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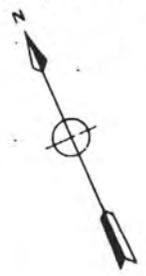
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SOUTH CAROLINA MARINE RECREATIONAL FISHERY SURVEY, 1992

South Carolina

34°

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CHARLESTON

Marine Resources Division  
Office of Fisheries Management  
Data Report Number 16

November, 1993

32°

SAVANNAH

Georgia

32°

BRUNSWICK

JACKSONVILLE

Florida

ST. AUGUSTINE

DAYTONA BEACH

30°

82°

80°

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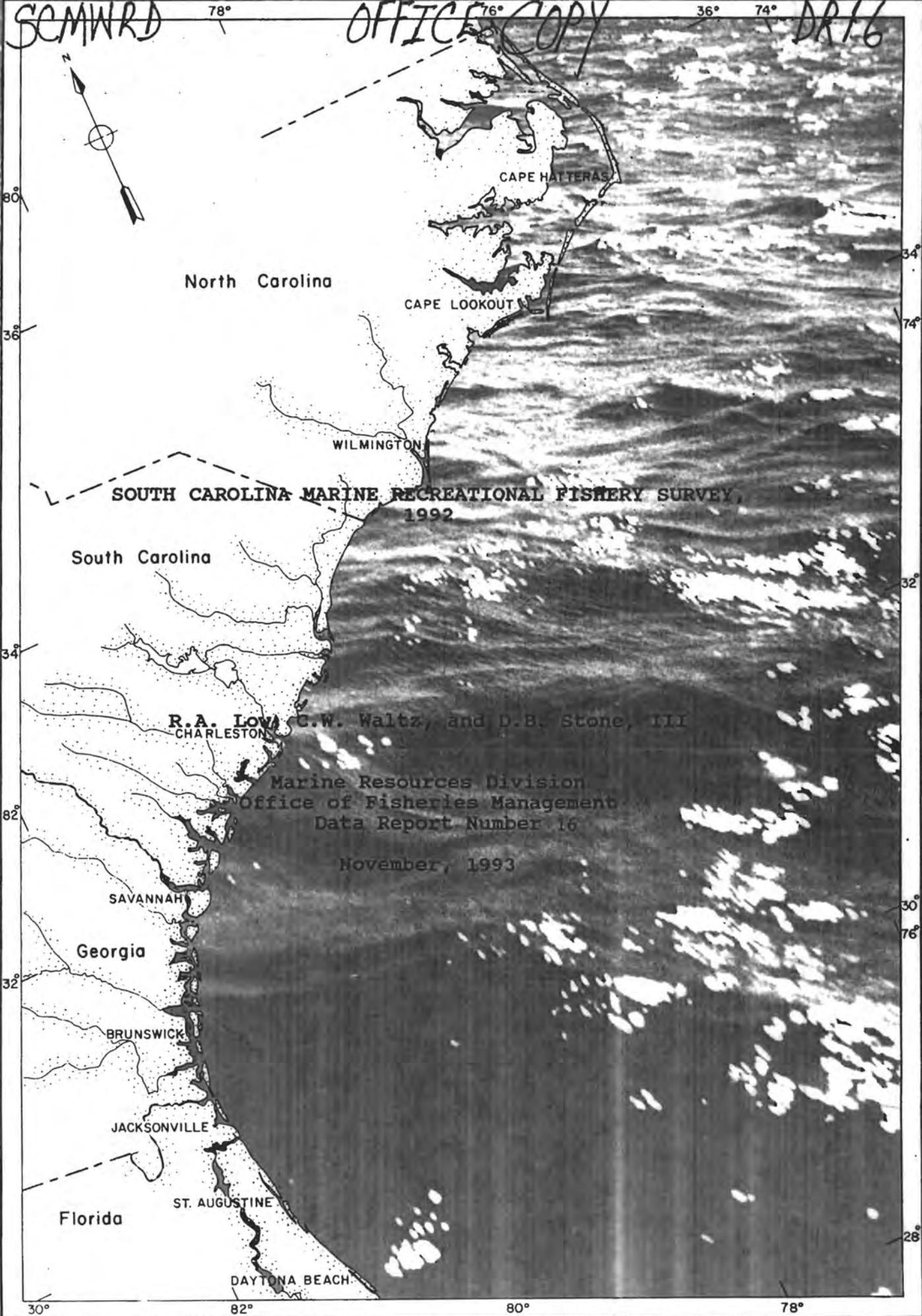
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## ACKNOWLEDGMENTS

Billy Glenn, Harvey Atwater, Robert Wiggers, and Pam Roy endured many tedious hours of interviewing fishermen and completing paperwork. We appreciate the constructive review of C.A. Barans. Joanna Walling typed the text and tables. We recognize the assistance of the staffs at KCA Research, Inc., CIC Research, Inc., and the Washington D.C. office of the National Marine Fisheries Service, Statistics Division in various aspects of the project. This project was conducted in cooperation with the Department of the Interior, U.S. Fish and Wildlife Service and funded in part (75% of total costs) by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777 K).

## PREFACE

In 1993, the National Marine Fisheries Service (NMFS) implemented several new procedures for processing effort data obtained in the phone survey of the MRFSS. These included 1) different guidelines for treatment of proxy data, 2) imputation for missing data, and 3) weighing county fishing effort data for county population size. The resulting effort data are more accurate statistically than those derived previously. The NMFS subsequently revised their original 1992 effort and catch estimates. The effects of steps 1 and 2 were to increase effort estimates and the catch estimates derived from them. The effects of step 3 were greatest in states where coastal counties vary greatly in population size and the most populated counties have either the lowest or the highest mean household fishing rates. The actual percentage changes in trip and catch estimates between the old and new methods vary by wave and mode with no consistent trends.

This information was received well after preparation of this report. Because the revised figures differ substantially from the original ones in many cases, it would have been necessary to regenerate most of the tables from the new files and substantially rewrite many sections of the associated text. Because of the differences in methodology, the new data would not be comparable to those from previous years, therefore detracting from the validity of between-years comparisons, trend line analysis, etc. The already long delayed date of distribution would have been extended even further, detracting from the time value of the information. The most practical approach therefore appeared to be distribution of this report as originally prepared (i.e., with the "old" data) while the revision of historical data files continues.

## 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 South Carolina's 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 (those within 25 to 50 miles of the coast, depending on season) is conducted by a NMFS contractor (CIC Research, Inc. in 1992) to obtain information on participation and effort. An on-site intercept survey (creel census) is employed to collect catch, effort, and demographic data. This task also is performed by a contractor (KCA Research, Inc. in 1992), which subcontracts the field work to the MRD. Fishermen interviewed include those fishing from shore or man-made shore facilities (e.g. docks, bridges, and piers), charterboats, and private boats. Headboat fishermen are not interviewed because their catch and effort data are submitted to the NMFS under mandatory reporting requirements effective in January, 1992. Fishermen using gear other than hook and line are seldom encountered during the MRFSS sampling and the results therefore do not pertain to such activities as gill netting, gigging, and spearfishing by divers.

Beginning in July, 1992, private boat fishermen were required by state law to possess a marine fishing stamp for the harvest of fish and shellfish. Fishermen on piers, charterboats, and headboats were exempt from this requirement, although the operators of these platforms were required to obtain permits and submit monthly reports on their fishing activities. Pier operators were required to report the number of anglers using their sites daily. Headboats were obligated to submit a copy of their NMFS report of daily numbers of anglers and fish caught to the MRD. A similar report was also mandatory for charterboat operators. Because these requirements took effect midway through the fishing year, information from these sources has not been included in this year's report and the discussion on charterboats is limited to information from the MRFSS except where otherwise noted.

Additional catch and effort data for the private boat mode were collected in a State Finfish Survey (SFS) using procedures similar to those of the MRFSS. During 1992, most of this effort was directed toward fishermen fishing in estuarine areas with red drum and spotted seatrout as their primary targets.

## METHODOLOGY

MRFSS procedures for the telephone and intercept surveys were described by Essig et al. (1991) and Van Voorhees et al. (1992). Fundamental procedures have remained the same since 1987 although

there have been minor modifications to the annual questionnaires. FSP staff conducted the 1992 MRFSS at 19 sites utilized by shore-based anglers, 9 charterboat docks, and 21 public boat ramps or landings (Table 1). The sampling schedule, provided by KCA Research, Inc., was based on historical usage patterns by fishing mode (shore, charterboat, and 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.

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 until the day's MRFSS interview quota (30) was obtained or further effort appeared unwarranted. SFS sampling followed similar procedures except that the site assignments were determined by the FSP. 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 (1992), 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, particularly 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 information on the capture and reporting 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 fish) could not be verified.

FSP staff coded, edited, and forwarded MRFSS interview forms to KCA for further processing. KCA then provided summaries of the wave intercept survey data and CIC Research furnished compilations of information from the phone survey. The NMFS provided preliminary wave estimates of participation and the number of trips (effort) by coastal residents, non-coastal residents, and out of state

Table 1. Distribution of 1992 MRFSS interviews by site and wave.

County	Mode	Site	Wave					Total	
			2	3	4	5	6		
Beaufort	Shore/private boat	Broad River	12	108	38	15	0	173	
		C.C. Haigh	26	11	5	4	0	46	
		Hunting Is. Park	0	11	11	28	67	117	
	Charterboat	Harbor Town	5	12	11	2	3	33	
		Shelter Cove	14	21	5	26	7	73	
		Shelling's Dock	0	4	0	1	4	9	
	Private boat	E.C. Glenn	2	37	49	2	5	95	
		Station Creek	0	0	4	0	8	12	
		Port Royal	0	0	0	0	13	13	
		Sam's Point	0	0	0	0	3	3	
	Charleston	Shore	Breach Inlet	5	16	17	6	0	44
			Crosby's Pier	5	8	12	5	16	46
Church Creek			1	0	0	0	0	1	
Chas. Battery			0	1	0	0	0	1	
Capt. Sam's			0	0	0	0	7	7	
Pitt St. bridge			0	0	0	2	0	2	
Shore/private boat		Limehouse	20	16	24	17	72	149	
		Remleys Point	6	0	32	27	30	95	
Charterboat		Bohicket Marina	8	17	6	14	9	54	
		Toler's Cove	0	9	0	0	0	9	
		Wild Dunes	0	0	0	0	4	4	
		City Marina	0	0	0	0	2	2	
Private boat		Folly River	0	0	3	25	28	56	
		Sol Legere	0	19	14	8	8	49	
		Cherry Point	0	0	0	0	17	17	
		Wappoo bridge ramp	14	19	65	21	12	131	
		Live Oak	0	0	7	1	0	8	
		R.E. Ashley	0	0	0	10	0	10	
		Shem Creek	0	0	0	5	0	5	
		Toogoodoo	2	0	5	0	0	7	
Georgetown	Shore	Pawley's Island	0	0	0	4	0	4	
		Huntington Beach	2	2	4	4	0	12	
	Charterboat/Private boat	Capt. Dick's	58	33	79	60	24	254	
		Voyager's View	0	10	10	3	0	23	
	Private boat	Boulevard	0	0	13	30	12	55	
		Murrells Inlet	72	126	74	73	59	404	
	South Island	3	10	7	0	29	49		
Horry	Shore	Cherry Grove Pier	4	7	8	0	5	24	
		Springmaid Pier	36	31	12	27	15	121	
		Surfside Pier	10	75	34	62	7	188	
		Garden City Pier	0	0	0	17	30	47	
		Myrtle Beach Park	0	0	43	0	0	43	
		Garden City Beach	3	0	0	0	0	3	
	Private boat	Cherry Grove	0	8	9	0	0	17	

Table 2. Distribution of 1992 SFS interviews by site and wave. All interviews were conducted in the private boat mode.

County	Site	Wave					Total	
		1	2	3	4	5		6
Beaufort	Broad River	2	0	24	5	0	0	31
	E.C. Glenn	0	7	0	0	1	0	8
	Port Royal	0	2	0	0	0	15	17
	C.C. Haigh	0	0	3	0	1	0	4
	Station Creek	0	0	0	0	2	29	31
	Sam's Point	0	0	0	0	2	13	15
	Pigeon Point	0	0	0	0	0	9	9
	Edding's Point	0	0	0	0	1	4	5
	Fripp Island	0	0	0	0	0	4	4
	All Joy	0	0	0	0	1	0	1
	Gray's Hill	0	0	0	0	0	2	2
	Bush Island	0	0	0	0	0	1	1
	Russ Point	0	0	0	0	0	7	7
	Lady's Island	0	0	0	0	0	1	1
Charleston	Remleys Point	5	9	8	8	14	109	153
	Mappoo Bridge Ramp	10	7	8	0	1	8	34
	Detco's	3	0	0	0	1	13	17
	Folly River	1	0	0	0	6	10	17
	Sol Legare	2	3	0	3	11	23	42
	Paradise Island	1	0	0	0	1	0	2
	City Marina	0	1	0	0	0	0	1
	Toler's Cove	0	4	0	0	0	0	4
	Shem Creek	0	3	0	0	0	1	4
	R.E. Ashley	0	0	0	0	7	17	24
	Dashoo River	0	0	0	0	1	0	1
	Steamboat	0	0	0	0	1	0	1
	Limehouse	0	0	0	0	7	31	38
	Folly Marina	0	0	0	0	0	2	2
	Wild Dunes	0	0	0	0	0	20	20
Georgetown	Murrells Inlet	3	16	15	24	5	5	68
	South Island	1	4	0	8	11	21	45
	Boulevard	4	0	0	7	6	1	18

fishermen. The NMFS also supplied estimates of the total numbers of fish caught by species and wave based on expansions of creel census catch rates and 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 effects of data adjustments. Most of these applied to the South Carolina survey results and are mentioned where appropriate.

### Survey Logistics

The telephone survey obtained complete interviews from 6,803 households during waves 2-6. In the MRFSS creel census 2,515 interviews were submitted to KCA (Table 1). KCA accepted 2,507, distributed by fishing area, wave, and mode as shown in Table 3. About 18% of the interviews were with charterboat fishermen, 27% were accounted for by shore anglers, and 55% were obtained from private boat fishermen. Nearly 62% of the shore interviews were obtained in Horry County with Grand Strand pier anglers representing 56% of the entire mode sample. Most of the charterboat interviews were obtained in Murrells Inlet. Murrells Inlet was also the location of 29% of the private boat interviews with most of the rest coming from only one or two sites in each county.

Shore MRFSS interviews required an average of 0.42 hours of survey effort per interview, charterboat interviews 0.44 hours, and private boat interviews also 0.44 hours. In each mode, the average effort per interview was somewhat lower than in the past two years, when the sample sizes were appreciably smaller.

Most of the 627 private boat interviews obtained in the SFS were group interviews. About 57% were obtained in Charleston County, with the remainder about equally divided between Beaufort and Georgetown Counties.

### Participation

About 7.5% of the coastal households contacted during the phone survey contained a member who had gone salt water sport fishing during that wave (i.e., in the last two months). At least one person had gone salt water fishing during the past year in 18.6% of all households contacted. Table 4 lists the positive response rates per wave compared with those during the previous five years. The average numbers of fishermen for all households interviewed are also shown.

Coastal residents (C) comprised the majority of the anglers interviewed in the MRFSS creel census (Table 5). Coastal residents represented 52% of the shore fishermen interviewed, while non-coastal South Carolina residents (NC) and out of state anglers (OOS)

Table 3. Distribution of MRFSS creel census interviews by area, mode, and wave. Source: KCA final wave reports.

Area	Wave	Mode		
		Shore	Charterboat	Private boat
Inland	2	40	7	110
	3	45	8	292
	4	39	4	288
	5	19	4	216
	6	87	10	296
Ocean <3 mi.	2	55	0	3
	3	116	4	15
	4	101	0	10
	5	120	19	13
	6	56	0	0
Ocean >3 mi.	2	0	76	15
	3	0	93	33
	4	0	99	60
	5	0	73	35
	6	0	42	4

Table 4. Percentage of coastal households contacted during the MRFSS phone survey that contained a member who went salt water fishing during the indicated two-month interval (i.e., wave). Source: CIC Research, Inc.

Year	MAR-APR	MAY-JUN	JUL-AUG	SEP-OCT	NOV-DEC
1992	6.9	7.3	8.1	8.7	5.3
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
Average fishermen per households interviewed					
1992	0.102	0.114	0.124	0.090	0.155
1991	0.092	0.145	0.152	0.135	0.121
1990	0.103	0.081	0.118	0.095	0.079

Table 5. MRFSS creel census interviews by residence, in numbers of anglers interviewed. Source: KCA final wave reports.

Wave	Shore			Charterboat			Private boat		
	C	NC	OOS	C	NC	OOS	C	NC	OOS
2	45	11	39	4	10	69	78	14	36
3	82	27	52	15	23	67	204	79	57
4	55	26	59	4	15	84	271	35	52
5	82	11	46	9	23	64	223	25	16
6	88	42	13	3	12	37	262	25	13
Total	352	117	209	35	83	321	1038	178	174

comprised 17% and 31% respectively. Most of the out of state fishermen were intercepted on the Grand Strand piers. Out of state residents accounted for 73% of the charterboat fishermen, whereas coastal residents were only 8% of this group. Non-coastal residents represented the remaining 19%. Three-quarters of the participants interviewed in the private boat mode were residents of coastal South Carolina. State non-coastal residents contributed 13% and out of state fishermen 12%.

During July through December, 1992, approximately 68,000 marine fishing stamps were issued to anglers, all of whom were presumably private boat fishermen. Charterboat permits were acquired by 113 vessels (excluding headboats) and ten piers obtained permits.

Total participation was estimated at 315,000 fishermen. Out of state anglers (N = 178,000) were the largest group (57%). Coastal residents (81,000) represented 26% and the remaining 17% (N = 57,000) consisted of non-coastal residents.

### Effort

Total effort was estimated at 1.216 M trips, distributed by wave, mode, and residential category as shown in Table 6. The majority of the trips (54%) were attributed to private boat fishermen with shore effort accounting for 41% of the total. Charterboat trips constituted the remaining 5%. The distribution of trips as determined from the phone survey was as indicated in Table 7. Of the 3,241 trips representing the sample population, 35% were reportedly in the shore mode and 62% in the private boat mode. Charterboat trips represented about 2% and headboat trips less than 1%.

The distribution by residency and mode of anglers interviewed in the creel census was the basis for effort extrapolations, thus the distribution of trips by mode and residency category was closely comparable to it. Coastal residents accounted for 61% of all effort, out of state anglers made 25% of the trips, and non-coastal residents contributed 14%. Within the shore mode, 50% of the trips were made by coastal residents. Out of state anglers contributed 34% and non-coastal residents made the remaining 16%. The vast majority (74%) of the charterboat trips were made by out of state fishermen. Non-coastal residents made 17% and coastal residents only 9%. In contrast, coastal residents contributed 73% of the private boat effort, non-coastal residents 13%, and out of state anglers 14%.

The distribution of trips by fishing mode and area is shown in Table 8. About 59% of all trips made occurred in inland waters, 31% were in coastal ocean waters, and 10% were in the Federal Conservation Zone (FCZ). Nearly 70% of the shore effort were ocean (i.e. pier or surf) trips and 30% occurred inland. About 89% of the charterboat trips were made in the FCZ and 4% in coastal ocean waters, with 7% directed at inland areas. The vast majority (86%) of the private boat trips occurred inland with only 3% to the

Table 6. Estimated trips in the South Carolina marine recreational fishery (finfish only, excluding headboats) in 1992. Source: NMFS.

Wave	Mode	Residency			Total
		Coastal	Non-coastal	Out of state	
2	Shore	26,128	6,387	22,645	55,160
	Charterboat	1,567	2,733	17,039	21,339
	Private boat	59,626	10,702	27,520	97,848
3	Shore	60,929	20,062	38,638	119,629
	Charterboat	1,029	1,578	4,597	7,204
	Private boat	97,831	37,885	27,335	163,051
4	Shore	65,538	30,982	70,305	166,825
	Charterboat	1,698	2,303	11,482	15,483
	Private boat	117,331	15,153	22,514	154,998
5	Shore	64,307	8,627	36,074	109,008
	Charterboat	895	2,287	6,365	9,547
	Private boat	122,944	13,783	8,821	145,548
6	Shore	32,033	15,288	4,732	52,053
	Charterboat	142	570	1,756	2,468
	Private boat	83,734	7,990	4,155	95,879
Annual	All	735,732	176,330	303,978	1,216,040

Table 7. Distribution of trips by mode (from phone survey). Source: CIC Research, Inc.

Type of fishing	MAR-APR	MAY-JUN	JUL-AUG	SEP-OCT	NOV-DEC
Total trips	321	921	833	831	335
Shore trips	78	387	254	327	85
Headboat trips	4	6	7	3	1
Charterboat trips	15	6	46	0	0
Private boat trips	224	522	526	501	249

Table 8. Estimated trips (excluding headboat effort) by fishing mode and area. Source: NMFS.

Mode	Inland	Ocean <3 mi.	Ocean >3 mi.
Shore	149,704	352,971	0
Charterboat	3,822	2,164	50,054
Private boat	562,496	20,983	73,844
Total	716,022	376,118	123,898

nearshore ocean area and 11% to FCZ waters.

The average numbers of days (= trips) per angler reportedly spent fishing in each mode and wave as reported in the phone survey are indicated in Table 9. The annual total is based on the wave 6 responses to the question "how many days did you fish in the last 12 months." It should be noted that these figures are considerably higher than those obtained by adding the per-wave averages.

The time of week and time of day of fishing as reported in the phone survey are shown in Table 10. Respondents indicated that about 59% of their effort occurred on weekends. Nearly 51% of all trips occurred between noon and 6:00 PM with very limited morning activity. The distribution of creel census interceptions is also shown for comparison. About 53% of the MRFSS interviews were obtained on weekends with nearly all being obtained between noon and 6:00 PM.

Respondents to the phone survey were asked whether they had used public access points or private facilities on their trips. For all modes combined, 73% of the trips reportedly used public access and 27% originated from private facilities. The distribution of private boat trips by point of origin is indicated in Table 11. About 74% of these trips originated from public locations with launching ramps accounting for 64% of all private boat effort.

### Species Preferences

About 30% of all fishermen interviewed during the MRFSS expressed no species preference (i.e., indicated "any"). The percentage of nonselective anglers was highest (62%) in the shore mode. About 13% of the charterboat trips were targeted at "anything" and 22% of the private boat fishermen reported no particular species preference.

Table 12 indicates the principal species or groups targeted in each mode. Spot remained the perennial favorite of shore fishermen. King mackerel were sought by pier fishermen as well as being the overwhelming choice of offshore fishermen. Red drum and spotted seatrout were the dominant choices of private boat fishermen, especially in the fall. About 66% of the directed red drum private boat effort occurred in waves 5 and 6, while 70% of the directed trips for spotted seatrout were made in wave 6. Sheepshead were popular in spring and summer, while most flounder effort occurred during waves 3 and 4. Virtually all of the cobia effort occurred in Beaufort County during wave 3 and most of the directed shark fishing was during waves 2 and 3.

### Catch

MRFSS catch estimates are vulnerable to large sampling errors associated with the numbers of fishermen interviewed and catches inspected (sample size), the range in numbers of fish in individual catches, and the frequency of occurrence of unusually large catches.

Table 9. Average days spent fishing per mode and wave. Source: CIC Research, Inc.

Wave	Shore	Charterboat	Private boat
2	2.7	0	3.2
3	4.7	0.5	4.5
4	4.5	0.5	5.1
5	4.0	0.2	5.1
6	5.4	0.1	5.8
Last 12 months	33.4	1.8	34.6

Table 10. Time of week and time of day of fishing, in numbers of trips or interviews. Sources: CIC Research, Inc. and KCA Research, Inc.

Interval	Weekday	Weekend	Morning				Afternoon/evening			
			0-3	3-6	6-9	9-12	12-3	3-6	6-9	9-12
Trips from phone survey										
MAR-APR	114	200	1	1	0	15	70	102	88	21
MAY-JUN	376	532	2	5	11	38	268	216	271	90
JUL-AUG	323	470	0	0	3	22	105	248	294	69
SEP-OCT	369	446	0	0	1	51	198	149	145	224
NOV-DEC	129	203	0	0	4	39	86	169	22	13
On-site survey interviews										
MAR-APR	128	178	0	0	0	18	110	169	9	0
MAY-JUN	261	345	0	0	0	15	232	344	14	0
JUL-AUG	288	313	0	0	0	10	279	310	2	0
SEP-OCT	269	230	0	0	0	13	266	212	8	0
NOV-DEC	220	275	0	0	0	6	251	238	0	0

Table 11. Number of private boat trips by type of access (from phone survey). Source: CIC Research, Inc.

Type of access	MAR-APR	MAY-JUN	JUL-AUG	SEP-OCT	NOV-DEC
Public:					
Launching ramp	157	323	325	298	160
Boat slip	11	20	82	7	8
Dock mooring	4	8	32	24	13
Private:					
Personal dock	18	34	31	97	33
Locked marina	21	25	35	31	22
Unlocked marina	12	71	18	44	13
Other	0	2	0	0	0

Table 12. Target species identified in the MRFSS by anglers designating a particular species (not including "any"), in percentages of responses by mode. Includes the top ten species/groups only.

Mode	Species/group	Percent targeting	Rank	
			1992	1991
Shore	Spot	37	1	1
	King mackerel	13	2	4
	Kingfishes	10	3	3
	Seatrouts	10	3	10
	Flounders	9	4	2
	Spanish mackerel	8	5	6
	Red drum	8	5	5
	Sharks	2	6	-
	Croaker	1	7	-
Sheepshead	1	8	12	
Private boat	Red drum	21	1	3
	Spotted seatrout	19	2	1
	Flounders	12	3	2
	Cobia	10	4	5
	Sheepshead	9	5	6
	Sharks	7	6	7
	Spot	7	7	9
	King mackerel	6	8	4
	Spanish mackerel	3	9	8
Black sea bass	2	10	10	
Charterboat (trips)	King mackerel	75	1	1
	Dolphin	6	2	-
	Red drum	5	3	5
	Spanish mackerel	4	4	2
	Spotted seatrout	3	5	4
	Grouper	2	6	-
	Black sea bass	2	6	6
	Offshore reef fish	2	6	-
	Sharks	1	7	-
Cobia	1	7	8	

Misidentification and confusion over common names can cause substantial errors in the estimated landings of similar species. Only catches inspected by the creel clerks can be verified and, for species having large percentages of the catch either released or discarded, the estimated total landings can be quite inaccurate. For the most frequently caught fish, relative ranking and trends in catch appear to be reasonably reliable when considered in conjunction with commercial landings and anecdotal information.

The total catch in 1992 (Table 13) was estimated at 3.475 M fish, a slight increase over 1991's figure. About 24% were released alive. Landings by wave are shown in Table 14 and those by fishing area in Table 15. Two-thirds of the total catch came from inland waters and 89% was taken in waters under state jurisdiction. About 11% was taken in the FCZ.

Ocean pelagic species represented less than 1% of the total landings. The principal components were dolphin and yellowfin tuna. Dolphin catches were well below average compared to those in recent years while tuna landings were considerably improved.

Reef fishes comprised 11% of the overall catch with black sea bass the dominant contributor (70% of the reef fish catch). An unusually high portion (44%) of the sea bass catch was reported taken in inland areas (compared to 7% last year) and some sampling error is suspected. Almost 25% of the black sea bass caught were released. Landings of most major reef fish groups (groupers, snappers, porgies, and grunts) showed mixed trends. A large portion of the spottail pinfish catch was reported taken in inland areas, where the species seldom occurs. Confusion with the pinfish probably accounted for this sampling artifact.

Coastal pelagic species (mainly mackerels) contributed 6% of the landings with king mackerel the dominant component. The king catch was the largest since 1988. In contrast, the estimated landings of Spanish mackerel were well below those in recent years. Although seldom targeted, bluefish were formerly a common catch in both estuarine and coastal areas. Estimated landings in 1992 were the lowest in years, reflecting a lack of juvenile fish.

Inshore sportfish is an arbitrary category that includes the more popular species targeted by inland anglers. This group accounted for 24% of the total catch. Landings of red drum, spotted seatrout, and flounders were all appreciably lower than in 1991, although sampling artifacts may have accounted for some of the apparent decline in red drum and spotted seatrout catches (see the Discussion section). About 29% of the red drum and 31% of the spotted seatrout were reportedly released. About 15% of the aggregate flounder catch was also released.

Inshore bottomfish made up 45% of the total landings with spot the principal species. Spot represented 36% of the total catch and these landings constituted a major increase over those in 1991. The catch of kingfishes (whittings), in contrast, declined.

Table 13. Estimated total catch (in thousands of fish) by South Carolina anglers in 1992 (excluding headboat landings). Totals are not necessarily additive due to rounding. Source: NMFS.

Category	Retained or discarded dead	Released	Total
<u>Ocean Pelagics</u>			
Dolphin	3	0	3
Tunas/other	5	<1	5
<u>Reef Fish</u>			
Black sea bass	199	68	268
Other sea basses	3	0	3
Groupers	5	<1	6
Vermilion snapper	10	0	10
Red porgy	24	0	24
Other porgies	6	0	6
Grunts	6	0	6
Triggerfish	4	0	4
Spadefish	17	4	20
Spottail pinfish	13	22	35
Amberjacks	2	0	2
<u>Coastal Pelagics</u>			
King mackerel	107	1	108
Spanish mackerel	49	12	61
Bluefish	25	13	38
Creville jack	<1	2	3
Barracuda	<1	6	7
Little tunny	<1	1	2
Cobia	2	2	4
<u>Inshore Sportfish</u>			
Red drum	98	40	138
Spotted seatrout	184	84	268
Weakfish	20	4	24
Summer flounder	4	2	6
Southern flounder	43	<1	44
Flounder, unclassified	4	6	11
Sheepshead	320	18	338
<u>Inshore Bottomfish</u>			
Kingfishes	164	37	200
Spot	1,019	237	1,257
Croaker	64	23	87
Black drum	12	0	12
Pompano	5	0	5
<u>Sharks</u>			
Sharprose	20	1	22
Unclassified	35	82	119
<u>Miscellaneous</u>			
Skates/rays	2	4	6
Catfishes	43	19	63
Toadfish	0	18	18
Searobins	0	8	8
Pigfish	8	0	8
Pinfish	44	63	107
Mullet	17	0	17
Puffers	19	42	61
Other	14	27	41
<b>Total</b>	<b>2,628</b>	<b>847</b>	<b>3,475</b>

Table 14. Estimated catch (in thousands of fish) by wave. Source: NMFS.

Category	Wave				
	2	3	4	5	6
<u>Ocean Pelagics</u>					
Dolphin	-	<1	2	<1	-
Tunas/other	<1	1	2	<1	<1
<u>Reef Fish</u>					
Black sea bass	78	50	28	91	21
Other sea basses	-	<1	-	2	-
Groupers	1	<1	<1	4	<1
Vermilion snapper	7	2	-	<1	-
Red porgy	11	7	-	1	5
Other porgies	1	4	-	<1	-
Grunts	3	-	-	3	-
Triggerfish	1	1	<1	<1	-
Spadefish	-	11	7	2	-
Spottail pinfish	-	-	12	23	-
Amberjacks	-	-	<1	1	<1
<u>Coastal Pelagics</u>					
King mackerel	41	8	26	28	5
Spanish mackerel	-	32	14	14	<1
Bluefish	3	16	6	7	5
Creville jack	-	<1	3	-	-
Barracuda	-	2	4	<1	-
Little tunny	<1	-	-	-	1
Cobia	-	4	-	-	-
<u>Inshore Sportfish</u>					
Red drum	10	5	22	79	23
Spotted seatrout	<1	3	17	60	188
Weakfish	11	-	2	12	-
Summer flounder	<1	1	2	1	1
Southern flounder	<1	10	24	5	4
Flounder, unclassified	-	5	2	4	<1
Sheepshead	200	27	25	44	43
<u>Inshore Bottomfish</u>					
Kingfishes	10	54	23	79	34
Spot	120	345	201	315	275
Croaker	4	37	39	6	<1
Black drum	3	-	<1	6	2
Pompano	-	-	5	-	-
<u>Sharks</u>					
Sharppnose	-	18	3	-	-
Unclassified	-	29	79	<1	10
<u>Miscellaneous</u>					
Skates/rays	-	2	<1	2	1
Catfishes	-	20	4	33	5
Toadfish	<1	8	4	3	1
Searobins	-	<1	-	8	-
Pigfish	-	<1	-	5	2
Pinfish	-	<1	14	53	38
Mullet	9	5	3	-	-
Puffers	12	15	<1	17	18
Other	<1	5	6	18	10
<b>Total</b>	<b>526</b>	<b>708</b>	<b>560</b>	<b>926</b>	<b>693</b>

Table 15. Estimated catch (in thousands of fish) by fishing area. Source: NMFS.

Category	Inland	Ocean <3 mi.	Ocean >3 mi.
<u>Ocean Pelagics</u>			
Dolphin	-	<1	3
Tunas/other	-	<1	5
<u>Reef Fish</u>			
Black sea bass	118	19	130
Other sea basses	2	-	1
Groupers	-	<1	5
Vermilion snapper	-	<1	9
Red porgy	-	2	22
Other porgies	4	<1	2
Grunts	-	3	3
Triggerfish	<1	<1	3
Spedefish	7	8	5
Spottail pinfish	33	1	1
Amberjacks	-	-	2
<u>Coastal Pelagics</u>			
King mackerel	-	<1	107
Spanish mackerel	6	23	32
Bluefish	21	10	6
Crevalle jack	3	-	<1
Barracuda	-	-	7
Little tunny	-	-	2
Cobia	4	-	<1
<u>Inshore Sportfish</u>			
Red drum	111	25	2
Spotted seatrout	264	4	-
Weakfish	11	10	3
Summer flounder	5	1	-
Southern flounder	37	7	-
Flounder, unclassified	7	4	-
Sheepshead	333	<1	5
<u>Inshore Bottomfish</u>			
Kingfishes	105	95	<1
Spot	782	475	-
Croaker	67	20	-
Black drum	9	-	3
Pompano	-	5	-
<u>Sharks</u>			
Sharprose	13	4	4
Unclassified	109	6	4
<u>Miscellaneous</u>			
Skates/rays	2	4	-
Catfishes	59	3	<1
Toadfish	16	2	-
Searobins	<1	8	-
Pigfish	8	-	-
Pinfish	83	24	-
Mullet	17	-	-
Puffers	41	13	8
Other	39	2	<1
<b>Total</b>	<b>2,317</b>	<b>780</b>	<b>378</b>

Sharks represented 4% of the overall catch. Most of the catch could not be reliably identified, since many species are similar in appearance and 59% of the catch were released. Two of the most common species appeared to be the sharpnose and bonnethead. About 87% of the sharks were caught in inland areas and presumably consisted mainly of these species.

#### Shore Mode

Fishing in the shore mode accounted for 502,675 trips, with 248,935 being made by coastal residents, 172,394 by out of state anglers, and 81,346 by non-coastal residents. About 70% of the trips occurred in the ocean and 30% inland. Over half of the shore effort was attributable to the Grand Strand piers. Most shore anglers indicated no species preference with those that did identifying spot as their most popular choice.

Shore fishermen caught about 29% of all fish landed with spot representing 69% of their catch (Table 16). Kingfishes comprised 10%. No other species or group contributed more than 2%.

#### Charterboat Mode

Charterboat fishermen accounted for 56,041 trips in 1992. Most (41,239) were made by anglers from out of state with 9,471 by non-coastal residents and 5,331 by coastal residents. About 89% of the effort occurred in the FCZ, 7% inland areas, and 4% in coastal ocean waters.

Of the 113 boats holding permits after 1 July, 88% reported making at least one trip while 10% reported no business. The remaining 2% did not submit reports. All but six of the vessels were certified for six or fewer passengers. Of the 107, 21% indicated on their permit application that they also engaged in commercial fishing at least occasionally. Vessels in the six-passenger permit category varied in length from 16 to 55 ft. About 29% were in the 20-26 ft. range, 29% in the 32-40 ft category, and 20% in the 27-31 ft bracket. Seven percent were less than 20 ft and 18% were more than 40 ft. Distribution of the fleet by area is shown in Table 17.

The estimated catch by charterboats was 201,000 fish (Table 18), of which nearly 40% were king mackerel. Charterboats landed 74% of the total king mackerel catch. The other principal species was black sea bass (28% of the charterboat landings); charterboats accounted for 21% of the overall landings of black sea bass.

Fishing success for king mackerel was highly variable from wave to wave with the highest catch rates in the fall. Catch rate estimates were based on trips targeted at king mackerel, using data from the MRFSS during waves 2 and 3 and data from charterboat trip reports during waves 4, 5, and 6. For the year, 4,084 kings were landed in 3,305.5 boat hours of directed effort, a catch rate of 1.24 fish per boat hour. Comparisons were also made for fishing

Table 16. Estimated catch (in thousands of fish) by wave in the shore mode. Source: MMFS.

Category	Wave					Total
	2	3	4	5	6	
<u>Reef Fish</u>						
Black sea bass	-	-	-	4	-	4
Other porgies	-	4	-	-	-	4
Spadefish	-	4	2	-	-	6
Spottail pinfish	-	-	11	-	-	11
<u>Coastal Pelagics</u>						
Spanish mackerel	-	15	4	2	-	21
Bluefish	-	9	1	-	-	10
<u>Inshore Sportfish</u>						
Red drum	2	-	6	16	<1	24
Spotted seatrout	-	-	1	-	4	5
Weakfish	8	-	-	-	-	8
Summer flounder	-	-	1	-	1	2
Southern flounder	<1	-	8	-	1	9
Flounder, unclassified	-	<1	-	3	<1	4
Sheepshead	-	<1	-	4	-	4
<u>Inshore Bottomfish</u>						
Kingfishes	5	13	11	45	31	105
Spot	38	193	184	147	132	694
Croaker	3	16	6	3	<1	28
Black drum	-	-	-	-	<1	<1
Pompano	-	-	-	5	-	5
<u>Sharks</u>						
Sharpnose	-	5	-	-	-	5
Unclassified	-	4	1	-	-	5
<u>Miscellaneous</u>						
Skates/rays	-	1	-	<1	<1	1
Catfishes	-	1	-	2	-	3
Toadfish	-	<1	-	2	<1	2
Searobins	-	<1	-	8	-	8
Pigfish	-	-	-	-	2	2
Pinfish	-	<1	14	3	-	17
Puffers	<1	6	-	8	4	18
Other	<1	-	-	<1	<1	1
<b>Total</b>	<b>57</b>	<b>272</b>	<b>250</b>	<b>252</b>	<b>176</b>	<b>1,007</b>

Table 17. Distribution of South Carolina charterboats by area.

Area of operation	Number of boats	Percent of total
Beaufort County		
Beaufort/Milton Head	37	33
Charleston County	42	37
John's Is. - Seabrook Is. and Edisto Beach	16	14
Charleston metro	26	23
Georgetown andorry Counties	33	29
Murrells Inlet/Georgetown	21	21
Little R./North Carolina	12	9
Unknown	1	1
<b>Total</b>	<b>113</b>	<b>100</b>

Table 18. Estimated catch (in thousands of fish) by wave in the charterboat mode. Source: NMFS.

Category	2	3	Wave 4	5	6	Total
<u>Ocean Pelagics</u>						
Dolphin	-	<1	2	<1	-	2
Tunas/other	<1	<1	2	<1	<1	3
<u>Reef Fish</u>						
Black sea bass	49	3	1	3	<1	56
Other sea basses	-	1	-	-	-	1
Groupers	<1	<1	<1	2	<1	3
Vermilion snapper	6	2	-	<1	-	8
Red porgy	9	7	-	1	<1	17
Other porgies	<1	<1	-	<1	-	1
Grunts	3	-	-	<1	-	3
Triggerfish	-	-	-	<1	-	<1
Spedefish	-	-	-	<1	-	<1
Amberjacks	-	-	<1	-	<1	1
<u>Coastal Pelagics</u>						
King mackerel	37	5	18	18	2	80
Spanish mackerel	-	6	3	<1	<1	10
Bluefish	3	<1	-	<1	-	4
Barracuda	-	<1	2	<1	-	3
Little tunny	<1	-	-	-	1	1
Cobia	-	<1	-	-	-	<1
<u>Inshore Sportfish</u>						
Red drum	<1	-	-	<1	<1	1
Spotted seatrout	-	<1	-	2	1	3
Summer flounder	-	-	-	<1	-	<1
Sheepshead	2	-	-	-	<1	2
<u>Inshore Bottomfish</u>						
Kingfishes	-	-	-	<1	-	<1
<u>Sharks</u>						
Sharprose	-	<1	-	-	-	<1
Unclassified	-	1	-	<1	-	1
<u>Miscellaneous</u>						
Puffers	-	-	-	-	<1	<1
Other	-	-	-	<1	-	<1
<b>Total</b>	<b>109</b>	<b>26</b>	<b>28</b>	<b>29</b>	<b>9</b>	<b>201</b>

success during artificial reef trips and non-reef trips. In order to have adequate numbers of observations for comparison, data were limited to those from the charterboat reports (i.e., waves 4-6). For the artificial reefs, effort equalled the total number of boat hours spent trolling. For non-reef fishing, calculations were based on the number of boat hours spent trolling with mackerels or anything as the targets. The artificial reef catch rate was 0.48 kings per boat hour, while the non-reef rate was 0.88.

### Private Boat Mode

Private boat fishermen made an estimated 657,324 trips (481,466 by coastal residents, 90,345 by out of state anglers, and 85,513 by non-coastal residents). About 86% of this effort occurred in inland waters, 11% in the FCZ, and 3% in coastal ocean areas. Three-quarters of these trips originated from public access points with launching ramps accounting for nearly two-thirds of all effort. The principal target species of inland anglers were red drum and spotted seatrout, particularly in the fall, with flounders a popular spring/summer choice, particularly in the northern third of the state.

Private boat anglers caught 2.238 M fish (Table 19), about 64% of the overall catch. Spot was the largest component of the mode catch (25%), followed by sheepshead (15%), spotted seatrout (11%), black sea bass (9%), sharks (6%), and red drum (5%). Most of the sheepshead were caught during wave 2, when this was by far the dominant species landed. Spotted seatrout were the principal catch in wave 6, while sharks were prominent components in mid-summer.

Data from the MRFSS and SFS were combined to calculate indices of catch per unit of effort (CPUE). Observations were limited to trips during which the anglers either targeted the species or caught at least one of it. Data for red drum, spotted seatrout, and flounders (primarily southern) are provided in tables 20, 21, and 22, respectively.

A total of 835 anglers interviewed in both surveys had either targeted red drum or caught at least one. The 411 anglers interviewed in the MRFSS represented about 30% of the total number of private boat fishermen. Success as measured by the SFS data was uniformly better than that indicated by the MRFSS results. In terms of percentages of successful angler trips, there was little difference between areas and about half of the anglers statewide had caught at least one red drum. There also was no appreciable difference in the mean CPUE with anglers statewide averaging 1.15 fish per trip.

Anglers targeting red drum were asked if they had caught any tagged red drum during the year and, if so, whether they had reported the recaptures to the MRD. In Beaufort County, 19% of the fishermen reported catching tagged fish and 88% claimed that they had reported all of them. In Charleston County, 20% of the fishermen had caught tagged fish and 78% indicated that they had

Table 19. Estimated catch (in thousands of fish) by wave in the private boat mode. Source: NMFS.

Category	2	3	Wave 4	5	6	Total
<u>Oceanic Pelagics</u>						
Dolphin	-	-	<1	-	-	<1
Tunas/other	-	<1	-	-	-	<1
<u>Reef Fish</u>						
Black sea bass	29	47	27	84	20	207
Other sea basses	-	-	-	2	-	2
Groupers	<1	-	-	1	-	1
Vermilion snapper	<1	-	-	-	-	<1
Red porgy	2	-	-	-	5	7
Other porgies	<1	-	-	-	-	<1
Grunts	-	-	-	3	-	3
Triggerfish	1	1	<1	<1	-	2
Spottail pinfish	-	-	1	23	-	24
Spadefish	-	8	5	2	-	15
Amberjacks	-	-	-	1	-	1
<u>Coastal Pelagics</u>						
King mackerel	4	3	8	10	3	28
Spanish mackerel	-	12	8	12	-	32
Bluefish	-	7	4	7	5	23
Creville jack	-	<1	3	-	-	3
Barracuda	-	2	1	-	-	3
Cobia	-	4	-	-	-	4
<u>Inshore Sportfish</u>						
Red drum	7	5	16	62	22	112
Spotted seatrout	<1	2	16	57	182	257
Weakfish	3	-	2	12	-	17
Summer flounder	<1	1	<1	1	<1	2
Southern flounder	-	10	16	5	3	34
Flounder, unclassified	-	4	2	1	-	7
Sheepshead	197	26	25	40	43	331
<u>Inshore Bottomfish</u>						
Kingfishes	5	41	12	34	4	96
Spot	82	152	18	168	143	563
Croaker	<1	21	33	3	-	57
Black drum	3	-	<1	6	2	11
<u>Sharks</u>						
Sharpnose	-	13	3	-	-	16
Unclassified	-	24	78	-	10	112
<u>Miscellaneous</u>						
Skates/rays	-	1	<1	1	<1	2
Catfishes	-	19	4	30	5	58
Toadfish	<1	8	4	2	<1	14
Pigfish	-	1	-	5	-	6
Pinfish	-	-	-	50	38	88
Mullet	9	5	3	-	-	17
Puffers	11	9	<1	9	14	43
Other	-	5	6	18	10	39
<b>Total</b>	<b>353</b>	<b>431</b>	<b>296</b>	<b>649</b>	<b>509</b>	<b>2,238</b>

Table 20. Catch and effort data of private boat inland anglers for red drum.

	MRFSS	SFS	Combined
Beaufort County			
Anglers	65	104	169
Angler hours	256.5	414.5	671.0
Fish	29	160	189
Fish/angler	0.44	1.54	1.12
Fish/angler hour	0.11	0.39	0.28
% without fish	69	32	46
Charleston County			
Anglers	226	246	472
Angler hours	1044.0	1083.5	2127.5
Fish	148	387	535
Fish/angler	0.65	1.57	1.13
Fish/angler hour	0.14	0.36	0.25
% without fish	65	40	52
Georgetown/Horry Counties			
Anglers	120	74	194
Angler hours	566.0	312.0	878.0
Fish	103	131	234
Fish/angler	0.86	1.77	1.21
Fish/angler hour	0.21	0.42	0.27
% without fish	55	30	45
Statewide			
Anglers	411	424	835
Angler hours	1866.5	1810.0	3676.5
Fish	280	678	958
Fish/angler	0.68	1.60	1.15
Fish/angler hour	0.15	0.37	0.26
% without fish	62	36	49

Table 21. Catch and effort data of private boat inland anglers for spotted seatrout.

	MRFSS	SFS	Combined
Beaufort County			
Anglers	64	101	165
Angler hours	290.0	406.5	696.5
Fish	88	185	273
Fish/angler	1.38	1.83	1.65
Fish/angler hour	0.30	0.46	0.39
% without fish	42	25	32
Charleston County			
Anglers	217	393	610
Angler hours	1079.0	1756.0	2835.0
Fish	392	911	1303
Fish/angler	1.81	2.32	2.14
Fish/angler hour	0.36	0.52	0.46
% without fish	41	48	46
Georgetown/Horry Counties			
Anglers	30	22	52
Angler hours	122.5	84.0	206.5
Fish	54	47	101
Fish/angler	1.80	2.14	1.94
Fish/angler hour	0.44	0.56	0.49
% without fish	57	45	52
Statewide			
Anglers	311	516	827
Angler hours	1491.5	2246.5	3738.0
Fish	534	1143	1677
Fish/angler	1.72	2.22	2.03
Fish/angler hour	0.36	0.51	0.45
% without fish	43	44	43

Table 22. Catch and effort data of private boat anglers for southern flounder.

	MRFSS	SFS	Combined
Beaufort County			
Anglers	13	2	15
Angler hours	44.5	10.0	54.5
Fish	9	4	13
Fish/angler	0.69	2.0	0.87
% without fish	38	0	33
Charleston County			
Anglers	44	34	78
Angler hours	256.0	173.5	429.5
Fish	38	30	68
Fish/angler	0.86	0.88	0.87
% without fish	34	47	40
Georgetown/Horry Counties			
Anglers	49	39	88
Angler hours	246.0	187.0	433.0
Fish	45	66	111
Fish/angler	0.92	1.69	1.26
% without fish	33	10	23
Statewide			
Anglers	106	75	181
Angler hours	546.5	370.5	917.0
Fish	92	100	192
Fish/angler	0.87	1.33	1.06
% without fish	34	27	31

reported all of them. Only 8% of the anglers in the Georgetown/Horry area had caught tagged red drum. All of these fishermen stated that they had reported all recaptures. Statewide, tagged fish were reported caught by 17% of the fishermen and 83% had reported all recaptures.

Statewide, 827 of the fishermen interviewed in both surveys had fished for and/or caught spotted seatrout. About 22% of the private boat anglers interviewed in the MRFSS were included. Success for this species by area was more variable than that for red drum with fishermen in the Georgetown/Horry area averaging slightly more fish per angler hour than those in Charleston County, where most of the directed effort occurred. Fishermen in Charleston County had the highest average catch per trip, although Beaufort County anglers reported the best ratio of successful trips. The average statewide catch per angler was about two fish.

Relatively few fishermen targeted flounders, particularly in the southern part of the state. About one-third of the anglers targeting flounders failed to catch at least one flounder and the average catch rate was slightly more than one fish per trip.

Ocean fishermen primarily targeted mackerels and fished during the summer. The annual catch rate for king mackerel (29 interviews from the MRFSS) was 0.51 fish per angler and 0.08 fish per angler hour. The catch rates for Spanish mackerel (26 observations) were 1.04 fish per angler and 0.22 fish per angler hour. Calculations were limited to the trips targeted at the species.

#### Length Distribution

A total of 633 red drum were measured (185 from the MRFSS and 448 from SFS sampling). About 62% were measured during wave 6 and 26% during wave 5. Distribution of lengths by county is shown in Fig. 1. The statewide mean total length was 43.5 cm. About 43% of the retained catch were 14-16 inches long, 25% were 16-18 inches, 8% were 18-20 inches and 17% exceeded 20 inches.

A total of 871 spotted seatrout were measured (292 from the MRFSS and 579 from the SFS). Most of the fish were caught in Charleston County during wave 6. Fig. 2 shows the distribution of total lengths by county. The statewide average size was 36.9 cm.

Length distribution of other important species are listed in Table 23. Mean sizes were as follows: 1) southern flounder, 38.6 cm, 2) sheepshead, 31.9 cm, 3) black sea bass, 25.9 cm, 4) Spanish mackerel, 46.4 cm, 5) and king mackerel, 76.5 cm.

### DISCUSSION

#### Survey Logistics

In 1991, sampling in the private boat mode was heavily concentrated in Georgetown and Charleston Counties with very little effort in the southern part of the state: only 8% of the SFS

Table 23. Length distributions of recreationally caught species in 1992.

Southern flounder		Sheepshead		Black sea bass		Spanish mackerel		King mackerel	
TL cm	N	TL cm	N	TL cm	N	FL cm	N	FL cm	N
<30	2	<20	9	<20	12	<30	1	<50	14
30	4	20	7	20	14	30	3	50	
31	8	21	14	21	22	31	2	51	
32	15	22	8	22	10	32	3	52	
33	11	23	12	23	28	33		53	
34	9	24	17	24	21	34	2	54	
35	9	25	20	25	10	35	2	55	1
36	12	26	17	26	19	36	2	56	2
37	12	27	12	27	10	37	1	57	1
38	12	28	10	28	13	38	5	58	4
39	3	29	15	29	12	39		59	2
40	6	30	22	30	7	40	5	60	2
41	9	31	28	31	9	41	6	61	5
42	13	32	15	32	6	42	7	62	4
43	16	33	31	33	2	43	7	63	4
44	3	34	19	34	6	44	11	64	3
45	5	35	21	35	5	45	5	65	4
46	2	36	15	36	2	46	3	66	9
47	4	37	15	37	2	47	3	67	5
48	3	38	12	38	1	48	3	68	11
49	7	39	13	39	2	49	4	69	6
50	1	40	3	40	1	50	5	70	17
51		41	1	41		51	3	71	19
52		42	2	42	1	52		72	18
53		43	8	43	1	53	1	73	25
54		44	3	44	1	54	3	74	19
55		45	4	45		55	1	75	17
56		46	4	46	2	56	1	76	20
57	1	47	1			57	1	77	12
58		48	4			58	1	78	17
59	1	49	2			59		79	19
60		50				60		80	8
>60	1	51	6			61	2	81	7
		52				62		82	7
		53				63		83	10
		54	1			64	2	84	8
		55	4			65	2	85	2
		56				66	4	86	4
		57				67	2	87	1
		58				68	1	88	2
		59				69		89	1
		60				70	1	90	2
		>60	1			>70	1	91	5
								92	6
								93	2
								94	6
								95	1
								96	6
								97	3
								98	4
								99	3
								100	
								>100	19

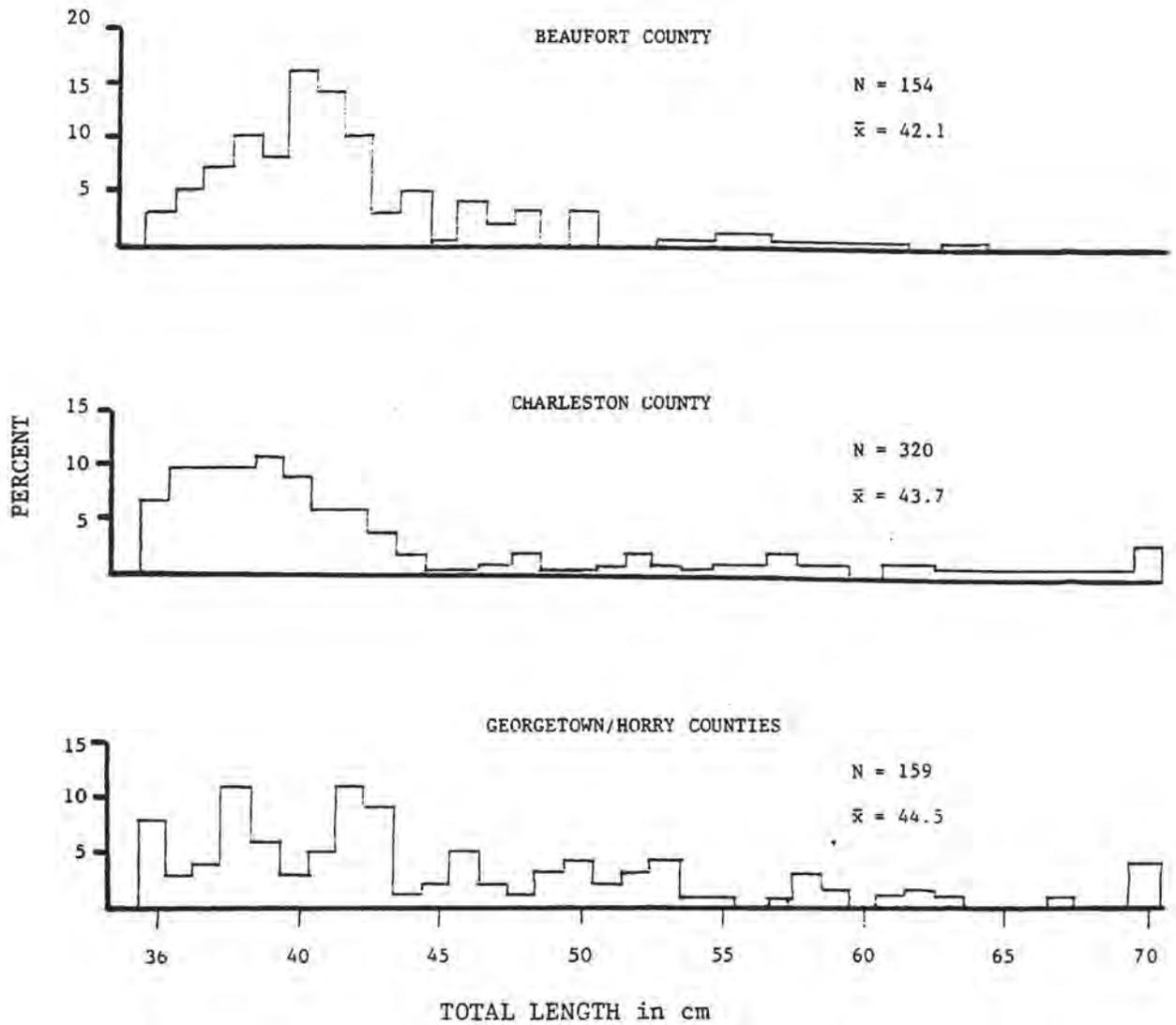


Fig. 1. Length distribution of red drum in 1992.

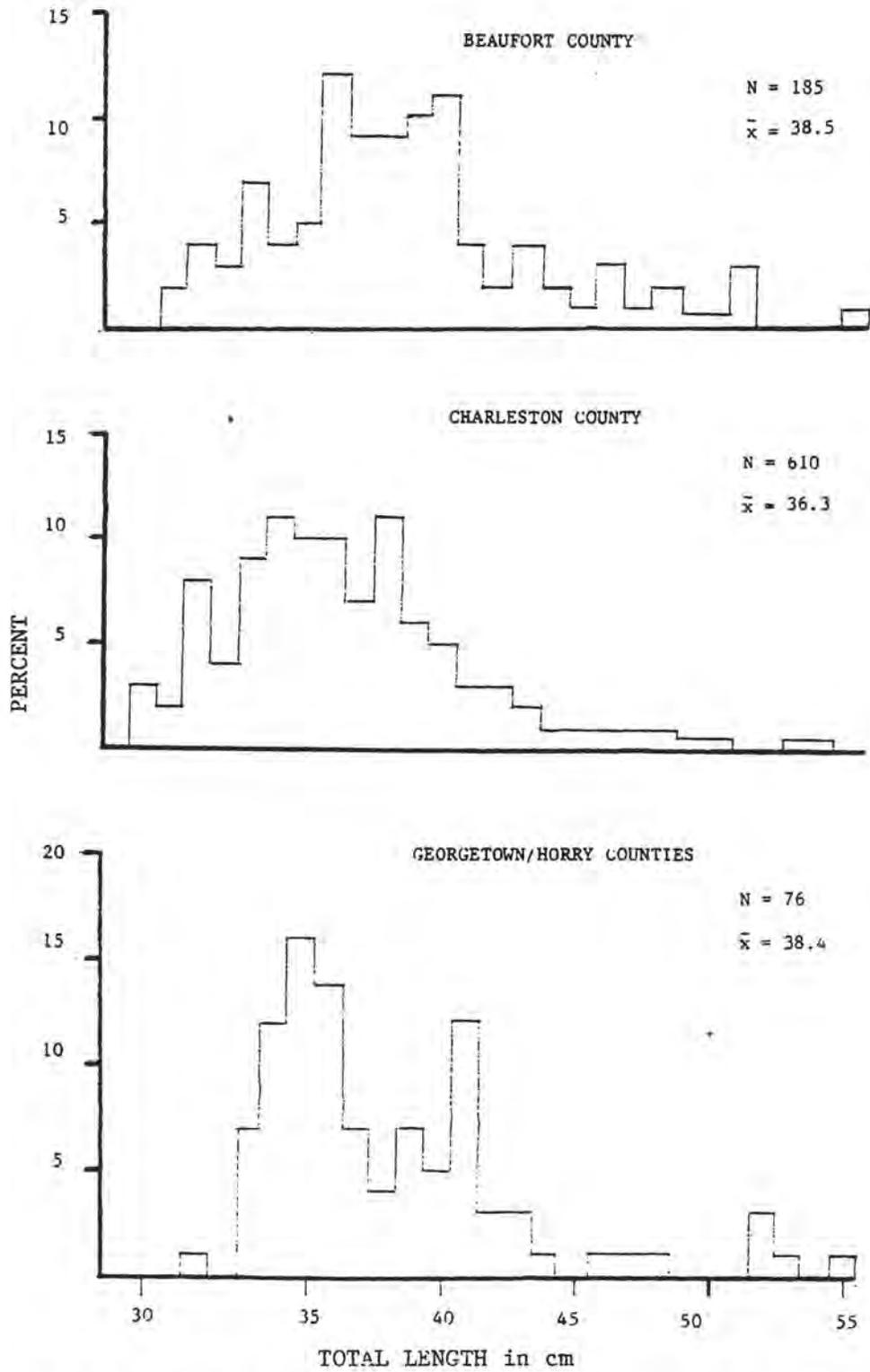


Fig. 2. Length distribution of spotted seatrout in 1992.

interviews came from Beaufort County. We historically have had sampling problems in this area, which has a large number of small, poorly developed access sites characterized by relatively low usage rates. It is expensive, in terms of cost per interview, to sample the private boat mode under such circumstances, particularly when the sites are widely dispersed. The logistics problem is compounded when the creel clerks are based out of Charleston and must spend a large portion of their available time just traveling to and from the general survey area.

Site selection in the MRFSS is weighted toward heavily utilized sites. Most of these are located in Georgetown and Charleston Counties, and they are few in number. This results in a large portion of the private boat mode sample being obtained at only a few locations. For example, 29% of the 1992 MRFSS private boat sample originated at the SCWMRD ramp at Murrells Inlet. Since there are no high-intensity sites in Beaufort County, only a relatively small number of interview assignments are allocated there.

In 1992, we partially addressed the problem by hiring a creel clerk who resided in the Beaufort area and limited her assignments to that area. This did not occur until late in wave 5, but still we were able to increase the overall allocation of SFS interviews from 8% to 22% in 1992 within an overall sample size comparable to that in 1991. We scaled back the SFS effort in Georgetown County in compensation because of the large amount of MRFSS sampling there.

#### Survey Reliability

The annual MRFSS quota was increased from the minimum level (1 X) to approximately 2.5 X in 1992, which reduced the standard errors associated with various estimates. Combined with a comparable level of SFS effort in both years but allocated differently, the sample sizes used to derive CPUE indices for red drum and spotted seatrout in 1992 were roughly triple those in 1991.

<u>Anglers Interviewed</u>	<u>Red drum</u>			<u>Spotted seatrout</u>		
	<u>1991(X)</u>	<u>1992</u>	<u>X</u>	<u>1991(X)</u>	<u>1992</u>	<u>X</u>
Beaufort County	17	169	+8.9	27	165	+5.1
Charleston County	201	472	+1.3	208	610	+1.9
Georgetown/Horry Counties	67	194	+1.9	36	52	+0.4
Total	285	835	+1.9	271	827	+2.0

Similarly, the numbers of fish inspected to generate the length frequency data base were substantially larger in 1992; the overall sample size for red drum was increased by 98% and that for spotted seatrout by 44%.

<u>Fish measured</u>	<u>Red drum</u>			<u>Spotted seatrout</u>		
	<u>1991(X)</u>	<u>1992</u>	<u>X</u>	<u>1991(X)</u>	<u>1992</u>	<u>X</u>
Beaufort County	14	154	+10.0	98	185	+0.9
Charleston County	159	320	+1.0	407	610	+0.5
Georgetown/Horry Counties	146	159	+0.1	100	76	-0.2

Total	319	633	+1.0	605	871	+0.4
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Results of the phone survey indicated that about 39% of all fishing trips occurred between 6:00 PM and midnight, whereas practically all of the creel census sampling occurred before then (Table 10). The modes of fishing referred to in the phone survey results were unknown. Since some species and/or size ranges of fish are more available and/or vulnerable to nighttime anglers, this apparently disparate distribution of actual vs sampled fishing effort may have introduced some bias. Anecdotal information regarding fishery characteristics suggests that any such problem was most severe for the shore mode, particularly the pier fishery. Most of the piers are open 24 hours and the night fishing tends to be different from the daytime activity.

Differences between the overall fishing population and the sampled population were of potential concern regarding the types of access used as well. The phone survey indicated that about 36% of the private boat trips originated from points other than public launching ramps, yet practically all of the interviews were obtained at these ramps. A preliminary analysis of differences between private/rental boat trips by access type conducted by the North Carolina Division of Marine Fisheries (NCDMRD) concluded that frequency of trips, their duration, and target species were somewhat different. A more detailed study is in progress by the NCDMF. The SCMRD has planned and scheduled a similar study for several years but has been unable to conduct it as yet.

#### Participation and Effort

Estimated total participation was the lowest since the MRFSS's interception in 1979 with the exception of the hurricane year of 1989 (Fig.3). This represented a 28% decrease from the previous year's total and was far below the projected level (broken line). Since 1979, the average annual increment in overall participation has been only about 0.125%. The declining trend in recent years is not unique to South Carolina. The U.S. Fish and Wildlife Service estimated a 7.8% decline in national salt water fishing participation between 1985 and 1990.

The trend in total effort has been similar with an average annual increment of only 0.145% since 1979 (Fig.4). The estimated total number of trips in 1992 was about 19% below the 1991 figure. Again, this trend is not unique to this state. The Sport Fishing Institute has estimated an annual loss of 1.1 M trips nationally in recent years.

#### Species Preferences, Catch and Catch Rates

There have been no significant changes in target species composition in recent years. Sheepshead continued a gradual increase in popularity, particularly in the spring.

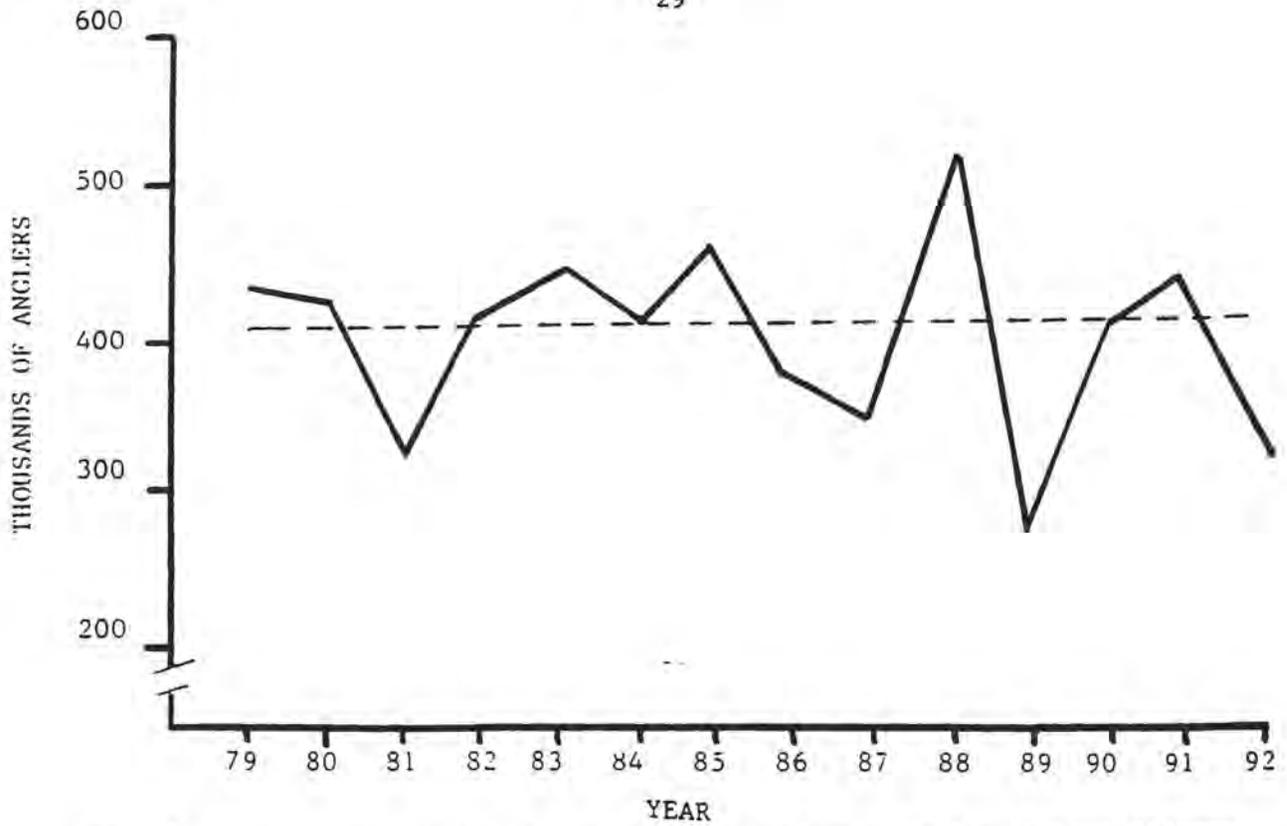


Fig. 3. Annual participation in the recreational hook-and-line fishery (by shore, charterboat, and private boat anglers).

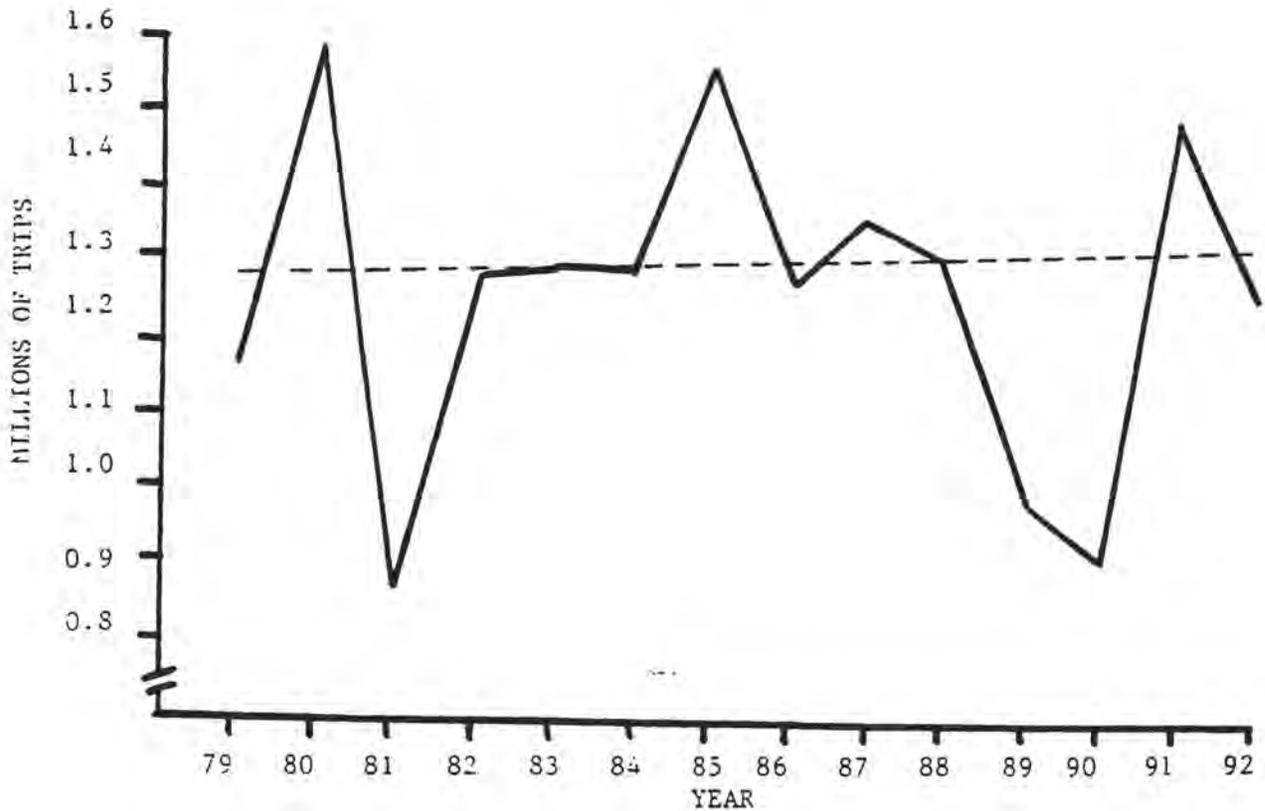


Fig. 4. Annual effort in the recreational hook-and-line fishery.

The species composition of the 1992 catch was generally similar to that in 1990 and 1991. The most obvious differences were the higher landings of spot (36% of the overall 1992 catch compared to 17% in 1991 and 7% in 1990) and sheepshead (10% in 1992 vs 5% in 1991 and 4% in 1990).

The estimated catch of red drum appeared to be substantially lower than that suggested by anecdotal information. The catch per angler trip derived from the 1992 MRFSS data was only 68% of that in 1991 (with the estimated catch being 72% of the 1991 catch). The catch rate observed during the SFS in 1991 was similar to that in the MRFSS, but there was a large discrepancy in 1992. Compared to the 1991 SFS estimate, the 1992 SFS catch rate was 45% higher. This suggests that the NMFS catch estimate was too conservative. The actual 1992 landings could have been about 264,000 fish, which would have represented a relatively strong showing.

The NMFS estimate of the spotted seatrout catch also appeared to be low when information from sources other than the MRFSS was considered. The 1992 catch rate from the MRFSS was 86% of the 1991 value but the catch estimate was only 63% of the 1991 figure. The catch rate from SFS data was 88% of the 1991 SFS CPUE. This suggested that the catch estimate should be appreciably higher than that derived by the NMFS, perhaps on the order of 360,000 fish. The winter was mild as in the previous year and there was no obvious explanation for such a pronounced decrease in the catch.

The king mackerel was the principal species targeted by ocean boat fishermen with the charterboat fleet accounting for most of the landings. The NMFS Panama City (Florida) laboratory has conducted a voluntary survey of the southeastern charterboat fishery for many years. Beginning in July, 1992, the MRD provided copies of charterboat reports to this program in order to expand the South Carolina and South Atlantic sample sizes. From these data, Panama City estimated the 1992 South Carolina charterboat catch rate as 1.2 king mackerel per boat hour of trolling. This was the highest CPUE in the South Atlantic area except for off North Carolina.

Although regional abundance of Spanish mackerel appeared to be high, the South Carolina estimated landings were well below those in recent years. The charterboat catch rate calculated by Panama City was 2.8 fish per boat hour of trolling, compared to more than 10 off North Carolina and Georgia and nearly 5 off northeast Florida.

#### Length Composition

Observed average sizes of most species in 1992 were very similar to those in recent years (Table 24). The most pronounced difference was for king mackerel, due to an unusually high percentage of fish over 100 cm FL observed in 1991. For both red drum and spotted seatrout, there was very little difference in mean length by area (county).

Table 24. Mean lengths (in cm) of major recreational species as determined from MRFSS and SFS data. Mackerel measurements are fork lengths, all others are total lengths.

Species	1988	1989	1990	1991	1992
Red drum	43.1	46.3	45.7	42.0	43.5
Spotted seatrout	36.5	37.7	37.1	36.6	36.9
Southern flounder	34.6	35.0	35.6	35.4	38.6
Sheepshead	32.6	-	34.2	32.2	31.9
Black sea bass	26.4	25.9	-	25.2	25.9
King mackerel	76.8	76.7	76.2	85.0	76.5
Spanish mackerel	42.2	41.2	42.0	45.7	46.4

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**APPENDIX**

### Charterboat MRFSS estimates/MRD reports

Beginning July 1, 1992, state law required all charterboats to obtain a permit and submit monthly reports of all daily fishing activity, including the numbers of anglers, total fish caught, numbers released, and pounds retained. Operators were also requested to provide information on fishing location, method, and target species on a voluntary basis. Results for waves 4-6 based on the MRFSS were compared with those obtained from the mandatory MRD reports.

During waves 4-6, the MRFSS interviewed 260 anglers from 69 charterboat trips, while 2,879 trips were reported to the MRD. The percentages of these trips targeted at various species were as indicated in Table I-1. About 18% of the trips reported to the MRD were targeted at species not identified in the MRFSS. About 40% of the MRD trip reports either specified "any" as the species preference or left it blank, which was considered equivalent to no preference. About 14% of the trips reported in the MRFSS identified "any" as the species preference. King mackerel was the indicated target on 69% of the MRFSS trips compared to 25% of those reported to the MRD.

The comparative distribution of effort by area is shown in Table I-2. Numbers of anglers (from Table 3) were used as proxies for effort because the distribution of MRFSS trips was not known. The distribution indicated for the MRFSS is similar to that inferred from Table 8 (which included waves 2 and 3). The information reported to the MRD indicated that 31% of the anglers fished in state waters (i.e., inland and the ocean <3 mi.) compared to only 15% as reported in the MRFSS.

Participation as estimated from the MRFSS compared to that reported to the MRD is shown in Table I-3. The numbers of boat trips shown under the MRFSS were estimated by dividing the numbers of anglers in each wave by the average number of anglers per boat trip calculated from the reports to the MRD. A total of 99 boats reported making at least one trip during the wave 4-6 period. The estimated wave boat trips under the MRFSS were divided by this figure to obtain the mean numbers of trips per boat. The MRD figures were obtained from direct wave counts (i.e., trips divided by the numbers of boats reporting).

Participation in each wave as estimated by the NMFS was much higher than that reported to the MRD and the overall number of anglers was slightly over double the number obtained from operator reports. Since it was reasonable to assume (see below) that the average number of anglers per trip should be comparable regardless of source, the inference was that the NMFS estimates of boat trips were also much higher than the figures reported to the MRD.

In this context, it is instructive to compare the apparent wave averages of trips per boat from the MRFSS data with information from the MRD reports. In wave 4, only 23% of the boats reported more

Table I-1. Species targeted during charterboat trips, in percentages of total trips.

	4		Wave 5		6		Total	
	MRFSS	MRD	MRFSS	MRD	MRFSS	MRD	MRFSS	MRD
Total observations	27	1,841	28	898	14	140	69	2,879
Species targeted								
Anything	7	41	14	39	29	36	14	40
King mackerel	78	24	64	26	57	24	69	25
Spanish mackerel	0	13	4	8	0	0	1	11
Dolphin	15	1	0	1	0	0	6	1
Grouper	0	1	7	2	0	0	3	1
Red drum	0	1	7	4	7	7	4	2
Spotted seatrout	0	1	4	5	7	18	3	3
Total percent	100	82	100	84	100	85	100	82

Table I-2 Distribution of charterboat effort by area, in percentages of anglers.

	4		Wave 5		6		Total	
	MRFSS	MRD	MRFSS	MRD	MRFSS	MRD	MRFSS	MRD
Total anglers	103	9,141	96	3,789	52	543	251	13,473
Inland	4	11	4	13	19	22	7	12
Ocean <3 mi.		0 23	20	11	0	5	8	19
Ocean >3 mi.	96	65	76	76	81	73	85	69

Table I-3 Numbers of charterboat anglers and boat trips.

	MRFSS			Total	MRD			Total
	4	5	6		4	5	6	
Anglers	15,483	9,547	2,468	27,498	9,141	3,789	543	13,473
Boat trips	3,115	2,262	636	6,013	1,841	898	140	2,879
X anglers/trip	-	-	-	-	4.97	4.22	3.88	4.68
X trips/boat	31	23	6	-	20.0	10.3	3.3	-

than 30 trips. In wave 5, 13% reported more than 20, and in wave 6 19% reported more than 6. The average boat under the NMFS scenario would have made 60 trips during the wave 4-6 interval, yet only 10% of the active boats reporting to the MRD reported 60 or more trips and 60% indicated that they had made 30 or less.

The catches estimated by the NMFS and those reported to the MRD are compared in Table I-4. The NMFS estimate of total catch was about three times the catch reported to the MRD. The most important difference was for king mackerel with the NMFS estimate being nearly six times the catch reported by the boat operators. In contrast, charterboat operators reported over twice as many Spanish mackerel as estimated by the NMFS. The NMFS estimate of shark landings was far below the catch reported to the MRD and the estimated sea bass catch was also substantially lower.

The catch rate of the principal species, king mackerel, calculated from the MRFSS data was 1.59 fish per angler. This was derived as follows. The total number of anglers in each wave (Table 6) was multiplied by the estimated percentage of fishing in the ocean >3 mi. (Table I-2) to obtain the estimated number of ocean >3 mi. anglers. For simplicity, it was assumed that all king mackerel were caught in the FCZ. This catch (38,364 fish) was divided by the number of ocean >3 mi. anglers ( $N = 24,119$ ) to obtain the CPUE. Based on the information reported to the MRD, the catch rate was 0.69 king mackerel per angler. The catch of kings taken in the FCZ ( $N = 6,403$ ) was divided by the number of ocean >3 mi fishermen ( $N = 9,248$ ) to obtain this index.

The final step in our analysis was to compare data from MRFSS interviews with those reported for the same vessel and date by the operators. Presumably, both sources referred to the same trip. Comparisons were possible for 45 such combinations. Of the remaining 22 trips covered by MRFSS interviews, boats had not submitted reports for 18 although they did provide reports for the appropriate month. For the remaining four trips, the operators either did not file reports for the appropriate month or provided a false report.

Aggregate results of the 45 individual comparisons are provided in Table I-5. The percentages shown are the differences of the MRFSS data from the MRD report data (i.e.,  $MRFSS \pm MRD/MRD$ ). Match-ups of the information ( $N =$  number of observations) reported in the various categories are summarized below.

All data identical	No. of anglers identical	Hours fished identical	Target species comparable	Same species caught	Same spp. & no. caught
$N = 1$ 2%	19 42%	7 16%	37 82%	20 44%	12 27%

Table 1-4 Charterboat catches as estimated by the NMFS compared to those reported to the MRD, in numbers of fish.

Category	MRFSS				MRD				%
	4	5	6	Total	4	5	6	Total	
Dolphin	1559	99	0	1658	423	46	0	469	+254
Tunas	1842	99	0	1941	70	53	1	124	+1465
Wahoo	567	99	0	666	84	31	0	115	+479
Bonito	0	199	190	389	7	1	1	9	+4222
Black sea bass	992	3282	285	4559	5645	1764	1034	8443	-46
Groupers	425	2490	190	3105	347	839	266	1452	+114
Snappers	0	597	0	597	594	728	104	1426	-58
Porgies	0	1591	47	1638	372	591	84	1047	+56
Grunts	0	497	0	497	242	539	90	871	-43
Triggerfish	0	298	0	298	64	182	34	280	+6
Spadefish	0	258	0	258	133	47	7	187	+38
Amberjacks	283	0	142	425	259	222	22	503	-16
King mackerel	18291	17747	2326	38364	3334	2707	434	6475	+493
Spanish mackerel	2719	384	95	3198	6321	1186	1	7508	-57
Bluefish	0	66	0	66	815	387	22	1224	-945
Barracuda	2379	398	0	2777	1296	396	9	1701	+63
Little tunny	0	0	997	997	821	270	116	1207	-17
Red drum	0	365	190	555	304	705	103	1112	-50
Spotted seatrout	0	2221	997	3218	423	924	330	1677	+92
Flounders	0	99	0	99	478	102	3	583	-83
Sheepshead	0	0	47	47	20	51	28	99	-53
Kingfishes	0	298	0	298	118	48	2	168	+77
Sharks	0	99	0	99	2539	258	3	2800	-965
Puffers	0	0	48	48	2	0	0	2	+2300
Other	0	199	0	199	2025	1052	79	3156	
Billfishes	-	-	-	-	28	1	0	29	
Spottail pinfish	-	-	-	-	82	47	1	130	
Jacks	-	-	-	-	423	74	0	497	
Tarpon	-	-	-	-	89	17	0	106	
Cobia	-	-	-	-	52	19	0	71	
Weakfish	-	-	-	-	109	300	53	462	
Spot	-	-	-	-	39	233	0	272	
Croaker	-	-	-	-	40	0	0	40	
Black drum	-	-	-	-	3	34	14	51	
Catfish	-	-	-	-	969	100	0	1069	
Skates/rays	-	-	-	-	56	61	1	118	
Pinfish	-	-	-	-	0	21	0	21	
Pigfish	-	-	-	-	51	0	0	51	
Toadfish	-	-	-	-	4	1	0	5	
Eels	-	-	-	-	2	1	0	3	
Unidentified	-	-	-	-	78	143	10	221	
<b>Total</b>	<b>29057</b>	<b>31385</b>	<b>65996</b>	<b>126438</b>	<b>26736</b>	<b>13133</b>	<b>773</b>	<b>40642</b>	

Table I-5. Comparison of MRFSS interviews and MRD reports.

Category	MRFSS interviews		MRD reports	Difference
Number of anglers		193	190	+2%
Total hours fished		292.5	189.5	+54%
Total catch (number of fish)		482	577	-16%
King mackerel		253	255	-
Spanish mackerel		18	26	-31%
Barracuda		20	32	-38%
Little tunny	(21)		(29)	
Bonito	(5)	28	(0)	-3%
Blackfin tuna	(2)		(0)	
Bluefish		1	4	-75%
Dolphin		10	8	+25%
Yellowfin tuna		11	8	+38%
Wahoo		3	3	-
Black sea bass		45	115	-61%
Groupers		28	27	+4%
Porgies		16	19	-16%
Snappers		6	2	+200%
Grunts		5	0	-
Triggerfish		3	2	+50%
Amberjacks		5	7	-29%
Spedefish		3	0	-
Sharks		1	2	-50%
Red drum		5	26	-80%
Spotted seatrout		18	11	+64%
Weakfish		0	1	-
Flounders		1	0	-
Unidentified		2	0	-

Many charterboat anglers were tired and/or somewhat inebriated when interviewed and nearly all had little fishing experience or knowledge of fish identified. Many boat captains (or their agents) completed their reports at the end of the month based on brief notes in their logs. Given these factors, a high incidence of complete agreement in the content of interviews and corresponding reports would not be expected. The usual difference in the number of anglers reported was  $\pm$  one individual. The large discrepancy in hours fished reflected the fact that anglers always indicated the total duration of their trip whereas the boat operators reported only the time spent fishing.

There was generally good agreement as to the species sought, since relatively few were targeted. Agreement on catches varied considerably. Bottomfish presented problems. Several species were usually encountered with their identities not well known to the anglers. This caused confusion during the interviews as to what was actually caught and how many of them, particularly when large percentages (such as of black sea bass and grunts) were released. Pelagic species caused fewer problems because they were fewer in number, less numerous in the catch, more easily recognizable, and usually retained. The principal problem group was the small tunas (i.e., bonito, little tunny, and blackfin tuna). These frequently were referred to as bonito (uncommon off South Carolina), although most of the fish probably were little tunny.

Most significant from a practical perspective was the high level of agreement in the overall numbers of anglers and the catch of the principal species, king mackerel. The overall catch of all species combined was in fairly good agreement as well if black sea bass were omitted.

Given these more or less similar results, it is discouraging that there were such large differences between the NMFS estimates of participation (anglers), effort (trips), and catches (particularly of king mackerel) and the figures reported to the MRD. Although a few active boats did not submit reports, they represented an insignificant part of the overall charterboat fleet. It is reasonable to assume, given the newness of the system and reluctance on the part of some operators to provide the required information, that some operators deliberately falsified their reports (most probably by withholding records for some of their trips). It is less likely that they reported the numbers of boat trips accurately but under-reported the numbers of anglers and/or fish. Regardless of the form, such under-reporting would have had to have occurred on a very large scale to account for the observed discrepancies.

We believe that the NMFS substantially overestimated the numbers of anglers (= trips), perhaps based on information from the phone survey. For example, the MRFSS data for wave 4 suggested that the typical boat made 31 trips during the 60-day interval. Relatively few boats made more than one trip per day regularly and many boats apparently sailed only once or twice a week, based on dockside visits to popular locations and interviews of marina operators. We

frequently had difficulty obtaining interviews according to the assignment schedule because of limited activity. The suggestion that the roughly 100 operating vessels averaged as many trips per wave as implied by the MRFSS data seemed very unrealistic when considered in conjunction with other information.

The distribution of trips by area appeared to be somewhat misrepresentative in the MRFSS with unduly low percentages for the inland and ocean <3 mi. areas in the samples. This may have contributed to the apparently excessive numbers of king mackerel and absence of sharks (a popular target and frequent catch of charterboat anglers in inland and coastal waters) in the NMFS catch estimates.

The NMFS king mackerel catch estimate equated to a catch rate (1.69 fish per angler) far higher than that indicated by other sources, including tournament sampling and conversations with boat captains. Most of the landings occurred in waves 4 and 5. The catch rate derived from the NMFS Panama City charterboat survey database was about 1.0 fish per trolling boat hour in wave 4 and 1.5 in wave 5. At an average of four hours of fishing per trip, that would equate to an average of four fish per boat trip in wave 4 and six in wave 5. These catches divided by the average numbers of anglers per boat trip (from Table I-3) corresponded to average catch rates of only about 0.80 and 1.41 fish per angler in waves 4 and 5, respectively.