = X̄
Georgetown/Horry	15	15	22	31	63	146 = N 41.1 = X̄
Total	34	29	46	110	100	319
X̄	40.1	40.3	43.7	39.4	45.3	42.0

Table 45. Sample distribution and mean sizes of spotted seatrout measured in the MRFSS and SFS. Lengths are in cm.

County		Wave 2	3	4	5	6	Total
Beaufort	N	0	1	31	12	54	98
	X̄	-	-	-	-	-	35.8
Charleston	N	5	29	96	109	168	407
	X̄	-	-	-	-	-	36.9
Georgetown/Horry	N	0	0	16	35	49	100
	X̄	-	-	-	-	-	36.2
Total	N	5	30	143	156	271	605
	X̄	39.9	39.6	35.4	34.3	35.4	36.6

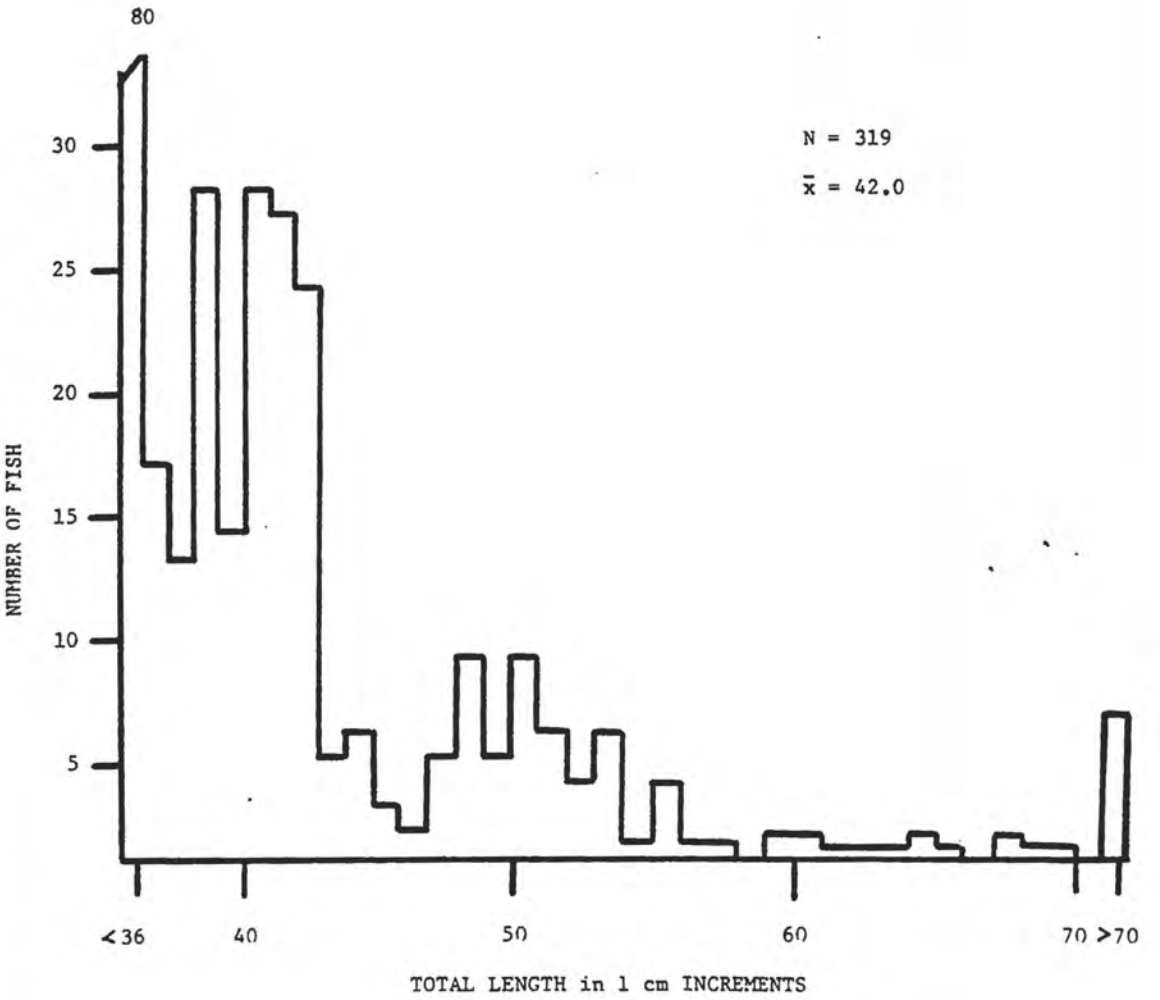

Fig. 1. Length distribution of red drum in 1991.

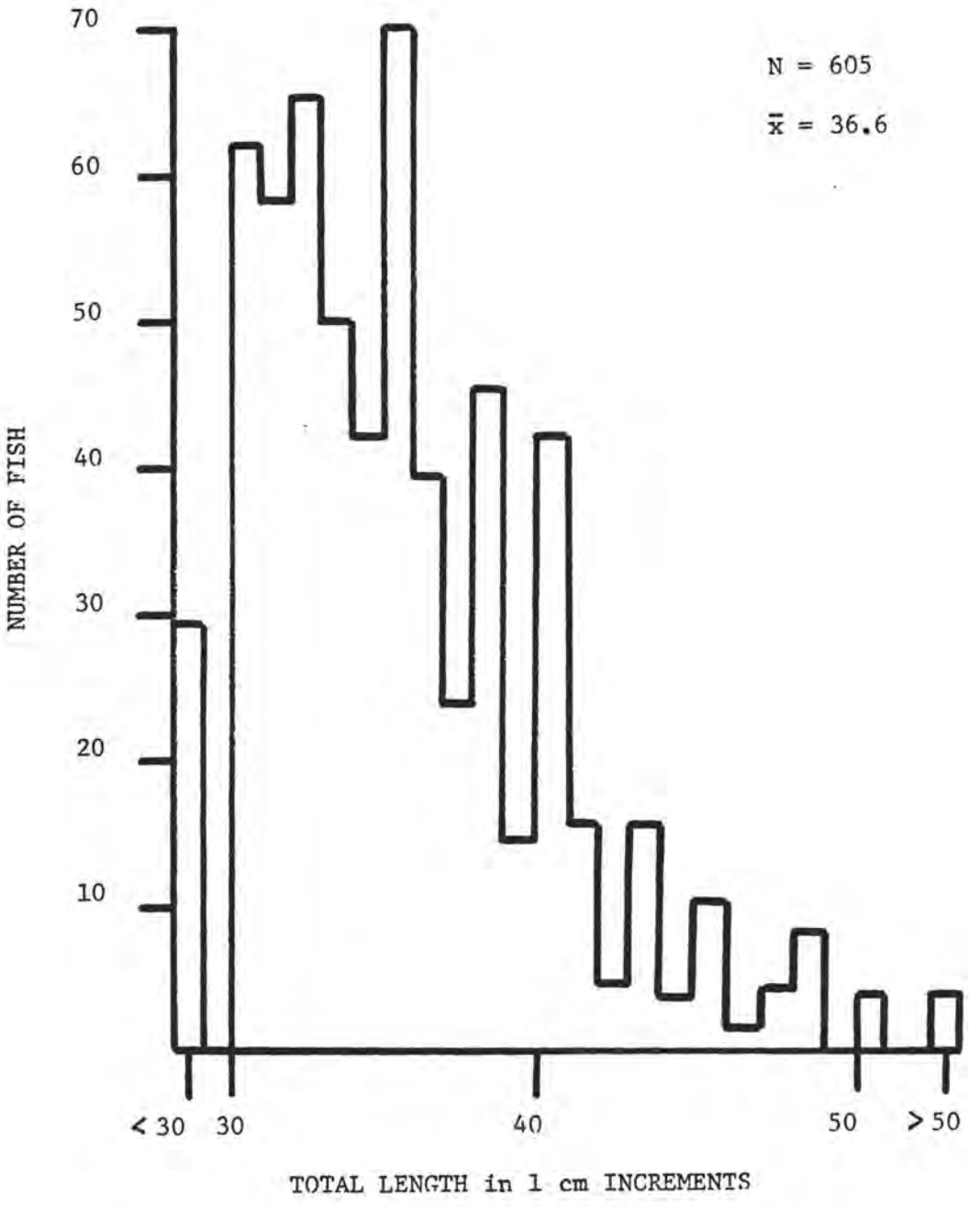

Fig. 2. Length distribution of spotted seatrout in 1991.

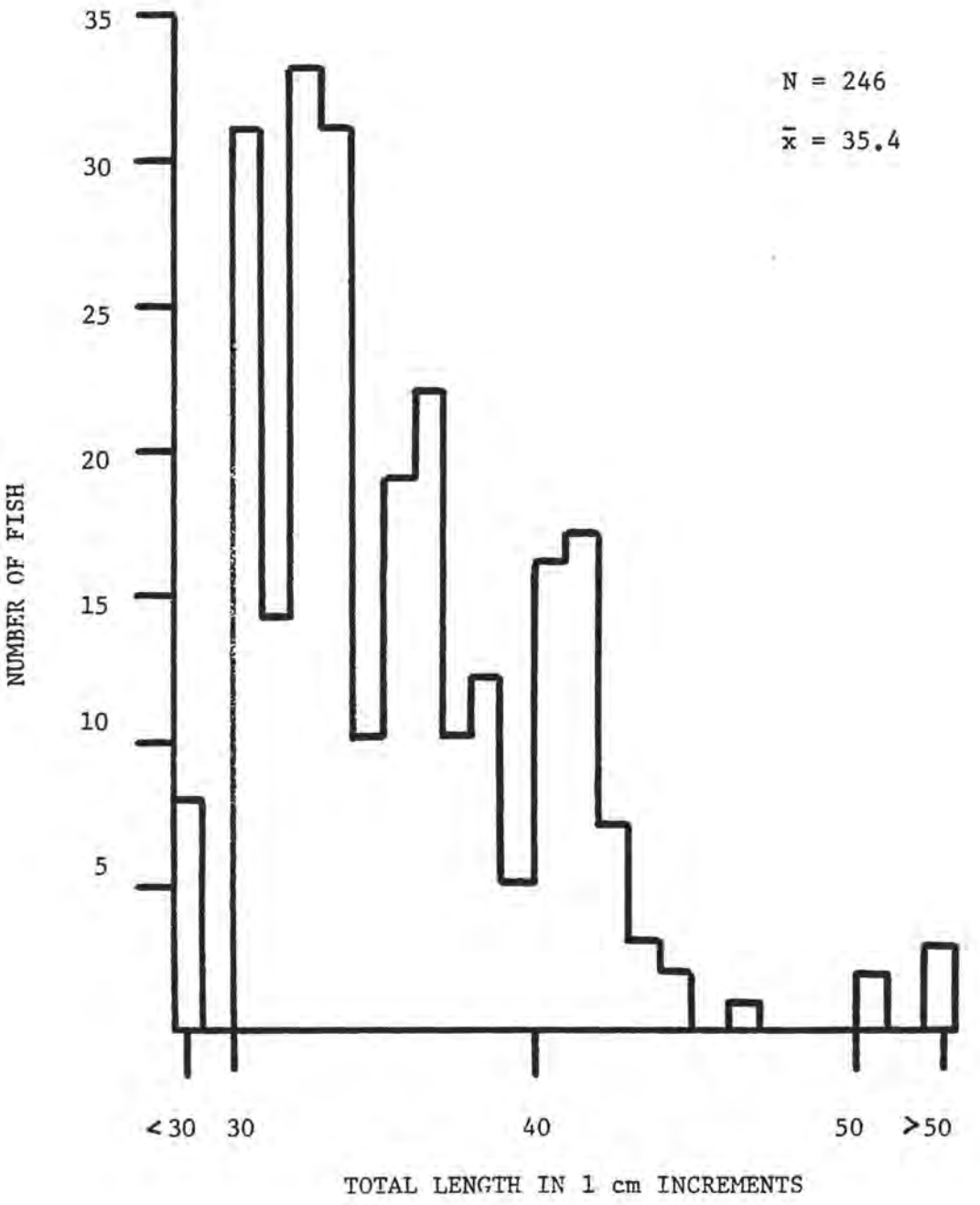

Fig. 3. Length distribution of flounders in 1991.

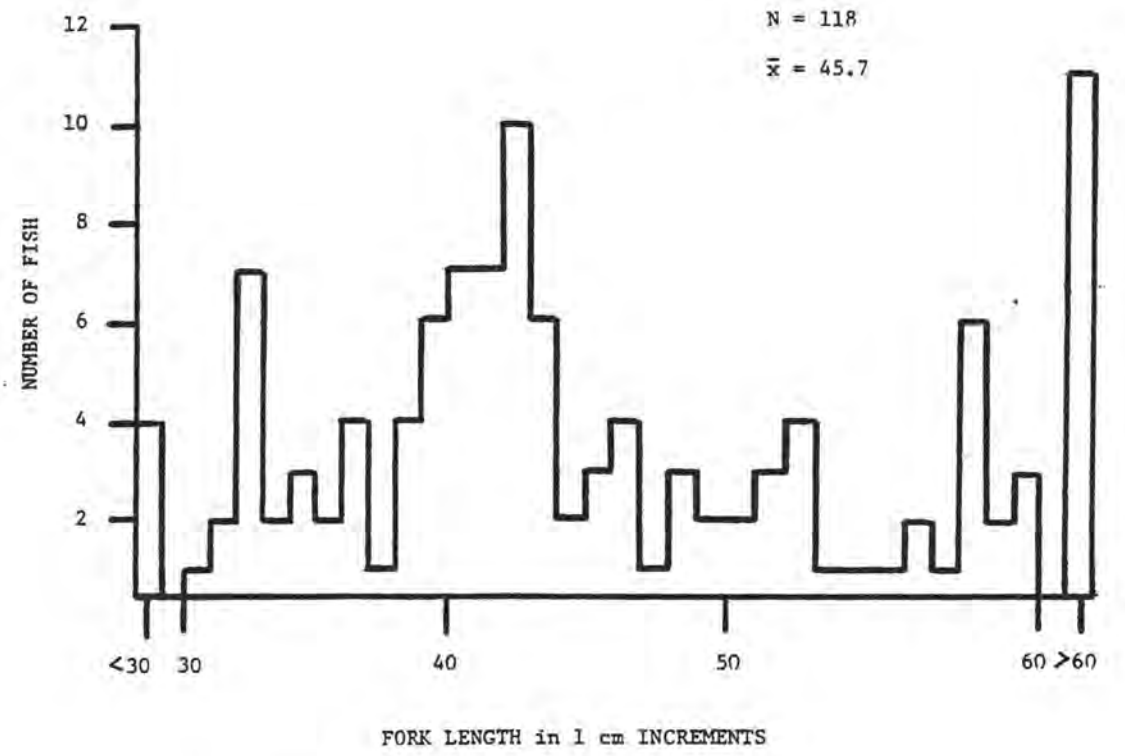

Fig. 4. Length distribution of Spanish mackerel in 1991.

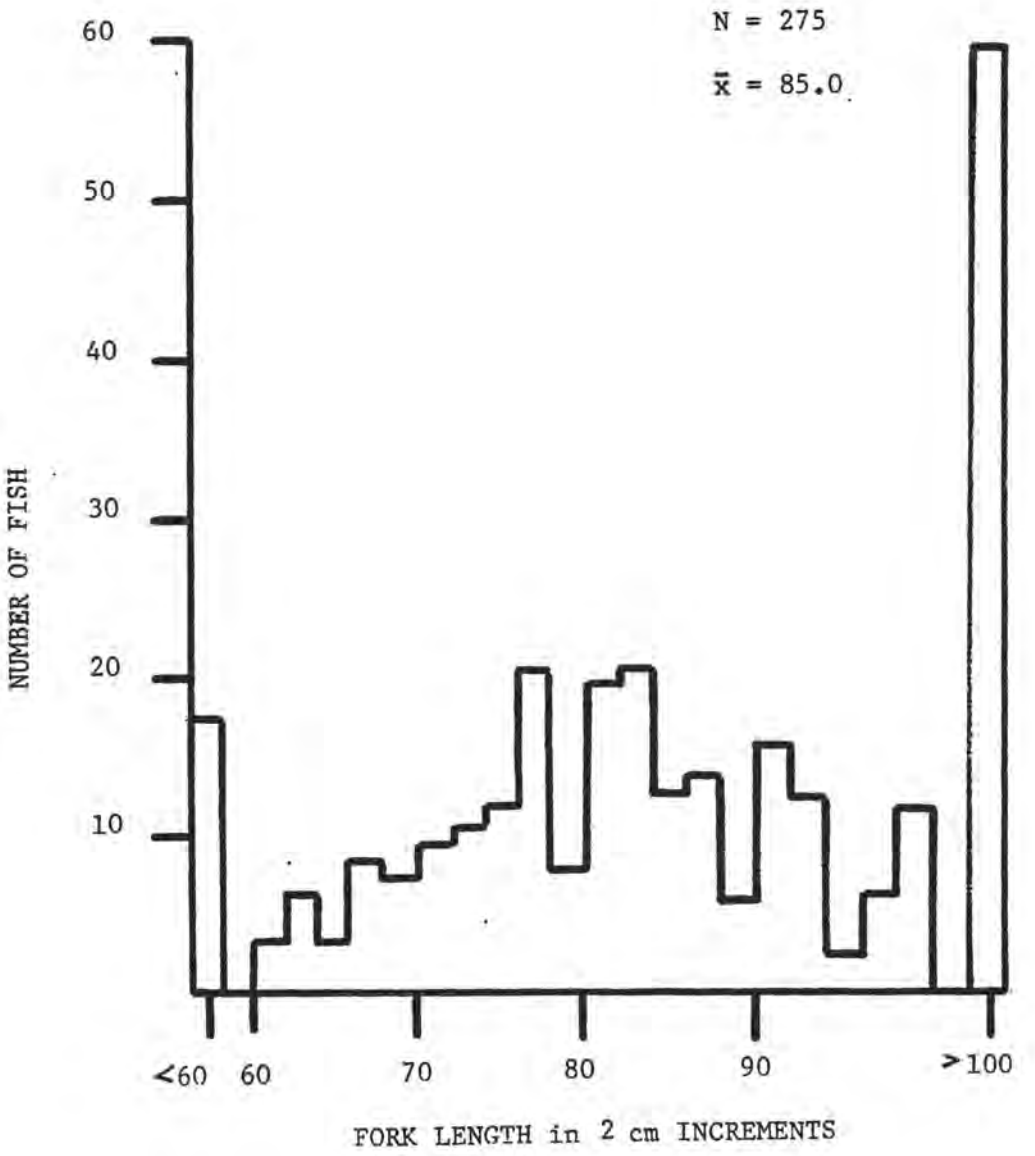

Fig. 5. Length distribution of king mackerel in 1991.

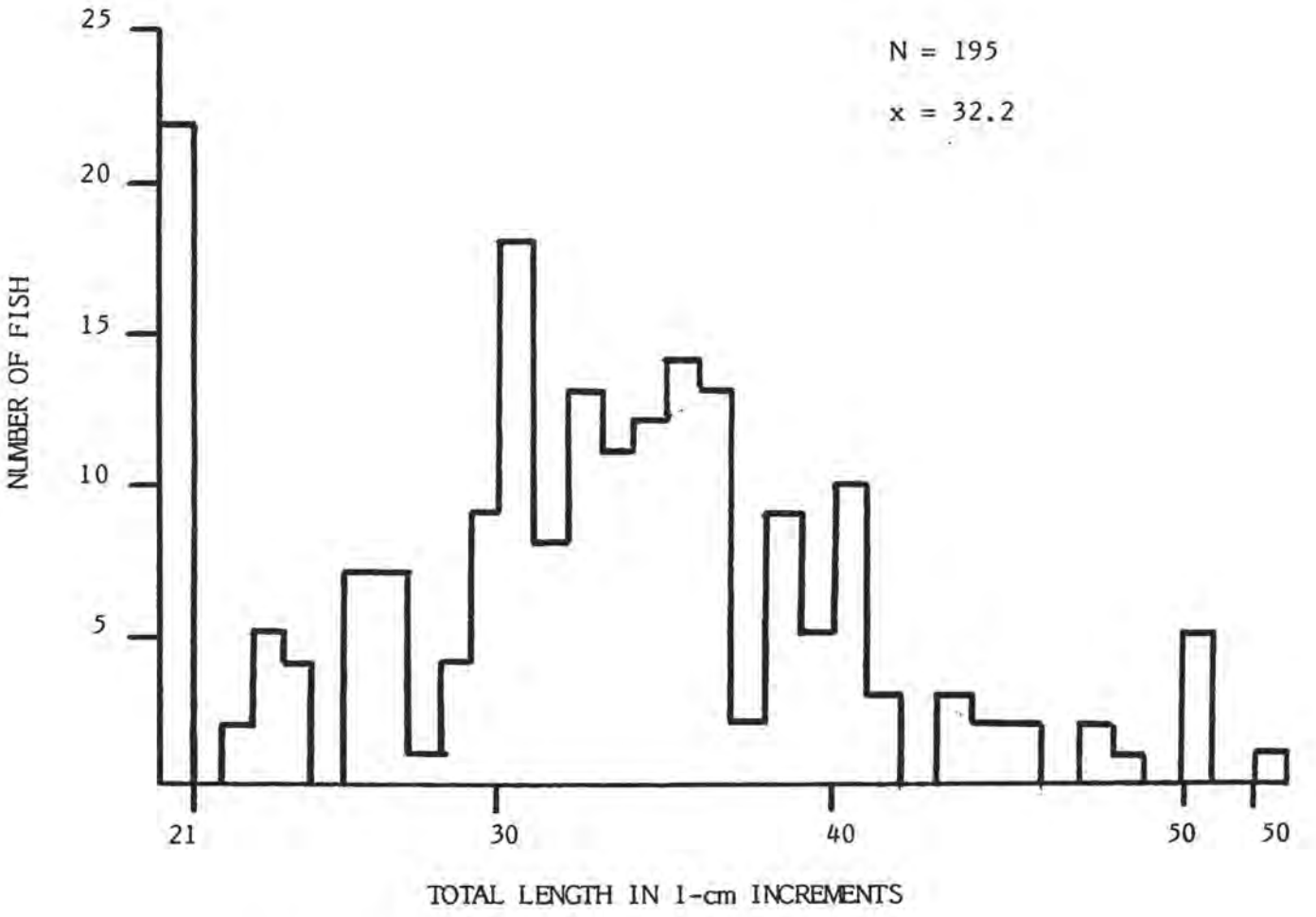

Fig. 6. Length distribution of sheepshead in 1991.

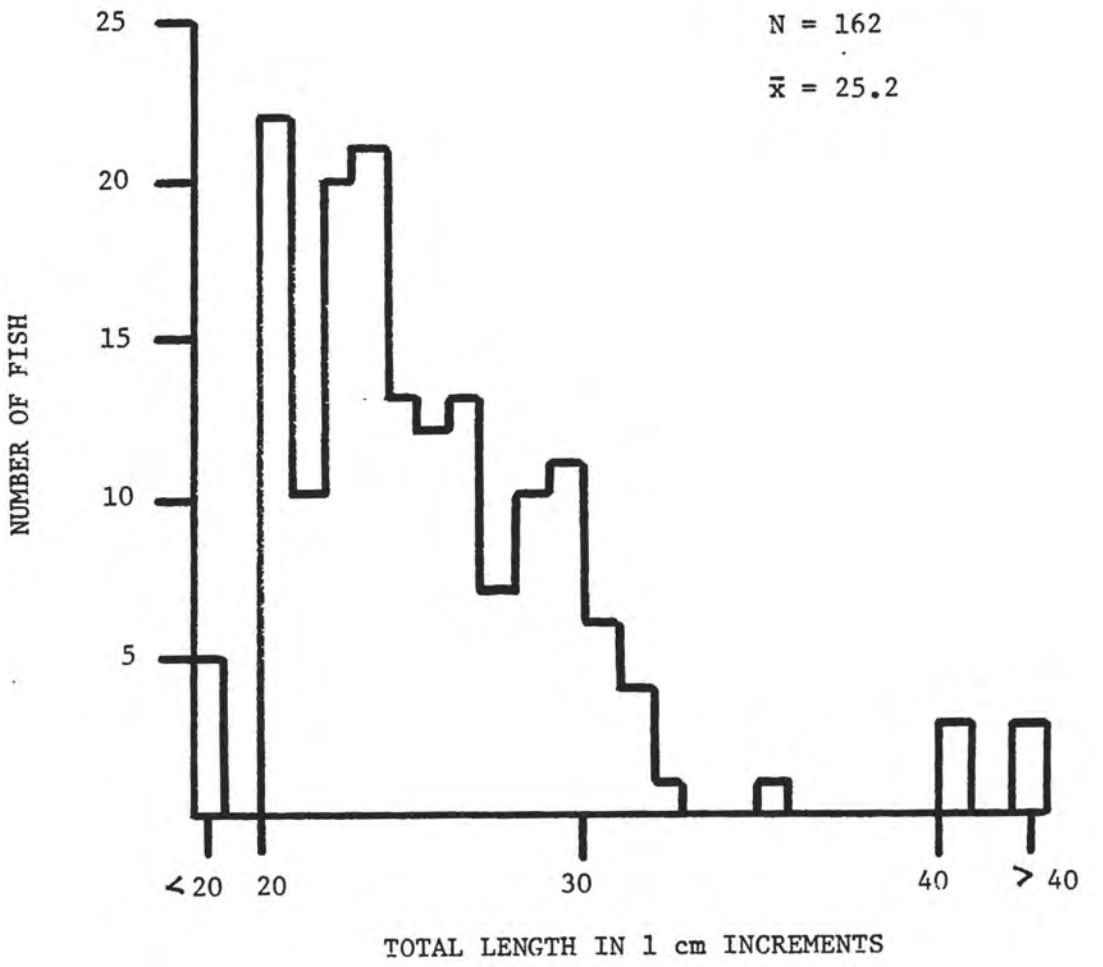

Fig. 7. Length distribution of black sea bass in 1991.

interest was at the state level. MRD's major current interest was in trends in private boat catch and effort for red drum and spotted seatrout. Enlargement of the MRFSS wave quotas did not appear to be the most effective way to expand this data base. We concluded that systematic enhancement of the creel census through supplementary state (SFS) sampling, free of MRFSS constraints, would be a more satisfactory approach.

In 1991, we expanded the SFS sample level in the private boat mode to 3.25X the 1990 level. We had hoped to distribute this effort somewhat evenly on a geographic basis but this proved impractical for several reasons, particularly during the peak fall fishing period. Due to delayed start-up of the MRFSS, we had to intensify that sampling in the fall to overcome an annual quota shortfall. This required an extensive effort in Georgetown County that resulted in increased SFS coverage there as well. We also had a prior commitment to devote a substantial portion of our discretionary (SFS) fall sampling to the Charleston area in conjunction with a red drum tagging study. Because of these considerations, the SFS private boat sampling was heavily concentrated in Charleston and Georgetown Counties, with very little representation from Beaufort County.

Considerably more effort per interview was required in the 1991 MRFSS compared to previous years, particularly in the shore and charterboat modes. The piers are the most productive source of shore interviews because large numbers of anglers are concentrated in a few easily accessed locations. The small number of piers in operation during 1991 caused more sampling effort to be expended in other locations although the percentage of interviews attributable to pier anglers remained about the same (about half of the mode total) as in previous years.

NMFS modified the sampling protocol for charterboats in 1991 and insisted on strict compliance to it. Previously, we had been allowed some flexibility in the disposition of assignments that contributed to more efficient use of field time. Most charterboats in South Carolina did not follow strict sailing schedules but rather operated on an opportunistic basis, a trait not overly compatible with the NMFS survey design. As a result, much time was spent in unproductive sampling, as reflected in the sharp increase in average effort expended by per charterboat interview.

Survey Reliability

The reduced MRFSS sample size resulted in somewhat larger standard errors associated with expanded estimates of effort, catch, and participation than in the previous few years (when sampling was as high as 3X). Given the relatively large inherent potential for error, particularly in the species catch estimates, this was of little practical significance. For species of principal concern at the state level, e.g. red drum and spotted seatrout, the additional data provided by supplemental MRD sampling offset the reduced MRFSS coverage.

A total of 200 red drum CPUE observations (i.e., individual or group trip results) were obtained from private boat inland fishermen. Of these, 30% were provided by MRFSS interviews and 70% by SFS sampling. Of the 216 spotted seatrout CPUE observations, 39%

were generated by the MRFSS and 61% by state sampling. For length frequencies, the sources of data were as follows: red drum (N = 319), MRFSS 14%, SFS 86%; spotted seatrout (N = 605), MRFSS 28%, SFS 72%; flounders (N = 246), MRFSS 13%, SFS 87%; Spanish mackerel (N = 118), MRFSS 44%, SFS 56%; king mackerel (N = 275), MRFSS 49%, SFS 51%; sheepshead (N = 195), MRFSS 18%, SFS 82%; and black sea bass (N = 162), MRFSS 30%, SFS 70%. In most instances the MRFSS data alone would have been too limited to provide reliable parameter estimates at the state level.

The CPUE estimates provided earlier were calculated as ratio-of-averages ($\Sigma X/\Sigma Y$) statistics without variances. When calculated as average-of-ratios statistics, the means are nearly the same but have associated variances which can be used to evaluate the precision of the estimates.

For red drum, the CPUE estimate for Beaufort County was not reliable due to the small sample size and very high proportion of zero (no catch) observations. Precision levels for the red drum CPUE estimators for Charleston and Georgetown/Horry Counties were comparable at about 20%, i.e., the estimated means were within ± 20% of the true means at the 95% confidence level. The relatively high percentage of zero observations was a problem; with the calculations limited to positive observations (i.e., trips during which fish were caught), the precision levels are somewhat better (in the 10-15% range). For the means and variances typically observed for red drum in the past few years, a sample of at least 500 observations would be required to obtain a precision level of ± 10%.

The only reliable estimate of CPUE for spotted seatrout was in Charleston County, where the precision level of the (average-of-ratios) mean was about ± 15% (for N = 289). In the other areas, smaller sample sizes and high incidence of no catches made the estimates quite tentative.

In contrast, the precision levels associated with length measurements were generally very good. For red drum, the means estimated for Charleston County and the Georgetown/Horry area had precisions in the ± 3-4% range. For spotted seatrout, the precisions for the estimates in all areas were less than 5%, as were the statewide estimates for most of the other species routinely measured.

Several nonstatistical considerations warrant mention. Due to confusion over identity, the flounder landings during the peak season (waves 2-4) were not accurately separated by species and the ratio of summer:southern flounder could not be determined. The latter species typically has represented nearly all of the catch in Charleston and Beaufort Counties and 70-80% of the statewide landings.

The results of the phone survey (Table 6) suggested that night fishing is a significant activity during the warmer months yet there was no night sampling. This may be an important consideration in the shore mode, since most piers are open around the clock and surf zone fishing for several important species (e.g. spotted seatrout) is generally considered to be more productive at night.

The MRFSS survey design is selective for high usage locations and times (days) of high frequency usage. As indicated, a few large and popular access points provided most of the interviews in both

surveys. Also, anglers originating from private access facilities were not intercepted in either survey, yet this group may be substantial in waves 3,4, and 5. The relationships between type of access and time of fishing with fishing success have not been assessed yet there is much speculation that fishermen using the less frequented locations and/or fishing during late evening or early morning may have substantially different catch rates for some species than the anglers most often intercepted (i.e., weekend afternoon users of heavily utilized public ramps).

Participation and Effort

Total participation in 1991 approximated the 1985-1990 (excluding 1989) average. Although participation by coastal residents was about 20% below this period's average, this was largely offset by increases in non-coastal (+7%) and out of state (+11%) participation. During the 13 years of the MRFSS, there has been very little growth in either overall participation or that in the various residential categories (Fig. 8).

The trend in total effort has closely paralleled that in effort by coastal residents (Fig. 9) and has also shown minimal growth since 1979. Although the dip in 1989/1990 ostensibly could be attributed to the hurricane and its subsequent recovery period, a detailed examination of the data by wave and residential category suggested that other unidentified factors also had a significant impact (Low et al. 1992).

Results of the phone surveys indicated that private boat fishing was the dominant angling activity (by 69% of the respondents). Most of the shore fishing was done from piers or docks. There was very little use of for-hire boats. The phone survey's findings appeared to be somewhat contrary to the intercept survey data regarding the areas fished. About 52% of the phone respondents indicated that they had fished in the ocean, whereas the intercept survey data identified inland waters as the principal fishing area.

Species Preferences

Compared to previous years, a substantially lower percentage of anglers indicated no species preference (29% in 1991 vs 41% in 1990). For the group that identified their target species, there were few changes in relative placement from other years. Red drum, spotted seatrout, and king mackerel have been the most popular species since 1987, although their rankings have varied annually. The next level has been consistently represented by flounders, spot, and Spanish mackerel. Perhaps the most significant change over the last five years has been the decline in the relative popularity of sharks (from 6th in 1988 to 9th in 1990 and 1991). This perhaps is a positive development given the growing concern about the status of shark populations.

Catches and Catch Rates

The estimated total catch in 1991, while substantially higher than that in the previous year, was well below the historical average. Species composition was somewhat different from that observed in preceding years (Table 46). Following a three-year

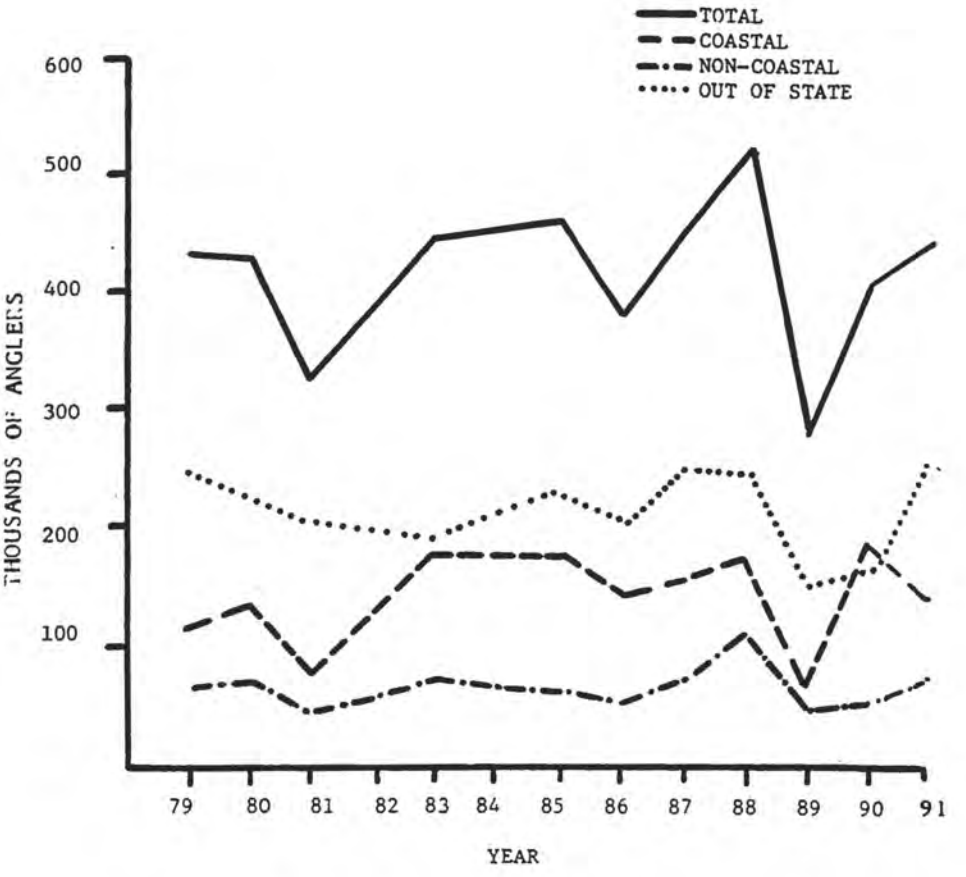

Fig. 8. Estimated participation in the South Carolina marine recreational fishery (shore, charterboat, and private boat).

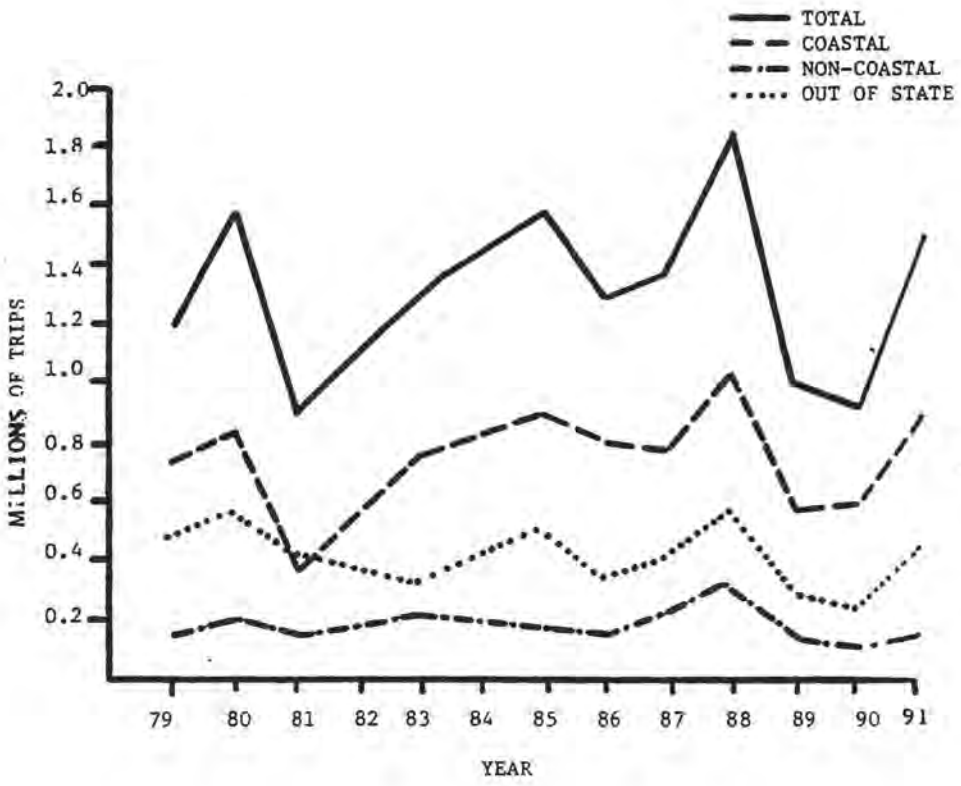

Fig. 9. Estimated effort in the South Carolina marine recreational fishery (shore, charterboat, and private boat).

Table 46. Species composition of annual landings. Values are percentages of the total number of fish landed.

Category	1987	1988	1989	1990	1991
Offshore Pelagics	<1%	<1%	<1%	1%	<1%
Offshore Bottomfish	13%	13%	13%	10%	17%
Black sea bass	11%	12%	10%	7%	15%
Coastal Pelagics	5%	6%	12%	14%	8%
King mackerel	1%	2%	2%	2%	3%
Spanish mackerel	1%	1%	4%	5%	4%
Bluefish	3%	2%	7%	6%	1%
Inshore Sportfish	17%	15%	9%	18%	24%
Red drum	8%	8%	3%	9%	5%
Spotted seatrout	7%	5%	4%	6%	12%
Flounders	2%	2%	1%	3%	5%
Inshore Bottomfish	23%	37%	36%	33%	33%
Kingfishes	7%	6%	4%	4%	7%
Spot	12%	26%	25%	7%	17%
Sheepshead	<1%	1%	1%	4%	5%
Other					
Sharks	6%	2%	2%	3%	7%
Miscellaneous	34%	24%	24%	21%	12%

sharp decline, black sea bass landings rebounded strongly. Bluefish landings dropped precipitously. Inshore sportfish made up nearly one-fourth of the total catch due to strong showings by spotted seatrout and flounders, for which catches were the best since 1987. Landings of spot, although low compared to historic levels, were up substantially from 1990. The sheepshead catch nearly doubled. In relative terms, the contribution of miscellaneous species was the lowest in recent years with pinfish conspicuously absent.

Shore fishing was little changed from 1990 in terms of species sought and fishing success. Perhaps the most notable features were the increased pier footage available for anglers and higher landings of spot. The overall catch rate (1.50 fish per angler) was slightly higher than in 1990.

Charterboat fishermen fared appreciably better in 1991 than in the previous year with both the percentage of successful anglers and catch rate substantially higher in all areas. Area preferences remained similar. Statewide, king mackerel continued to be the most important species in the fishery. Success for this species was considerably better in 1991, presumably reflecting the healthy status of the stock. The daily bag limit was increased from three fish to five on September 4, although this appeared to have relatively little effect on the landings. The overall charterboat catch rate (1.56 kings per angler) was more than double the 1990 index (0.63) with a far higher percentage (75%) of successful anglers (44% in 1990).

The percentage of charterboat fishermen using artificial reefs in 1991 was somewhat lower (14% vs 21% in 1990). Reef fishing continued to be most popular in Beaufort County. Spanish mackerel was the most numerous pelagic species caught while black sea bass dominated the overall reef catch. Reef users caught relatively few king mackerel and their hourly catch rate of this species was less than half of the nonreef group.

Relatively few private boat fishermen went offshore. Those that did preferred the king mackerel and other pelagic species as targets and were rather successful. Compared to 1990, when 46% of the offshore anglers interviewed had used artificial reefs, reef fishing was less popular (only 22% of the fishermen interviewed in 1991 reported using them). As in the previous year, the reefs were most popular with Beaufort County anglers and utilized by few Charleston County fishermen. Black sea bass was the most numerous catch. Approximately equal percentages of reef and nonreef users caught no fish. The reef fishermen caught more fish per trip overall but fewer king mackerel.

Private boat fishermen fishing in the nearshore ocean area concentrated their effort around jetties targeting sheepshead, king mackerel, red drum, and flounders. They were not overly successful compared to the anglers fishing in other areas.

As in previous years, private boat anglers in estuarine waters were primarily seeking spotted seatrout and/or red drum, although flounders were popular targets in the northern counties in summer. Spot and spotted seatrout were the most abundant components of their catches. Fishermen in Georgetown and Horry Counties were the most successful in terms of the average number of fish caught overall and the numbers of flounders landed. Anglers fishing for red drum did

not do as well in 1991 as in 1990 while those targeting spotted seatrout fared considerably better (Table 47). The mild winter probably contributed to the apparent abundance of spotted seatrout throughout the coastal area.

Length Composition

Average sizes of most important species were slightly smaller in 1991 compared to 1990's benchmarks. The notable exceptions were mackerels, particularly king mackerel. For several years, the average fork length of this species had been about 76 cm. In 1991, it increased to 85 cm due to a strong showing of large fish.In 1990, about 3% of the measured catch exceeded 100 cm whereas 21% of the 1991 fish did. Spanish mackerel in 1991 averaged nearly 46 cm compared to 42 cm in the previous year.

The mean size of red drum statewide was 42.0 cm vs 45.7 cm in 1990. Perhaps the most notable aspect was the high incidence of undersized fish. Following the imposition of the year round size limit in 1990, about 10% of the fish were undersized. During 1991, nearly 25% of the inspected catch was below the legal minimum. The reported release rate, due presumably to small size, was 43% in 1991 compared to 46% in the previous year. Had these undersized fish been released as well, the overall percentage of red drum caught and released would have substantially exceeded that of the fish retained. Inclusion of the undersized fish in the length sample accounted for much of the reduction in overall mean size.

About 77% of the 1991 red drum catch (retained) was below the 18.0 in (45.7 cm) minimum size limit that has been proposed by the Atlantic States Marine Fisheries Commission. As in 1990, very few fish above the size of first maturity were observed.

The mean size of spotted seatrout (36.6 cm) was slightly lower than in 1990 and identical to that in 1988. There has been very little variation in the annual averages since the surveys were initiated, a trend observed in other southeastern states as well. A substantially lower percentage (11%) of the 1991 catch was released compared to recent years (e.g. 23% in 1990). About 5% of the observed 1991 fish were undersized compared to 2% or less in previous years. Several states in the southeast have a 14.0 in (35.6 cm) minimum size for this species. About 62% of the 1991 catch were below this standard.

Compliance with the new minimum size limit on flounders appeared to be very good with only a 3% incidence of undersized fish. Despite the impact of the size limit on landings, the flounder catch was the largest since 1986. Average size was nearly the same as in 1990.

Management Considerations

One of the principal management concerns has been the tag recapture reporting rate, particularly for red drum. Several studies in other states have indicated that as much as 50% of the tagged fish caught are not reported to the appropriate agencies. This results in substantial underestimation of fishing mortality rates when stock assessments are conducted.

We addressed this aspect in the 1991 SFS by asking fishermen if they had caught any tagged red drum this (calendar) year. If they

Table 47. Fishing success parameters for red drum and spotted seatrout.

Parameter	Area	1990	1991
	Red Drum		
Anglers with no catch	Beaufort County	57%	64%
	Charleston County	58%	39%
	Georgetown/Horry Counties	28%	20%
Fish per angler	Beaufort County	2.06	0.89
	Charleston County	1.15	0.91
	Georgetown /Horry Counties	1.64	1.55
	Spotted Seatrout		
Anglers with no catch	Beaufort County	45%	34%
	Charleston County	48%	17%
	Georgetown/Horry Counties	57%	27%
Fish per angler	Beaufort County	1.00	3.06
	Charleston County	1.65	2.00
	Georgetown/Horry Counties	0.46	3.49

gave a positive response, they were then asked if they had reported none, some, or all of the tag recoveries to MRD. Tabulation of results was limited to inland anglers and those fishing around jetties. Charterboat anglers, shore fishermen, offshore private boat fishermen, and private boat anglers in the nearshore ocean zone who were fishing for mackerels or other oceanic species were not included.

The following summarizes the survey results. Most recent recovery rates

County	No. respondents	No tags	Yes/none	Yes/some	Yes/all
Beaufort	42	42	0	0	0
Charleston	266	233	5	0	28
Georgetown/ Horry	195	174	0	3	18
Total	503	449	5	3	46

County	% catching tagged fish	% reporting all tags
Beaufort	0	0
Charleston	12.4	84.8
Georgetown/Horry	10.8	85.7
Total	10.7	85.2

of tagged red drum have ranged from 16-20% in open estuarine systems. Returns from the public tagging program have generally been slightly lower than those from MRD-conducted studies. Most of the latter have offered rewards under various systems (e.g. lottery, scaled paybacks, flat rate, etc.) while the public program has not. A 1991 MRD study found no unidirectional trend in reporting rates as a function of the amount or type of reward offered. Return rates in various reward categories ranged from 12% (no reward) to 23%, with 14-17% reported in most categories.

The SFS results suggested that relatively few anglers were likely to catch a tagged red drum during the year. It appeared that the vast majority of those who did reported all of their tag recoveries. Only about 1% of the total angling population most likely to have caught red drum reported catching tagged fish but not reporting any of them. This suggests that the nonreporting rate for tagged fish in South Carolina is probably rather low, at least far less than the 50% level reported elsewhere.

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