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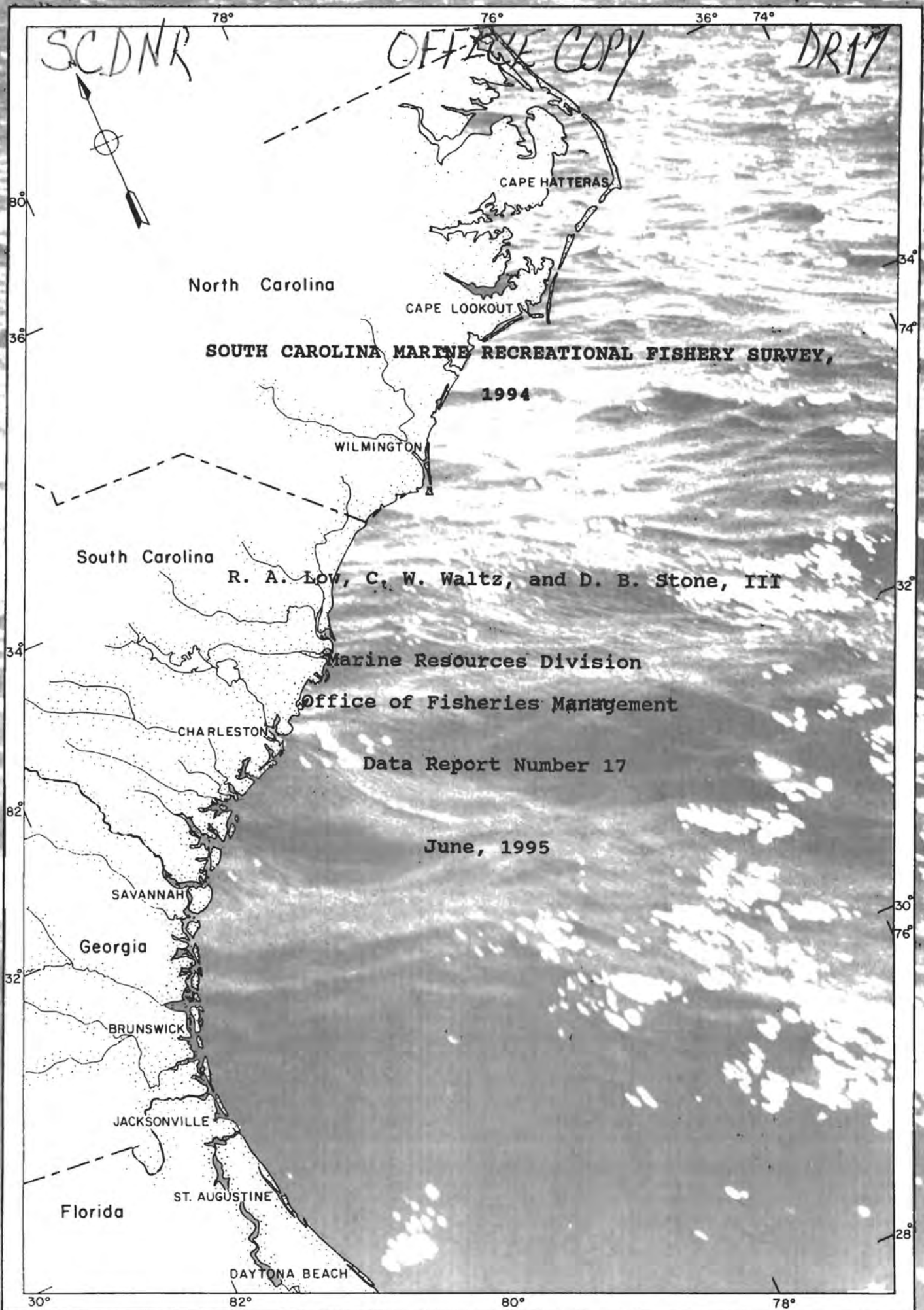


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INTRODUCTION

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 South Carolina's marine fisheries. One instrument used to obtain such information for recreational finfish 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 with the principal objectives of obtaining participation, effort, and catch data on a regional basis.

In 1994, the MRFSS was conducted during March through December. A telephone poll of coastal households by Burke Marketing Research obtained information on participation and effort. An on-site intercept survey or creel census was administered by QuanTech, which contracted the field work to the FSP. Fishermen interviewed included those fishing from shore or manmade shore facilities (docks, piers, bridges), charterboats, and private boats. Headboat fishermen were not included. Fishermen using gear other than hook and line were rarely intercepted and the results of the MRFSS therefore did not pertain to such activities as gill netting, gigging, and spearfishing by divers.

Additional catch and effort data for the private boat mode were collected in a State Finfish Survey. This effort was primarily targeted at fishermen fishing in estuarine areas.

Since July, 1992, private boat anglers have been required to have a marine fishing stamp, but not shore anglers and charterboat passengers. Operators of piers and charterboats obtained permits from the Department of Natural Resources and submitted monthly reports of daily fishing activity to the FSP. Pier operators reported daily attendance, while charterboat captains reported numbers of anglers, hours fished, and catch (numbers by species kept and released) per trip. Headboat operators were required by federal regulations to submit similar reports to the NMFS.

METHODOLOGY

MRFSS procedures for the telephone and intercept surveys were described by Essig et al. (1991) and Van Voorhees et al. (1992). In 1993, the NMFS revised procedures for processing telephone survey data used to estimate effort. These included 1) different guidelines for treatment of proxy data, 2) imputation for missing data, and 3) adjustment of fishing effort data by county for county population. The resulting effort estimates were statistically more reliable than those derived previously and, in South Carolina, were usually higher. The catch estimates derived from the effort data also generally increased when the new procedures were applied.

Early in 1995, the NMFS issued revised historical data sets based on the new calculation methodology. The new estimates generated from these data are contained in this report and are the basis for trend analysis, etc.

Fundamental field procedures for the intercept survey have remained basically unchanged since 1987, the first year of recent MRD participation. Minor modifications have been made to the annual questionnaires. The sampling schedule, provided by QuanTech, was based on historical usage patterns by fishing mode and sampling wave. Sampling waves were two-month intervals beginning with March-April. Site assignments reflected relative usage rates with the most heavily trafficked 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/she then went to the nearest alternative location for that mode. The clerk usually remained on-site until the day's MRFSS quota (30 interviews) was obtained or further effort appeared unwarranted. SFS sampling followed similar procedures, although selection of alternate sites was left completely to the discretion of the creel clerk.

FSP staff obtained MRFSS interviews at 25 shore sites, 8 charterboat docks, and 25 public boat ramps or landings (Table 1). SFS data were collected at 25 sites as indicated in Table 2. Although these visits were scheduled by the FSP, their distribution was largely determined by MRFSS assignments because of logistical considerations.

MRFSS interviews were conducted in accordance with procedures and guidelines established by the NMFS and QuanTech. An MRFSS interview pertained to an individual fisherman with all members of a fishing party usually being interviewed (there were exceptions, particularly with charterboat groups). An SFS interview was a trip interview and often included more than one angler.

Information obtained included the number of anglers in the party, hours spent fishing, area fished, targeted species, and residency of the respondent. Catch data consisted of the numbers of fish caught by species and their disposition (i.e., retained, discarded dead, released alive, given away, or used for bait). Up to 20 fish of each species were weighed and/or measured per catch.

FSP staff coded and edited MRFSS interview forms and forwarded them to QuanTech for additional processing. QuanTech provided summaries of intercept survey wave data and Burke Marketing Research furnished compilations of information from the phone surveys. The NMFS provided estimates of participation and effort. The NMFS also supplied estimates of the total numbers of fish caught by species and wave based on expansions of creel census catch rate data and total numbers of trips.

Table 1. Distribution of 1994 MRFSS interviews by site and wave.

Mode	County	Site	Wave					Total	
			2	3	4	5	6		
Shore	Beaufort	Broad River pier	8	58	0	0	0	66	
		Hunting Is. pier	6	7	27	0	25	65	
		Port Royal pier	7	7	12	0	3	29	
		Station Creek	0	2	1	5	1	9	
		Lady's Island	0	5	0	0	0	5	
		Eddings Point	0	0	4	0	0	4	
		E.C. Glenn	0	0	0	0	1	1	
	Charleston	Crosby's pier	9	15	0	0	5	29	
		Limehouse dock	14	4	2	0	0	20	
		Breach Inlet Br.	0	0	13	0	0	13	
		Church Creek Br.	7	2	0	0	0	9	
		Bowens Island dock	0	4	0	4	0	8	
		Brittlebank pier	2	0	0	3	2	7	
		Steamboat dock	4	0	0	0	0	4	
		Bohicket Marina	3	0	0	0	0	3	
		Wappoo Cut	0	0	2	0	0	2	
		Dawhoo dock	0	0	2	0	0	2	
	Georgetown	Midway Inlet	0	0	0	20	0	20	
		Murrells In. jetty	0	0	5	2	0	7	
	Horry	Garden City pier	43	48	18	0	16	125	
		Surfside pier	0	25	33	34	9	101	
		Springmaid pier	8	17	1	38	4	68	
		Myrtle Bch. pier	0	2	22	35	3	62	
		Cherry Grove pier	0	0	9	14	17	40	
		2nd Avenue pier	0	0	16	0	0	16	
	Charterboat	Beaufort	Shelter Cove	40	16	20	39	22	137
			Palmetto Bay	0	9	0	4	6	19
			Fripp Is. marina	0	0	4	0	5	9
Harbor Town marina			0	0	6	0	0	6	
Charleston		Bohicket marina	13	22	16	0	0	51	
		Wild Dunes marina	0	6	5	0	0	11	
Georgetown		Capt. Dick's marina	6	5	7	13	4	35	
		Voygers View marina	5	3	7	0	0	15	
Private boat		Beaufort	Russ Point	20	6	18	19	0	63
			Port Royal	0	14	20	12	14	60
			Broad River	8	36	4	0	3	51
			Station Creek	2	3	28	5	13	51
			Eddings Point	0	0	0	5	15	20
	C.C. Haigh		9	0	4	2	0	15	
	E.C. Glenn		0	0	4	0	5	9	

Mode	County	Site	Wave					Total
			2	3	4	5	6	
		Paige Point	0	0	0	0	4	4
		Wimbee	0	0	2	2	0	4
		Brickyard Point	0	3	0	0	0	3
		Lady's Island	0	2	0	0	0	2
		Fripp Island marina	2	0	0	0	0	2
		Orange Grove	2	0	0	0	0	2
	Colleton	Live Oak	0	3	0	12	0	15
		Bennetts Point	0	0	1	0	0	1
	Charleston	Remleys Point	17	8	38	16	0	79
		Limehouse	17	3	26	1	7	54
		Wappoo Cut	0	5	30	5	0	40
		Folly River	10	0	5	5	8	28
		Sol Legare	3	0	0	0	0	3
		Wild Dunes	0	0	0	0	2	2
		Paradise island	0	0	0	1	0	1
	Georgetown	Murrells Inlet	42	74	73	80	19	288
		South Island	0	13	0	0	9	22
		Boulevard	0	0	6	4	0	10

Table 2. Distribution of 1994 SFS interviews by site and wave.

County	Site	Wave						Total
		1	2	3	4	5	6	
Beaufort	Russ Point	7	6	15	4	16	0	48
	Station Creek	4	0	10	16	15	0	45
	Sam's Point	3	7	12	7	7	6	42
	Eddings Point	0	5	21	1	12	0	39
	Port Royal	0	5	0	6	24	0	35
	C.C. Haigh	0	0	0	13	0	0	13
	Lady's Island	0	0	2	10	0	0	12
	Parris Island	0	0	0	10	0	0	10
	Broad River	2	0	0	0	7	0	9
	All Joy	0	0	0	6	0	0	6
	E.C. Glenn	0	0	0	0	4	2	6
	Gray's Hill	0	2	0	0	3	0	5
	Paige Point	0	0	0	5	0	0	5
	Orange Grove	2	0	0	0	0	0	2
Colleton	Live Oak	0	1	0	0	5	0	6
	Bennetts Point	2	0	0	0	3	0	5
Charleston	Remleys Point	21	4	15	1	23	0	64
	Wappoo Cut	7	4	7	0	24	0	42
	Wild Dunes	13	0	0	0	0	0	13
	Sol Legare	0	0	5	0	6	0	11
	Steamboat	0	0	0	0	6	0	6
	R.E. Ashley	3	0	0	0	0	0	3
	Limehouse	1	0	0	0	1	0	2
	Folly River	0	0	0	0	1	0	1
	Dawhoo	0	0	0	0	1	0	1
Georgetown	Murrells Inlet	2	0	0	28	25	3	58
	Boulevard	0	6	0	12	0	0	18
	South Island	0	0	0	7	9	0	16

All data from the SFS were processed by the FSP. The FSP also calculated estimates of catch per unit of effort (CPUE) for species of interest, using data from both the MRFSS and SFS. CPUE was calculated by adding the total number of fish caught on targeted trips and dividing this figure by the total number of anglers on those trips. A targeted trip was one in which the species was either identified as the species preference or at least one was caught.

In cases where catches were pooled for a fishing party, e.g. a charterboat group, and anglers couldn't recall how many fish each had caught, the group catch was divided by the number of fishermen to obtain CPUE. It should be emphasized that the numbers and kinds of fish not inspected by the creel clerks (e.g. released or discarded catch) could not be verified.

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 contacted 7,139 eligible households during waves 2-6 (March-December). In the MRFSS creel census, QuanTech accepted 1,836 interviews.

Charterboat anglers represented 15% of the creel census sample population, shore anglers 39%, and private boat fishermen 46%. About 62% of the charterboat sample came from Beaufort County, 22% from Charleston County, and 18% from Georgetown County. Fishermen on the Grand Strand (Horry County) piers represented 57% of the shore mode group. The distribution of the private boat sample by county was 39% Georgetown County, 34% Beaufort County, and 25% Charleston County.

Distribution of the MRFSS interviews by fishing area, wave, and mode is shown in Table 3. About 61% of the shore fishermen interviewed were fishing in the ocean (mostly from the Grand Strand piers) with 39% fishing in inland waters. About 28% of the charterboat anglers had been fishing in inland areas, 17% in coastal ocean waters, and the remaining 55% offshore. The vast majority (88%) of the private boat fishermen had been fishing inland waters. About 8% had fished offshore and 4% in coastal ocean areas.

Allocation of survey effort and costs is summarized in Table 4. MRFSS and SFS interviews were not directly additive, since the SFS interviews were primarily group interviews (2X would be a reasonable conversion factor to individual interviews).

Table 3. Distribution of MRFSS creel census interviews by wave, mode, and fishing area. Source: QuantTech.

Area	Wave	Shore	Charterboat	Private boat	Total
Inland	2	58	5	111	174
	3	103	19	165	287
	4	63	24	217	304
	5	12	8	151	171
	6	44	22	91	157
	All	280	78	735	1,093
Ocean < 3 mi.	2	51	16	2	69
	3	94	10	0	104
	4	103	0	19	122
	5	143	16	12	171
	6	49	6	3	58
	All	440	48	36	524
Ocean > 3 mi.	2	0	36	19	55
	3	0	32	4	36
	4	0	41	32	73
	5	0	32	9	41
	6	0	9	5	14
	All	0	150	69	219
All		720	276	840	1,836

Table 4. Survey logistics.

Survey	Characteristic	Wave					All
		1/2	3	4	5	6	
MRFSS	Interviews	298	427	499	383	229	1,836
	On-site hrs	164.75	189.00	208.00	126.00	168.25	856.00
	Travel hrs	204.25	179.00	212.75	144.00	212.25	952.25
	Miles	5,117	5,842	6,228	4,562	4,694	26,443
SFS	Interviews	110	82	143	177	11	523
	On-site hrs	218.25	56.75	92.50	142.50	10.50	738.75
	Travel hrs	262.00	46.25	75.00	122.25	8.00	513.50
	Miles	3,913	960	1,905	2,813	140	9,731
Total	Interviews	408	509	642	560	240	2,359
	On-site hrs	383.00	245.75	300.50	268.50	178.75	1594.75
	Travel hrs	466.25	225.25	287.75	266.25	220.25	1465.75
	Miles	9,030	6,802	8,133	7,375	4,834	36,174

Participation

Nine percent of the coastal households contacted during the MRFSS phone survey contained a member who had gone salt water sport fishing during the last two months. At least one member had gone salt water sport fishing during the past year in 18.4% of all eligible households. Table 5 lists the positive response rates per wave compared with those from previous years.

Coastal residents comprised the majority (52%) of the anglers interviewed in the MRFSS (Table 6). They were the predominant group in the private boat (72%) and shore (47%) modes. Out of state residents represented 34% of the total sample population and the vast majority (83%) of the charterboat fishermen.

During July through December, 1994, a total of 73,095 salt water fishing stamps was sold to private boat anglers. Six-passenger charterboat permits were acquired by 137 individuals (= number of boats) with 25 permits issued to vessels (mostly headboats) with larger passenger capacities. Nine fishing piers obtained permits.

Total participation was estimated at 859,000 fishermen. Coastal residents (457,000) comprised the largest group (53%). Out of state anglers (247,000) represented 29% and noncoastal residents 18%.

Effort

Total effort was estimated at 1.908 M trips, distributed by wave, mode, and residential category as indicated in Table 7. Coastal residents contributed 59% of the effort, out of state anglers 27%, and noncoastal residents 14%. Distribution of effort by mode and fishing area is shown in Table 8.

Respondents in the phone survey were asked to specify the number of trips made in each mode. About 62% of the total trips reported had been made in the private boat mode with 35% being shore trips. About 3% of the total effort consisted of charterboat trips with only 0.3% having been headboat trips.

The average numbers of trips (= days fished) made per angler in each wave and mode as reported in the phone survey are indicated in Table 9. The annual figures are based on wave 6 responses to the question, "how many days did you fish in the last twelve months?" as a proxy for the year's total effort.

The time of day of fishing as reported in the phone survey is shown in Table 10. The distribution of creel census interviews is shown for comparison. About 10% of the trips reported in the phone survey were made between midnight and noon, when there was no on-site sampling. About 38% occurred after 6:00 PM, whereas only 1% of the on-site interviews was conducted then.

Table 5. Percentage of coastal households contacted during the MRFSS phone survey that contained a member who went salt water sport fishing during the indicated wave. Source: QuanTech.

Year	Wave				
	2	3	4	5	6
1987	5.9	9.4	8.8	9.1	8.4
1988	7.0	6.7	10.2	NA	NA
1989	7.5	5.5	7.1	5.7	5.1
1990	5.8	7.6	5.6	6.7	5.7
1991	5.6	8.7	9.2	8.4	7.6
1992	6.9	7.3	8.1	8.7	5.3
1993	6.3	8.8	10.2	9.8	7.4
1994	6.8	9.8	9.1	11.4	7.4

Table 6. MRFSS creel census interviews by residence, in numbers of anglers interviewed. C-coastal, NC-noncoastal, OOS- out of state. Source: QuanTech.

Wave	Shore			Charterboat			Private boat		
	C	NC	OOS	C	NC	OOS	C	NC	OOS
2	55	16	38	0	8	49	95	11	26
3	101	29	67	6	8	47	126	22	21
4	75	21	70	0	13	52	187	26	55
5	70	24	61	5	6	45	114	34	24
6	40	27	26	0	0	37	81	11	7
All	341	117	262	11	35	230	603	104	133

Table 7. Estimated recreational fishing trips by wave and residency (finfish only, excluding headboats).
Source: NMFS.

Wave	Mode	Residency			Total
		Coastal	Noncoastal	Out of state	
2	Shore	91,085	26,498	62,931	180,515
	Charterboat	0	0	0	0
	Private boat	96,930	11,223	26,528	134,862
	All	188,015	37,721	89,459	315,377
3	Shore	111,103	31,901	73,702	216,706
	Charterboat	3,746	4,510	22,014	30,270
	Private boat	151,656	26,480	25,276	203,412
	All	266,505	62,891	120,992	450,388
4	Shore	68,606	19,210	64,033	151,849
	Charterboat	0	0	0	0
	Private boat	180,185	25,052	52,996	258,233
	All	248,791	44,262	117,029	410,082
5	Shore	101,059	30,879	85,619	217,557
	Charterboat	3,056	3,578	19,005	25,639
	Private boat	203,815	45,479	40,426	289,720
	All	304,874	79,936	145,050	532,916
6	Shore	52,755	35,609	34,290	122,654
	Charterboat	0	0	0	0
	Private boat	62,772	8,525	5,425	76,722
	All	115,527	44,134	39,715	199,376
All	Shore	424,608	144,097	320,576	889,281
	Charterboat	6,801	8,087	41,020	55,909
	Private boat	695,358	116,760	150,651	962,769
	All	1,126,767	268,944	512,247	1,907,959

Table 8. Estimated recreational fishing trips by fishing area and mode (finfish only, excluding headboats).

Mode	Fishing area		
	Inland	Ocean < 3 mi.	Ocean > 3 mi.
Shore	341,859	547,421	0
Charterboat	13,091	12,288	30,530
Private boat	845,814	42,886	74,069
Total	1,200,764	602,595	104,599

Table 9. Average trips per angler by mode and wave. Source: Burke Marketing Research.

Wave	Shore	Mode	
		Charterboat	Private boat
2	1.95	0.02	2.51
3	3.64	0.05	4.28
4	4.98	0.20	5.51
5	6.65	0	5.53
6	2.78	0	5.90
Annual	16.16	0.57	29.89

Table 10. Time of day of fishing. Sources: QuanTech and Burke Marketing Research.

Wave	0-3	Morning			Afternoon		Evening	
		3-6	6-9	9-12	12-3	3-6	6-9	9-12
Trips from phone survey								
2	1	0	61	14	43	118	136	8
3	13	2	21	16	76	219	278	12
4	21	4	4	46	115	297	240	63
5	26	3	6	12	88	283	209	25
6	9	0	5	11	31	119	57	5
On-site survey interviews								
2	0	0	0	29	149	116	4	0
3	0	0	0	24	233	170	0	0
4	0	0	0	23	230	232	14	0
5	0	0	0	17	150	215	1	0
6	0	0	0	15	157	57	0	0

Table 11. Number of private boat trips by type of access (from phone survey). Source: Burke Marketing Research.

Type of access	Wave					Total
	2	3	4	5	6	
Public						
launching ramp	106	243	305	333	80	1,067
boat slip	21	48	13	84	21	187
mooring dock	2	13	36	10	4	65
other	0	18	18	2	3	41
Private						
personal dock	14	71	45	91	22	243
locked marina	24	7	29	10	5	75
unlocked marina	1	25	67	11	3	107
other	0	1	3	0	0	4

Respondents to the phone survey were asked whether they had used public access points or private facilities on their private boat trips. Distribution by point of origin is shown in Table 11. About 76% of the trips originated from public locations. Public launching ramps were the most commonly used type of access, accounting for 60% of all private boat fishing trips.

Species Preferences

Most of the shore fishermen expressed no species preference. Spot was the most popular target of shore fishermen, particularly those fishing from the ocean piers.

Species preferences of charterboat anglers were determined from mandatory trip reports submitted to the FSP. Table 12 lists the results. One-third of the inland anglers identified sharks as their target. The next most popular species was red drum, specified by 15%. About 32% of the inland charterboat fishermen indicated no species preference.

In coastal waters, sharks were the predominant target, sought by roughly half of the fishermen. Spanish mackerel and tarpon were the next most preferred species. About 10% of the coastal charterboat anglers expressed no species preference.

Mackerels were the primary targets of offshore charterboat anglers with 39% seeking king mackerel and 12% targeting Spanish mackerel. About 32% of the offshore anglers indicated no species preference with most engaged in surface trolling.

Preferences indicated by private boat anglers in both surveys were similar and the data were combined in Table 13. Red drum and spotted seatrout were the most popular choices in inland areas, being specified by 24% and 19% of all fishermen interviewed, respectively. Flounders were the third choice, identified by 14% of the inland private boat anglers. No other species exceeded 5%. About 28% indicated no species preference.

The majority of the private boat ocean fishermen were interviewed at the Murrells Inlet ramp in Georgetown County. In coastal ocean waters, flounders were the most preferred species (17% of those fishermen interviewed). Spanish mackerel and spot each had 11% and red drum 8%. About 35% of the fishermen indicated no species preference. Offshore fishermen primarily targeted king mackerel (37% of those anglers interviewed) with black sea bass the second choice (14%). About 25% of the offshore fishermen had no preference.

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

Table 12. Species preferences of charterboat anglers. Source: MRD trip reports.

Fishing area	Species	Number of anglers
Inland	Sharks	1,551
	Red drum	702
	Spotted seatrout	319
	Tarpon	192
	Flounder	134
	Cobia	109
	Spanish mackerel	65
	Sheepshead	62
	Spot	14
	Kingfishes	6
	Crevalle jack	2
	Any	1,462
	Total	4,618
	Ocean < 3 miles	Sharks
Tarpon		466
Spanish mackerel		520
Sheepshead		285
King mackerel		282
Red drum		249
Bluefish		80
Black sea bass		67
Cobia		64
Flounders		16
Spotted seatrout		9
Black drum		9
Weakfish		3
Kingfishes		4
Any	514	
Total	5,090	
Ocean > 3 miles	King mackerel	6,362
	Spanish mackerel	2,015
	Grouper	553
	Dolphin	384
	Black sea bass	371
	Sharks	366
	Tunas	326
	Marlin	201
	Barracuda	137
	Sheepshead	131
	Amberjack	110
	Cobia	78
	Spadefish	56
Red drum	27	

Fishing area	Species	Number of anglers
	Wahoo	20
	Snapper	14
	Tarpon	8
	Swordfish	4
	Bluefish	5
	Red porgy	3
	Any	5,630
	Total	16,467

Table 13. Species preferences by fishing area and county of private boat fishermen interviewed in the MRFSS and SFS, in numbers of anglers.

Area	Target species	BFT	COL	CHS	GTN	HOR	Total
Inland							
	Red drum	162	17	173	51	0	403
	Spotted seatrout	196	10	93	20	0	319
	Flounders	63	0	28	130	2	223
	Sheepshead	33	0	38	3	0	74
	Spot	5	0	8	58	0	71
	Sharks	49	0	5	2	0	56
	Cobia	17	0	0	0	0	17
	Crevalle jack	0	0	7	0	0	7
	Kingfishes	5	0	1	0	0	6
	Weakfish	5	0	0	0	0	5
	Tarpon	2	0	0	2	0	4
	Catfish	0	0	3	0	0	3
	Any	212	8	128	111	0	459
	Total	749	35	484	377	2	1647
Ocean < 3 miles							
	Flounders	0	0	0	22	0	22
	Spot	0	0	0	15	0	15
	Spanish mackerel	0	0	0	14	0	14
	Red drum	2	0	0	9	0	11
	Black sea bass	0	0	6	0	0	6
	Sharks	0	3	3	0	0	6
	King mackerel	0	0	1	3	0	4
	Spotted seatrout	0	0	0	3	0	3
	Tarpon	0	0	2	0	0	2
	Kingfishes	0	0	0	2	0	2
	Sheepshead	0	0	0	2	0	2
	Any	3	0	7	36	0	46
	Total	5	3	19	106	0	133
Ocean > 3 miles							
	King mackerel	2	0	8	29	0	39
	Black sea bass	8	0	4	3	0	15
	Sharks	6	2	0	0	0	8
	Spanish mackerel	0	0	0	6	0	6
	Spadefish	0	0	5	0	0	5
	Sheepshead	3	0	0	0	0	3
	Grouper	2	0	0	0	0	2
	Flounders	0	0	0	2	0	2
	Any	7	0	0	19	0	26
	Total	28	2	17	59	0	106

catches (variability), and the frequency of occurrence of unusually large or small catches (probability distribution).

Misidentification and confusion over common names can cause substantial errors in the estimated landings of similar species when the creel clerks are unable to inspect the catches. For species having large percentages of the catch unavailable for such inspection, the estimated total landings can be highly inaccurate. For the most frequently caught species, relative ranking and trends in catch appear to be reasonably reliable; however, caution should be exercised in quantitative applications of the absolute numbers.

The estimated total catch of marine fish was 7.886 M fish. Disposition is shown in Table 14. Landings by wave are listed in Table 15. Distribution by fishing area is indicated in Table 16. The numbers for some species, particularly pinfishes, were extremely high by historical standards and were probably greatly exaggerated.

Oceanic pelagics comprised a very small part of the overall landings. Dolphin was the principal species. Most of the catch was accounted for by charterboat fishermen.

Landings of reef fish consisted predominantly of black sea bass. Much of this catch, particularly in inland waters, consisted of very small sea bass which were released. The high estimate for spottail pinfish was probably attributable to sampling error. No landings were reported for red porgy and vermilion snapper, although charterboat reports submitted to the MRD listed both species.

Spanish mackerel and bluefish dominated catches of coastal pelagic species, particularly in the nearshore ocean (< 3 mi.) zone. Relatively large percentages of the catch of both species were released with the majority of bluefish being < 2 pounds. Pier fishermen contributed substantially to the landings of both species.

Most of the inshore sportfish catch was taken by private boat anglers with red drum and spotted seatrout the principal components. Relatively high percentages of the landings of both species were released (75% for red drum and 66% for spotted seatrout). The flounder catch consisted mostly of southern flounder; at least 75% of the unclassified landings (mostly released) probably consisted of this species.

Inshore bottomfish, particularly spot, were the principal target of shore fishermen and the major part of their catch. Kingfishes and spot were usually targeted with croaker an incidental catch.

Identification of sharks was questionable, since so many were released. Small species such as sharpnose and bonnethead appeared

Table 14. Estimated total catch (in thousands of fish) by South Carolina anglers in 1994 (excluding headboat landings). NR - None Reported. Source: NMFS.

Category	Retained or discarded dead	Released	Total
Oceanic Pelagics			
Dolphin	8	0	8
Wahoo	< 1	0	< 1
Yellowfin tuna	5	0	5
Reef Fish			
Black sea bass	124	356	480
Groupers	1	0	1
Porgies	3	0	3
Snappers	NR	NR	NR
White grunt	6	0	6
Tomtate	5	0	5
Triggerfish	1	0	1
Spadefish	5	1	6
Spottail pinfish	36	201	236
Sand perch	0	21	21
Amberjacks	2	5	7
Coastal Pelagics			
King mackerel	26	2	28
Spanish mackerel	95	209	304
Bluefish	118	132	250
Crevalle jack	0	6	6
Barracuda	2	2	4
Little tunny/bonito	1	2	3
Cobia	1	2	3
Inshore Sportfish			
Red drum	101	311	412
Spotted seatrout	114	220	334
Weakfish	47	0	47
Summer flounder	11	2	13
Southern flounder	151	1	152
Flounder, unclassified	0	86	86
Sheepshead	47	6	53
Inshore Bottomfish			
Kingfishes	207	81	288
Spot	1,339	329	1,668
Croaker	188	142	330
Black drum	7	0	7
Pompano	8	9	17
Sharks			
Sharpnose	28	23	52
Unclassified	51	266	317
Miscellaneous			
Skates/rays	2	77	79
Catfishes	90	286	376
Toadfish	5	129	134

Category	Retained or discarded dead	Released	Total
Searobins	0	29	29
Pigfish	10	0	10
Pinfish	262	1,241	1,503
Mullet	358	2	360
Puffers	0	45	45
Other	19	177	196

Table 15. Estimated total catch (in thousands of fish) by wave.
NR - None Reported. Source: NMFS.

Category	Wave				
	2	3	4	5	6
Oceanic Pelagics					
Dolphin	NR	8	NR	NR	NR
Tunas/other	NR	4	2	3	NR
Reef Fish					
Black sea bass	147	29	107	182	16
Groupers	NR	NR	< 1	< 1	NR
Porgies	2	NR	NR	NR	NR
Grunts	NR	NR	5	< 1	5
Triggerfish	1	NR	NR	NR	NR
Spadefish	NR	4	1	1	NR
Spottail pinfish	7	61	137	NR	7
Sand perch	NR	NR	7	14	NR
Amberjacks	NR	NR	2	5	NR
Coastal Pelagics					
King mackerel	1	12	3	9	3
Spanish mackerel	NR	50	129	125	NR
Bluefish	44	20	25	154	6
Creville jack	NR	NR	4	2	NR
Barracuda	NR	NR	4	NR	NR
Little tunny/bonito	NR	NR	NR	3	NR
Cobia	NR	3	NR	NR	NR
Inshore Sportfish					
Red drum	10	25	159	171	47
Spotted seatrout	NR	32	72	187	43
Weakfish	NR	NR	< 1	46	NR
Summer flounder	NR	NR	5	8	NR
Southern flounder	4	69	44	31	3
Flounder, unclassified	8	27	20	31	NR
Sheepshead	27	2	8	10	7
Inshore Bottomfish					
Kingfishes	17	70	67	86	48
Spot	80	137	110	420	921
Croaker	48	23	77	181	NR
Black drum	NR	5	1	NR	2
Pompano	NR	3	NR	14	NR
Sharks					
Unclassified	10	235	78	47	NR
Miscellaneous					
Skates/rays	7	19	35	14	5
Catfishes (marine)	25	114	129	102	6
Toadfish	29	37	21	44	4
Searobins	6	NR	18	5	NR
Pigfish	NR	NR	5	5	NR
Pinfish	4	61	111	1,196	68
Mullet	204	34	< 1	88	33
Puffers	2	7	10	26	NR

Table 16. Estimated total catch (in thousands of fish) by fishing area. Source: NMFS.

Category	Inland	Ocean < 3 mi.	Ocean > 3 mi.
Oceanic Pelagics			
Dolphin	0	0	8
Tunas/other	0	2	7
Reef Fish			
Black sea bass	183	25	273
Groupers	0	0	1
Porgies	0	0	3
White grunt	0	0	6
Tomtate	0	0	5
Triggerfish	0	0	1
Spadefish	0	3	3
Amberjack	0	0	7
Coastal Pelagics			
King mackerel	4	8	16
Spanish mackerel	13	225	65
Bluefish	58	168	24
Crevalle jack	6	0	< 1
Barracuda	0	0	4
Little tunny/bonito	0	0	3
Inshore Sportfish			
Red drum	400	12	0
Spotted seatrout	334	0	0
Weakfish	0	47	0
Summer flounder	11	2	0
Southern flounder	134	18	0
Flounder, unclass.	65	21	0
Sheepshead	50	1	2
Inshore Bottomfish			
Kingfishes	108	180	0
Spot	828	835	5
Croaker	103	225	< 1
Black drum	6	0	2
Pompano	0	17	0
Sharks			
Unclassified	185	132	52
Miscellaneous			
Skates/rays	76	3	0
Catfishes (marine)	327	37	12
Toadfish	125	6	3
Searobins	4	11	15
Pigfish	5	0	5
Pinfishes	822	842	76
Mullet	239	121	0
Puffers	34	7	4

to be the major catch components, although blacktips were commonly cited by boat anglers in coastal waters.

Shore Mode

The majority of the anglers interviewed were fishing off the Grand Strand piers or inland bridges and docks. Very few bank or surf fishermen were intercepted. Although most of the piers operated 24 hours a day during the season, there was no night sampling.

Pier operators reported a total attendance of 204,113 anglers. Six of the piers exceeded 20,000 fishermen in annual attendance. The peak season was July-September (91,542 anglers), followed by the fall (October-December) with 59,321 fishermen. Most of the facilities were closed during January and February.

The total estimated shore catch (Table 17) largely reflected what was caught on the Grand Strand beachfront piers. Principal species included inshore bottomfish, Spanish mackerel, bluefish, and sharks. The fall run of spot was the major attraction for the piers with over half of the annual shore catch of this species landed during wave 6. Spanish mackerel and bluefish were significant in the summer.

Charterboat Mode

This discussion is based on data submitted by operators under the state's mandatory reporting system. The appendix contains a comparison of these results with those from the MRFSS and evaluation of the reliability of the two data sets.

During calendar year 1994, 175 vessels (excluding those designated as headboats by the NMFS) were permitted for at least one month. Distribution of the fleet by length and port location was as follows:

	Length (ft)				
	< 20	20-26	27-31	32-40	> 40
Beaufort County/GA.	3	24	6	15	5
Charleston County	11	15	8	10	20
Georgetown County	0	6	6	8	6
Horry County/N.C.	1	2	9	12	3

Length and/or location were unknown for five vessels.

A total of 147 boats reported making at least one trip in 1994, carrying 26,175 anglers. Participation by season and fishing area is shown in Table 18. Operators reported 5,951 trips, distributed by length category and port location as follows:

Table 17. Estimated total shore catch (in thousands of fish) by wave. NA - Not Available. Source: NMFS.

Category	Wave					All
	2	3	4	5	6	
Reef Fish						
Black sea bass	0	2	2	1	0	5
Spadefish	NA	NA	NA	NA	NA	3
Coastal Pelagics						
King mackerel	0	6	0	0	0	6
Spanish mackerel	0	31	56	105	0	192
Bluefish	41	8	10	95	0	154
Cobia	NA	NA	NA	NA	NA	2
Inshore Sportfish						
Red drum	3	1	6	3	7	20
Weakfish	0	0	< 1	46	0	47
Summer flounder	0	0	3	0	0	3
Southern flounder	3	6	3	10	3	24
Flounder, unclass.	0	6	5	15	0	26
Sheepshead	0	0	< 1	1	0	2
Inshore Bottomfish						
Kingfishes	7	50	40	49	38	183
Spot	80	131	68	166	698	1,143
Croaker	48	23	31	13	0	115
Black drum	0	1	0	0	0	1
Pompano	0	3	0	14	0	17
Sharks						
Unclassified	2	150	5	10	0	167
Miscellaneous						
Skates/rays	5	15	2	3	1	26
Catfishes (mar.)	22	44	30	58	1	154
Toadfish	26	29	6	1	1	64
Searobins	3	0	8	0	0	12
Pinfish	3	140	137	481	65	826
Mullet	0	0	0	88	33	121
Puffers	0	4	0	6	0	10

Table 18. Participation (number of anglers) in the 1994 South Carolina charterboat fishery, as reported on daily logsheets.

Fishing area	JAN/MAR	APR/JUN	JUL/SEP	OCT/DEC	Total
Inland	170	1,322	2,529	597	4,618
Ocean < 3 mi.					
natural bottom	96	1,479	2,651	315	4,541
manmade habitat	49	210	227	63	549
Ocean > 3 mi.					
natural bottom	179	5,690	7,055	1,318	14,242
manmade habitat	53	790	1,153	229	2,225
Total	547	9,491	13,615	2,522	26,175

Table 19. South Carolina charterboat trips in 1994, as reported on logsheets.

Fishing area	JAN/MAR	APR/JUN	JUL/SEP	OCT/DEC	Total
Inland	61	360	560	249	1,230
Ocean < 3 mi.					
natural bottom	22	367	642	81	1,112
manmade habitat	12	52	51	17	132
Ocean > 3 mi.					
natural bottom	42	1,183	1,469	258	2,952
manmade habitat	11	193	269	52	525
Total	148	2,155	2,991	657	5,951

	Length (ft)				
	< 20	20-26	27-31	32-40	> 40
Beaufort County/GA.	163	1,157	407	1,410	67
Charleston County	208	428	139	276	337
Georgetown County	0	81	116	160	121
Horry County/N.C.	47	0	381	247	199

Vessels for which length and/or port location were unknown made seven trips. Table 19 lists the distribution of trips by fishing area and season.

About 21% of the boat trips were made in inland areas, 21% in coastal ocean waters, and 58% offshore. Artificial reef trips accounted for 14% of the total ocean effort.

Roughly one-third of the annual effort in inland areas was not targeted at any particular species (Table 20). Sharks were the most popular targeted group in terms of directed effort, followed closely by red drum. Appreciable seasonal effort was also directed at spotted seatrout and tarpon.

In coastal ocean natural bottom areas, sharks were the dominant target group. Over manmade habitat, sheepshead and king mackerel were the principal species preferences.

In the offshore ocean zone, about 37% of the boat hours over natural bottom were not directed at any particular species. King mackerel was the overwhelming choice of trollers, followed by Spanish mackerel, while groupers were the most preferred target of bottom fishermen.

King mackerel was also the dominant preference of anglers trolling over offshore artificial reefs, followed again by Spanish mackerel. Very little effort was directed at bottomfish.

About 30% of the total ocean effort was not targeted at any particular species and consisted of surface trolling. About 30% was directed at king mackerel. About 80% of the directed king mackerel effort occurred over offshore natural bottom and 16% over offshore artificial reefs.

Sharks were the second most targeted group by ocean fishermen (about 10% of the total boat hours). Nearly all of the directed shark fishing consisted of bottom fishing over coastal natural bottom.

Eight percent of the overall ocean effort was directed at Spanish mackerel. About 55% of the directed Spanish mackerel fishing took place over offshore natural bottom, 20% over coastal natural bottom, and 20% over offshore artificial reefs.

About 70% of the total ocean effort as measured in boat hours occurred over offshore natural bottom. Coastal natural bottom

Table 20. Directed 1994 charterboat effort in South Carolina, as reported on daily logsheets. Inland effort is in angler hours, ocean effort is in boat hours.

Species	Inland	Ocean		manmade habitat		Ocean Total
		natural bottom < 3 mi.	> 3 mi.	< 3 mi.	> 3 mi.	
King mackerel	0	136	5,040	112	1,007	6,295
Sharks	2,987	1,877	228	8	21	2,134
Spanish mackerel	190	352	982	84	354	1,772
Tarpon	1,185	661	13	0	0	674
Grouper	0	0	648	0	14	662
Tunas	0	0	616	0	0	616
Dolphin	0	0	608	0	0	608
Sheepshead	215	140	69	119	32	360
Black sea bass	0	23	240	16	52	331
Marlin	0	0	323	0	0	323
Red drum	2,918	194	15	36	13	258
Cobia	581	104	14	3	56	177
Barracuda	0	0	43	0	74	117
Amberjack	0	0	81	0	27	108
Bluefish	0	63	3	0	0	66
Spadefish	0	0	8	0	42	50
Wahoo	0	0	48	0	0	48
Flounder	567	19	0	3	0	22
Snapper	0	0	21	0	0	21
Spot. seatrout	1,302	3	0	17	0	20
Swordfish	0	0	14	0	0	14
Black drum	0	3	0	9	0	12
Red porgy	0	0	8	0	0	8
Weakfish	0	0	0	6	0	6
Kingfishes	12	3	0	0	0	3
Spot	46	0	0	0	0	0
Crevalle jack	16	0	0	0	0	0
Any	5,731	516	5,215	41	415	6,187
Total	15,750	4,094	14,237	454	2,107	20,892

Table 21. South Carolina charterboat landings by season, in numbers of fish reported on trip logsheets.

Species/group	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC	Total
Oceanic Pelagics					
Dolphin	0	2,443	816	101	3,360
Wahoo	0	229	117	11	357
Tunas (except little tunny/bonito)	0	556	237	28	821
Billfishes	0	32	43	1	76
Reef Fish					
Black sea bass	2,289	9,437	7,161	6,085	24,972
Groupers	26	1,098	1,504	870	3,498
Red snapper	21	230	144	73	468
Vermilion snapper	27	2,427	2,910	781	6,145
Other snappers	0	366	813	0	1,179
Red porgy	65	1,138	1,027	307	2,537
Other porgies	6	312	404	243	965
White grunt	3	354	583	204	1,144
Other grunts	5	346	91	171	613
Triggerfish	12	393	546	420	1,371
Spadefish	0	170	220	5	395
Spottail pinfish	12	171	403	141	727
Sand perch	0	181	78	40	299
Amberjack	0	288	721	89	1,098
Coastal Pelagics					
King mackerel	4	2,122	2,930	983	6,039
Spanish mackerel	0	3,884	6,636	282	10,802
Bluefish	0	743	874	214	1,831
Crevalle jack	0	151	786	44	981
Other jacks	0	5	39	8	52
Barracuda	0	469	1,939	47	2,455
Little tunny/bonito	5	185	520	218	928
Cobia	0	152	67	2	221
Inshore Sportfish					
Red drum	318	399	1,116	1,532	3,365
Spotted seatrout	1	208	454	951	1,614
Weakfish	1	35	47	100	183
Flounder	3	270	496	80	849
Sheepshead	761	976	71	201	2,009
Tarpon	0	10	216	2	228
Inshore Bottomfish					
Kingfishes	0	134	528	31	693
Spot	2	19	28	868	917
Croaker	0	11	270	6	287
Black drum	39	114	15	78	246

Species/group	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC	Total
Sharks					
Sharpnose	1	1,983	1,117	10	3,111
Unclassified	22	1,947	4,657	91	6,717
Other					
Rays	1	41	179	8	229
Catfish	3	334	1,118	42	1,497
Toadfish	1	44	58	6	109
Pinfish	1	19	77	57	154
Unclassified/other	2	68	177	173	420

supported 19% with offshore artificial reefs accounting for 9%.

Charterboat landings as reported to the FSP by vessel operators are listed in Table 21.

Aggregate charterboat landings of oceanic pelagic species were slightly below those in 1993 with minor decreases for nearly all species except wahoo. Only 76 billfish were reported compared to 98 in 1993. Most of this decline was attributable to blue marlin. The spring (April-June) quarter was the peak season. Landings for the principal species, dolphin, were higher in both April and June in 1994, but there was a large decrease in the May landings. Inclement weather was probably a significant detractive factor. The total dolphin catch in numbers of fish was down about 2%, while landed weight increased 17% due to the unusually large average size in 1994.

Total numerical landings of the principal reef fish species, black sea bass, increased 21% over the 1993 figure. Numbers of most other species were also up moderately with the aggregate grouper catch 12% larger.

Landings of king mackerel were down 22% from those in 1993. The number of fish caught per boat hour of trolling, while following the same seasonal pattern as in previous years, was consistently lower (Fig. 1). The total Spanish mackerel catch was about the same as in 1993. Monthly catch rates over natural bottom were consistently lower in 1994, while those over artificial reefs were generally higher than in 1993. Overall CPUE was somewhat lower.

Month	Spanish Mackerel						Total CPUE
	Natural bottom			Manmade habitat			
	Fish	Boat hr	CPUE	Fish	Boat hr	CPUE	
APR	281	128	2.20	93	58	1.60	2.01
MAY	565	186	3.04	147	62	2.37	2.87
JUN	1,088	312	3.49	218	52	4.19	3.59
JUL	657	208	3.16	528	120	4.40	3.61
AUG	905	242	3.74	489	80	6.11	4.33
SEP	503	136	3.70	152	29	5.24	3.97
Total	3,999	1,212	3.30	1,654	408	4.05	3.49

The overall number of red drum reported caught in 1994 was 27% greater than the 1993 catch with more effort directed at this species. Much of the catch consisted of large fish that were released. The total catch of spotted seatrout, in contrast, declined 43%. There was much more directed effort for tarpon in 1994 and the catch (nearly all released) increased substantially.

Shark species identities are confusing and the species composition of the reported landings was therefore questionable. The principal components appeared to be sharpnose and blacktips. The overall number of sharks reported caught increased 45% from 1993 with the majority released.

Fig. 1. South Carolina charterboat CPUE for king mackerel.

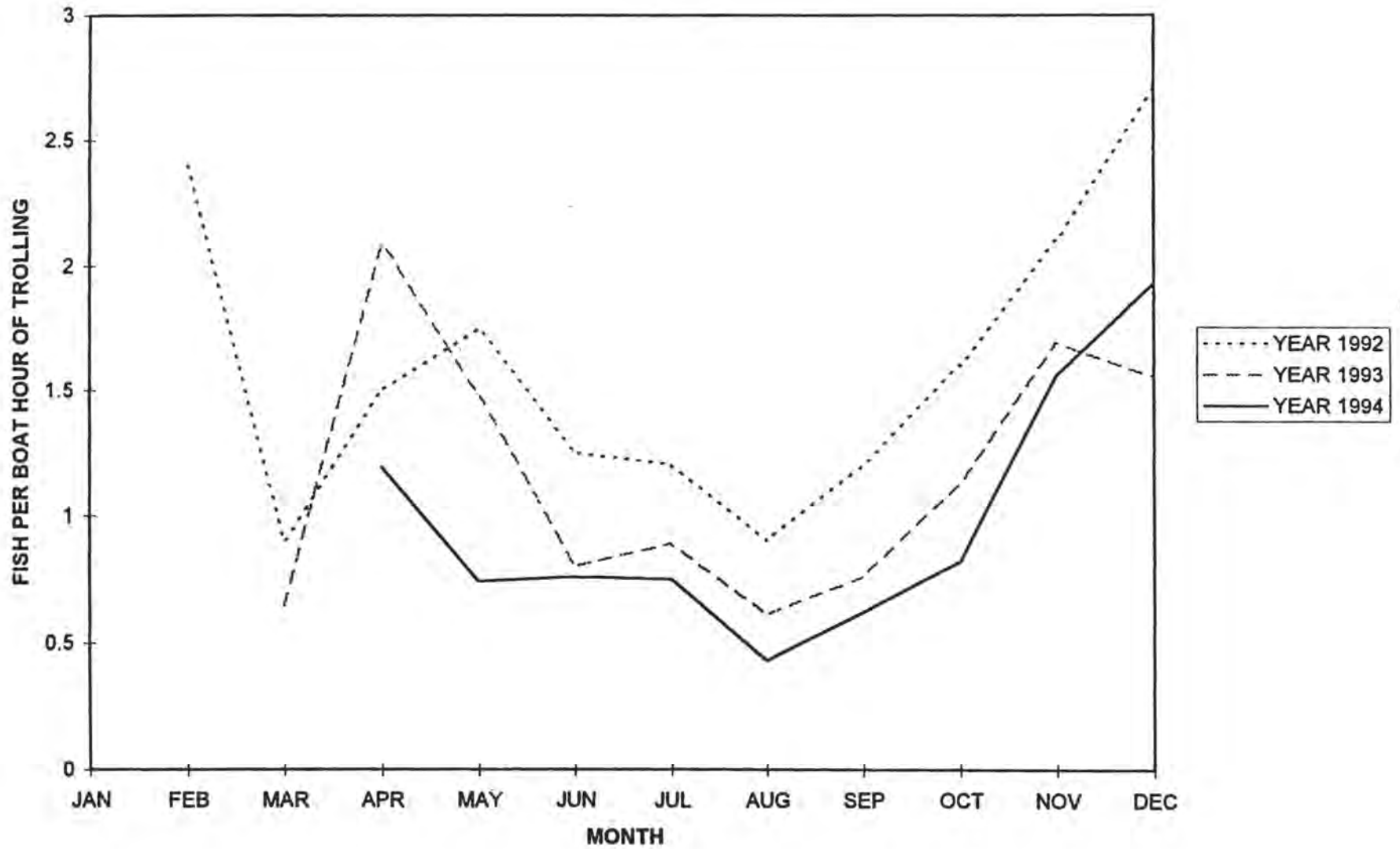


Table 22. Estimated total private boat catch (in thousands of fish) by wave. NA - Not Available. Source: NMFS.

Category	Wave					All
	2	3	4	5	6	
Oceanic Pelagics						
Tunas/other	0	0	2	2	0	4
Reef Fish						
Black sea bass	147	26	105	172	16	467
Groupers	0	0	< 1	0	0	< 1
Porgies	2	0	0	0	< 1	3
White grunt	0	0	0	0	5	5
Tomtate	0	0	5	0	0	5
Triggerfish	1	0	0	0	0	1
Spadefish	NA	NA	NA	NA	NA	2
Spottail pinfish	NA	NA	NA	NA	NA	119
Sand perch	NA	NA	NA	NA	NA	13
Amberjack	0	0	2	0	0	2
Coastal Pelagics						
King mackerel	1	4	3	2	3	12
Spanish mackerel	0	0	73	5	0	78
Bluefish	3	12	15	42	6	79
Crevalle jack	0	0	4	2	0	6
Barracuda	0	0	4	0	0	4
Little tunny/bonito	NA	NA	NA	NA	NA	2
Cobia	0	1	0	0	0	1
Inshore Sportfish						
Red drum	7	24	152	168	40	392
Spotted seatrout	0	32	72	187	43	334
Summer flounder	0	0	2	8	0	10
Southern flounder	1	64	41	22	0	128
Flounder, unclass.	8	22	15	15	0	60
Sheepshead	27	2	7	8	7	51
Inshore Bottomfish						
Kingfishes	10	17	28	37	9	101
Spot	0	6	41	254	223	525
Croaker	0	0	46	168	0	215
Black drum	0	4	< 1	0	2	6
Sharks						
Unclassified	8	66	72	34	0	180
Miscellaneous						
Skates/rays	2	4	33	10	4	52
Catfishes (marine)	3	64	99	44	5	215
Toadfish	2	8	14	42	3	70
Searobins	3	0	10	5	0	18
Pigfish	0	0	5	5	0	10
Pinfish	NA	NA	NA	NA	NA	795
Mullet	204	34	< 1	0	0	239
Puffers	2	2	10	20	0	34

Private Boat Mode

Estimated landings by private boat fishermen are listed in Table 22.

Very few of the private boat anglers intercepted in the MRFSS had been fishing in the Gulf Stream or farther offshore, so few landings of oceanic pelagic species were documented.

Most of the reef fish catch was accounted for by private boat anglers with black sea bass the only significant component. The large landings of spottail pinfish appeared to be due to sampling error.

Private boat anglers caught about 43% of the estimated king mackerel catch and 26% of the overall Spanish mackerel landings. King catches were spread throughout the year with Spanish mackerel landings almost entirely during July and August. Most of the bluefish catch was taken incidentally while fishing for other species.

The principal species sought by private boat anglers were red drum, spotted seatrout, and flounders. Most of the red drum landings and all of the spotted seatrout catch were attributable to this mode, primarily in late summer and fall. Flounder landings peaked in late spring and early summer, while sheepshead were taken mainly in early spring. Private boat anglers also landed appreciable numbers of sharks during the summer and inshore bottomfish in the fall.

Data from the MRFSS and SFS were used to calculate CPUE indices for major species of interest. Input data for red drum, spotted seatrout, flounders (mostly southern), and sheepshead are provided in Tables 23, 24, 25, and 26, respectively.

The MRFSS contributed 38% of the total sample used to derive CPUE for red drum. Indices of fishing success were generally similar for data from both surveys. CPUE was highest in Beaufort County and declined northward.

MRFSS data represented 36% of the sample for spotted seatrout. CPUE indices determined from both survey data sets were similar except in Georgetown County, where both sample sizes were very small. CPUE was highest in the central part of the coastline.

The MRFSS contributed 57% of the flounder observations. Variability between areas and surveys was higher than with the other species, although results from each dataset were comparable in the Georgetown/Horry County area, where most of the directed activity occurred. Combined indices were similar there and in Beaufort County with success considerably less in the central coastal area.

Table 23. Catch and effort data of private boat anglers for red drum.

	MRFSS	SFS	Combined
Beaufort County			
Number of observations	39	103	142
Number of anglers	79	193	272
Number of angler hours	295.0	716.0	1,011.0
Total fish caught	170	414	584
Fish/angler	2.15	2.15	2.15
Fish/angler hour	0.58	0.58	0.58
% of anglers with no fish	37	23	27
Colleton/Charleston Counties			
Number of observations	57	72	129
Number of anglers	95	141	236
Number of angler hours	384.0	522.5	906.5
Total fish caught	159	156	315
Fish/angler	1.67	1.11	1.33
Fish/angler hour	0.41	0.30	0.35
% of anglers with no fish	42	36	39
Georgetown County			
Number of observations	21	20	41
Number of anglers	35	36	71
Number of angler hours	140.5	136.0	276.5
Total fish caught	24	46	70
Fish/angler	0.69	1.28	0.99
Fish/angler hour	0.17	0.34	0.25
% of anglers with no fish	71	31	51
Statewide			
Number of observations	117	195	312
Number of anglers	209	370	579
Number of angler hours	819.5	1,374.5	2,194.0
Total fish caught	353	616	969
Fish/angler	1.69	1.66	1.67
Fish/angler hour	0.43	0.45	0.44
% of anglers with no fish	45	29	35

Table 24. Catch and effort data of private boat anglers for spotted seatrout.

	MRFSS	SFS	Combined
Beaufort County			
Number of observations	35	87	122
Number of anglers	69	155	224
Number of angler hours	220.5	546.0	766.5
Total fish caught	65	136	201
Fish/angler	0.94	0.88	0.90
Fish/angler hour	0.29	0.25	0.26
% of anglers with no fish	62	59	60
Colleton/Charleston Counties			
Number of observations	35	41	76
Number of anglers	49	85	134
Number of angler hours	224.0	344.0	568.0
Total fish caught	195	306	501
Fish/angler	3.98	3.60	3.74
Fish/angler hour	0.87	0.89	0.88
% of anglers with no fish	39	22	28
Georgetown County			
Number of observations	7	7	14
Number of anglers	13	14	27
Number of angler hours	62.0	73.5	135.5
Total fish caught	7	23	30
Fish/angler	0.54	1.64	1.11
Fish/angler hour	0.11	0.31	0.22
% of anglers with no fish	62	57	59
Statewide			
Number of observations	77	135	212
Number of anglers	131	254	385
Number of angler hours	506.5	963.5	1,470.0
Total fish caught	267	465	732
Fish/angler	2.04	1.83	1.90
Fish/angler hour	0.53	0.48	0.50
% of anglers with no fish	53	46	49

Table 25. Catch and effort data of private boat anglers for flounders.

	MRFSS	SFS	Combined
Beaufort County			
Number of observations	20	38	58
Number of anglers	48	73	121
Number of angler hours	165.0	274.0	439.0
Total fish caught	32	90	122
Fish/angler	0.67	1.23	1.00
Fish/angler hour	0.19	0.33	0.28
% of anglers with no fish	40	30	34
Colleton/Charleston Counties			
Number of observations	17	12	29
Number of anglers	33	24	57
Number of angler hours	155.5	98.0	253.5
Total fish caught	20	16	36
Fish/angler	0.61	0.67	0.63
Fish/angler hour	0.13	0.16	0.14
% of anglers with no fish	64	58	61
Georgetown/Horry Counties			
Number of observations	65	28	93
Number of anglers	120	54	174
Number of angler hours	510.0	218.5	728.5
Total fish caught	118	58	176
Fish/angler	0.98	1.07	1.01
Fish/angler hour	0.23	0.27	0.24
% of anglers with no fish	48	41	45
Statewide			
Number of observations	102	78	180
Number of anglers	201	151	352
Number of angler hours	830.5	590.5	1,421.0
Total fish caught	170	164	334
Fish/angler	0.85	1.09	0.95
Fish/angler hour	0.20	0.28	0.24
% of anglers with no fish	48	38	44

Table 26. Catch and effort data of private boat anglers for sheepshead.

	MRFSS	SFS	Combined
Statewide			
Number of observations	19	32	51
Number of anglers	40	72	112
Number of angler hours	155.5	284.5	440.0
Total fish caught	45	115	160
Fish/angler	1.13	1.60	1.43
Fish/angler hour	0.29	0.40	0.36
% of anglers with no fish	45	38	40

The sample sizes for sheepshead were small and were pooled into a single dataset for the entire coastal area. Anglers intercepted in the SFS appeared to have been somewhat more successful than those interviewed in the MRFSS.

Length Distribution

A total of 311 red drum was measured with 93 from the MRFSS and 218 from the SFS. Length distributions by county are shown in Fig. 2. Average size increased from south to north; in Beaufort County, it was 42.2 cm, in Charleston County 43.9 cm, and in Georgetown County 47.5 cm. The average total length statewide was 43.2 cm (Fig. 3). Because of the 27 in. (69 cm) maximum size limit, large fish had to be released.

A total of 367 spotted seatrout was measured with the sample divided roughly evenly between Beaufort and Charleston Counties. Very few fish were observed in Georgetown County. Most of the sample was obtained during wave 5. Length distribution by county is illustrated in Fig. 4. There was little difference in average size between Beaufort (36.7 cm) and Charleston Counties (36.9 cm). The average size statewide was 36.9 (Fig. 5).

The total sample size for southern flounder (N=238) was relatively large compared to previous years and somewhat more evenly distributed geographically. The statewide average total length was 39.5 cm. Length distribution is shown in Fig. 6.

Sheepshead were distributed over a wide size range (Fig. 7). Fish taken in the ocean were generally larger than those from inland waters.

Sample sizes for other important species were smaller than in recent years. Length distributions and mean sizes are listed in Table 27.

DISCUSSION

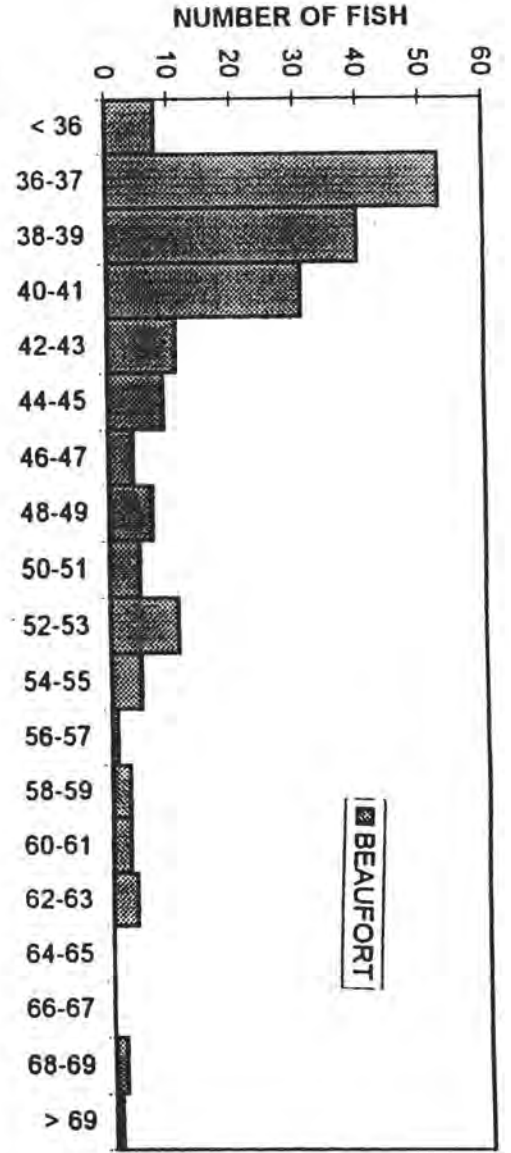
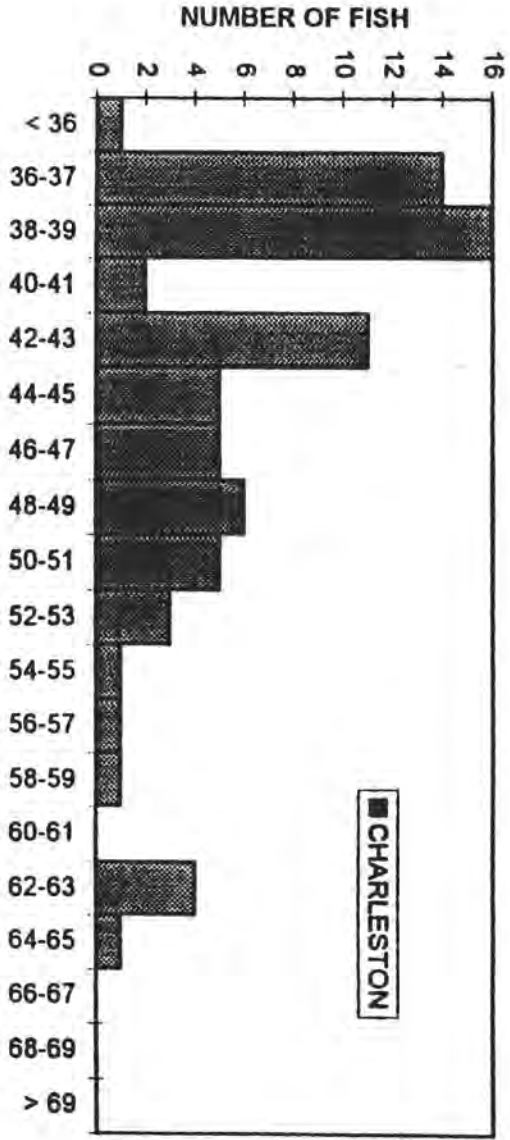
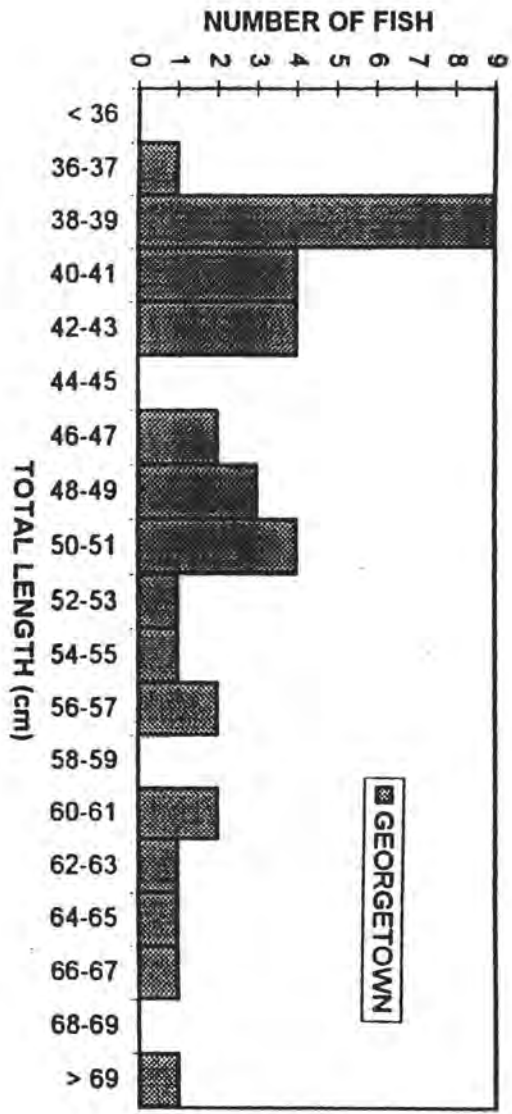
Discrepancies between results from the MRFSS charterboat sampling and MRD reporting system are discussed in the Appendix.

Survey Logistics

Geographical distribution of the MRFSS interviews within modes differed from that in recent years. The percentage of shore anglers interviewed who fished from the Grand Strand piers was much higher than in 1993 and close to the historical average. This reflected the return to normal operation of all facilities and addition of one new pier.

Prior to 1993, most charterboat interviews were obtained in Murrells Inlet. In 1994, 60% of the sample was taken in Beaufort County, 22% in Charleston County, and 18% in Georgetown County.

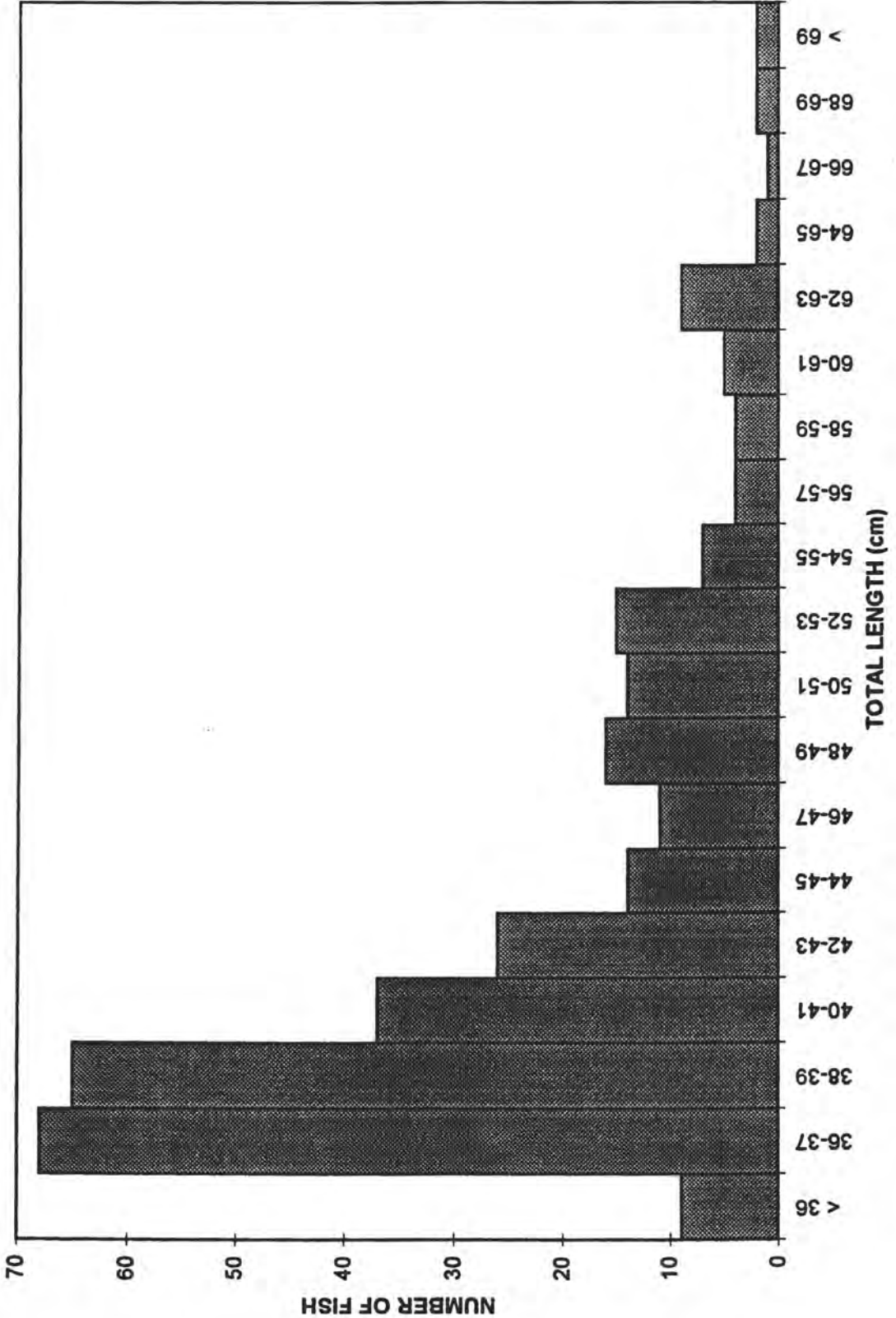
Fig. 2. Length distribution of red drum by county.



N = 311

Chart1

Fig. 3. Length distribution of red drum statewide.



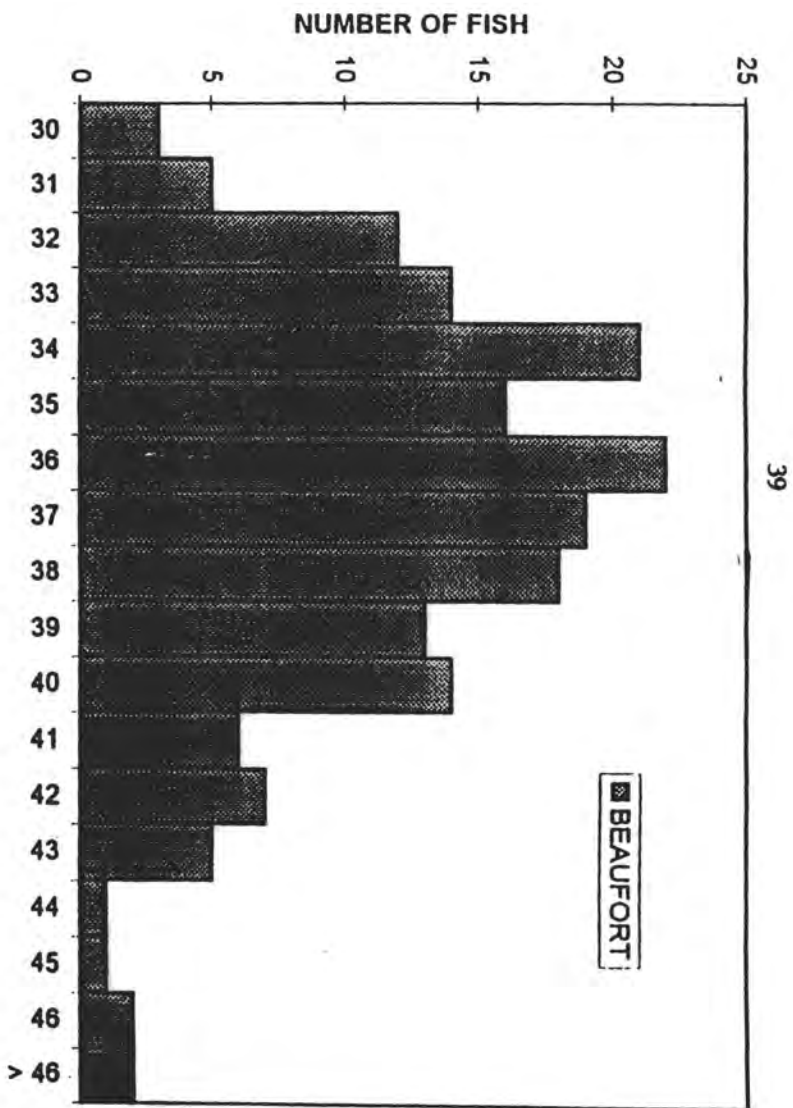
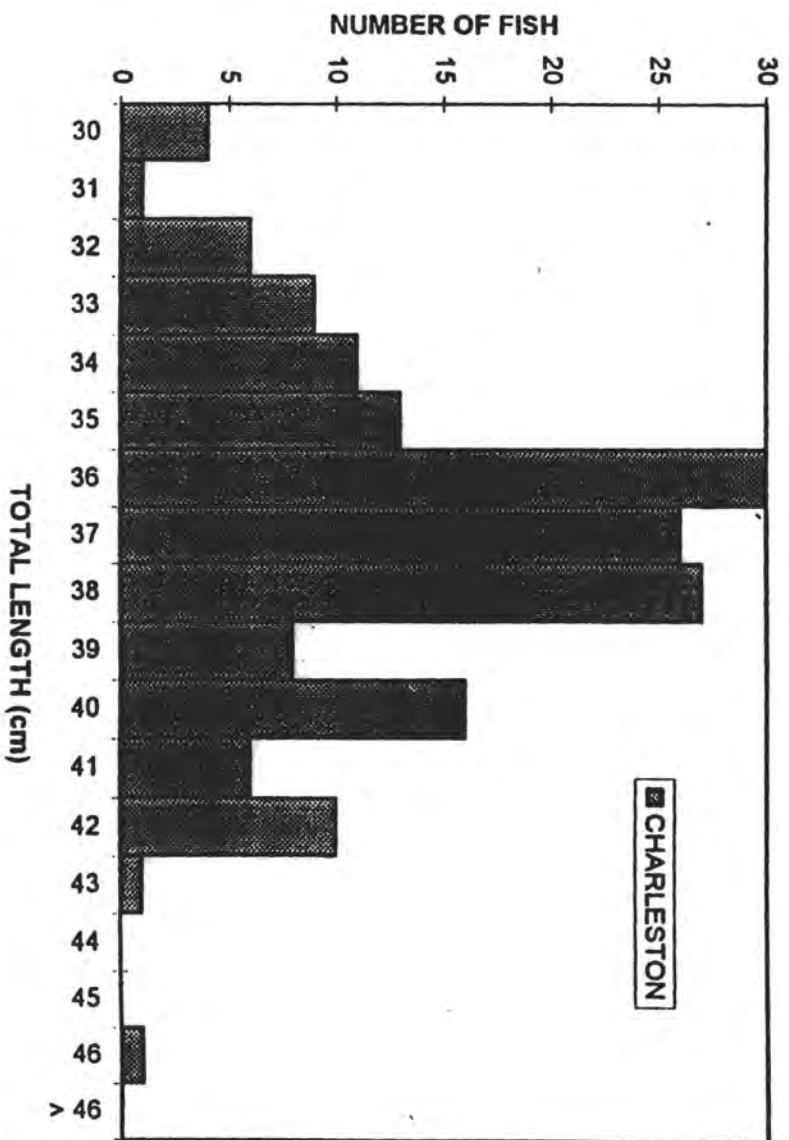
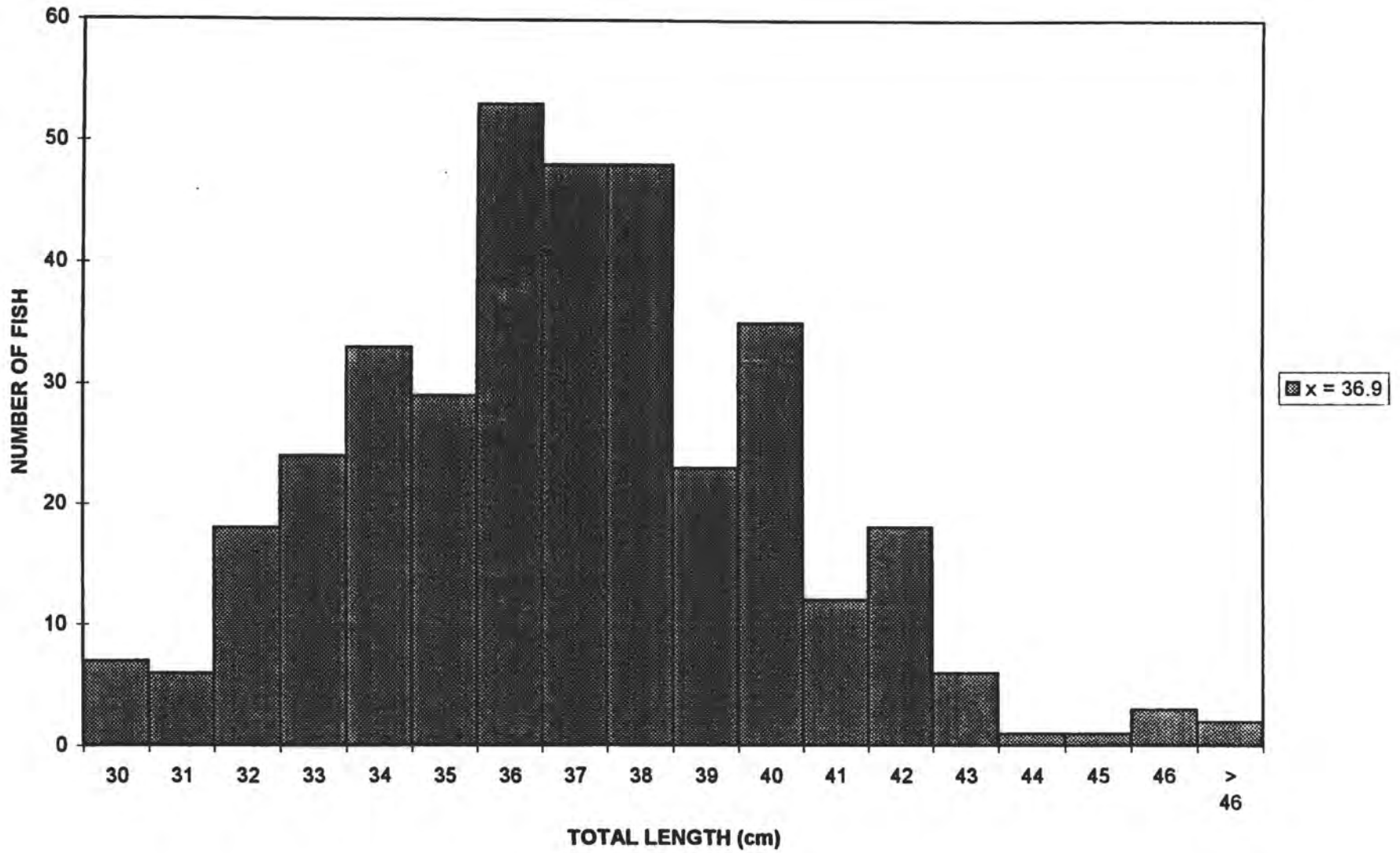


Fig. 4. Length distribution of spotted seatrout by county.

Fig. 5. Length distribution of spotted seatrout statewide.



40

Fig. 6. Length distribution of southern flounder.

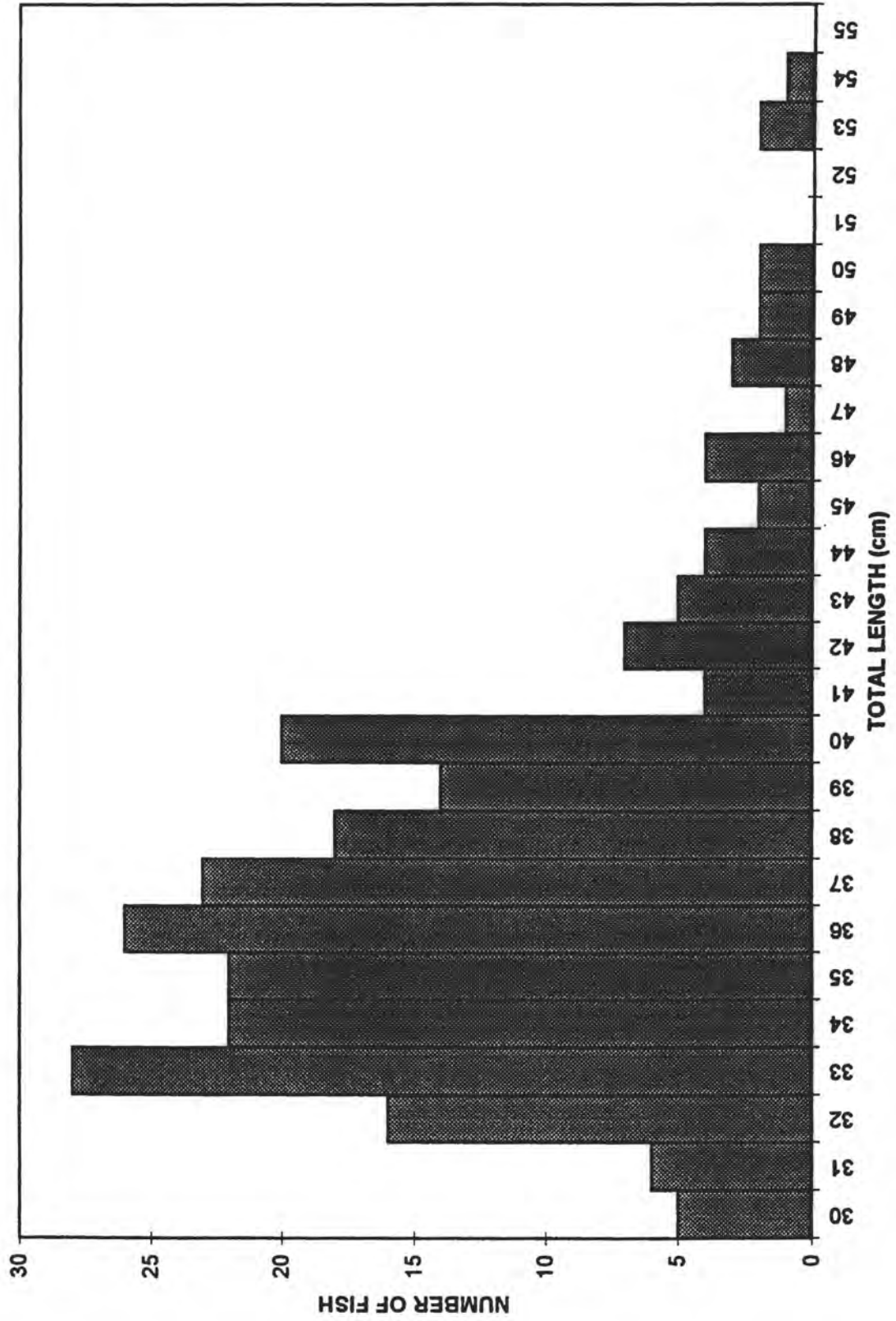
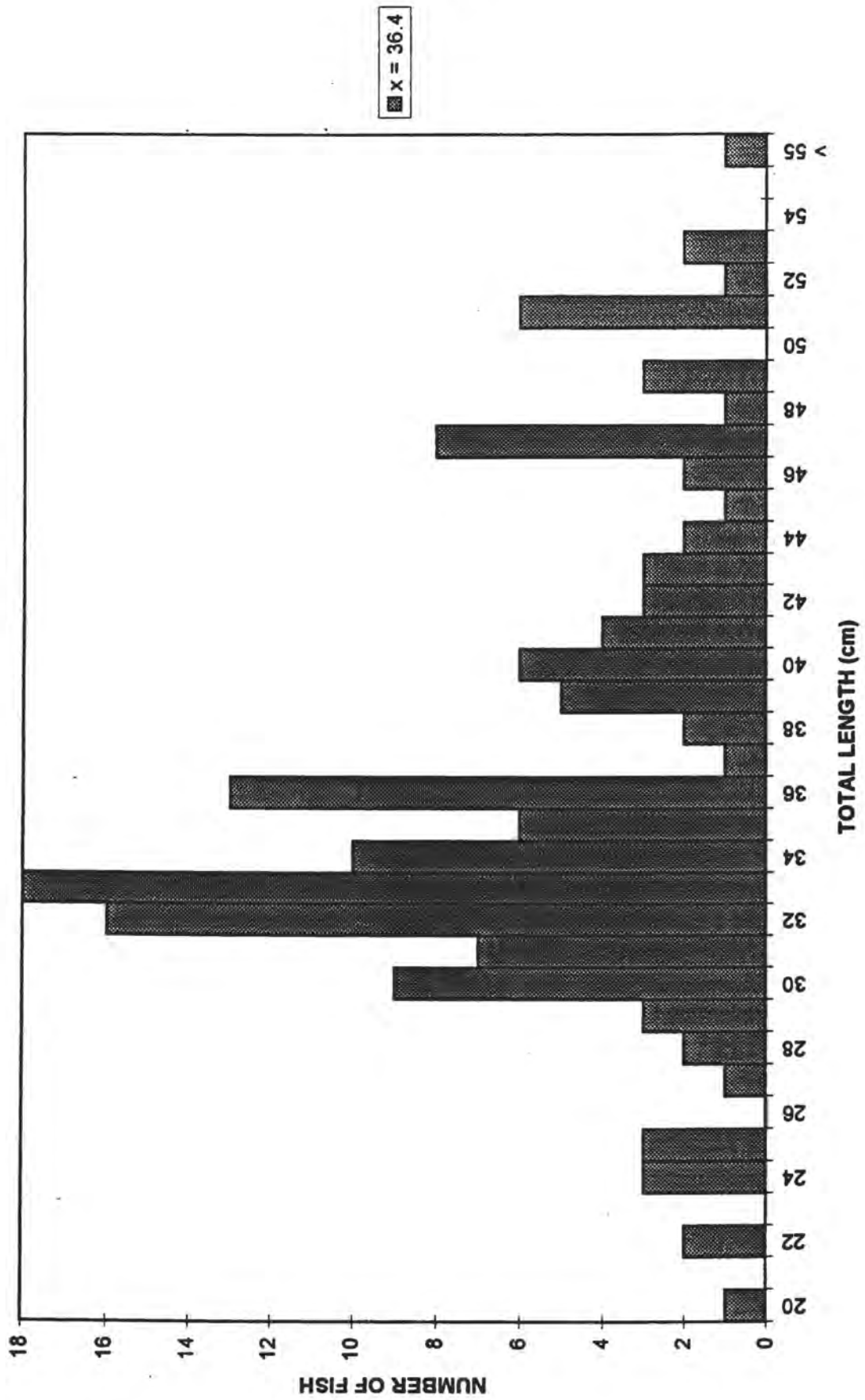


Fig. 7. Length distribution of sheepshead.



According to MRD reports, 54% of the boat trips originated in Beaufort County, 23% in Charleston County, and 8% in Georgetown County. The remainder took place in Horry County. In the last two years, the distribution of the sample population has reflected the distribution of actual effort much more representatively than previously.

Geographic distribution of interviews in the private boat mode was more even between counties than in 1993. In 1993, less than 15% of the sample was obtained in Beaufort County, whereas in 1994 the contribution was 34%. The number of sites contributing more than 20 interviews also increased, although Murrells Inlet remained by far the major source of interviews (35% of the mode total).

Participation and Effort

Estimated participation was the highest recorded to date. The annual trend is shown in Fig. 8 (headboat anglers not included). The indicated increase from 1993's level appears highly improbable.

The estimated number of coastal resident anglers increased from 139,000 to 457,000, according to the MRFSS. The number of marine stamps issued to private boat fishermen was practically identical (about 73,000) in both years. The percentage of coastal households containing a saltwater angler was 18.4% in 1994 vs 18.0% in 1993, hardly sufficient to account for the indicated increase. The positive responses per wave were comparable in both years (except for wave 5) as well.

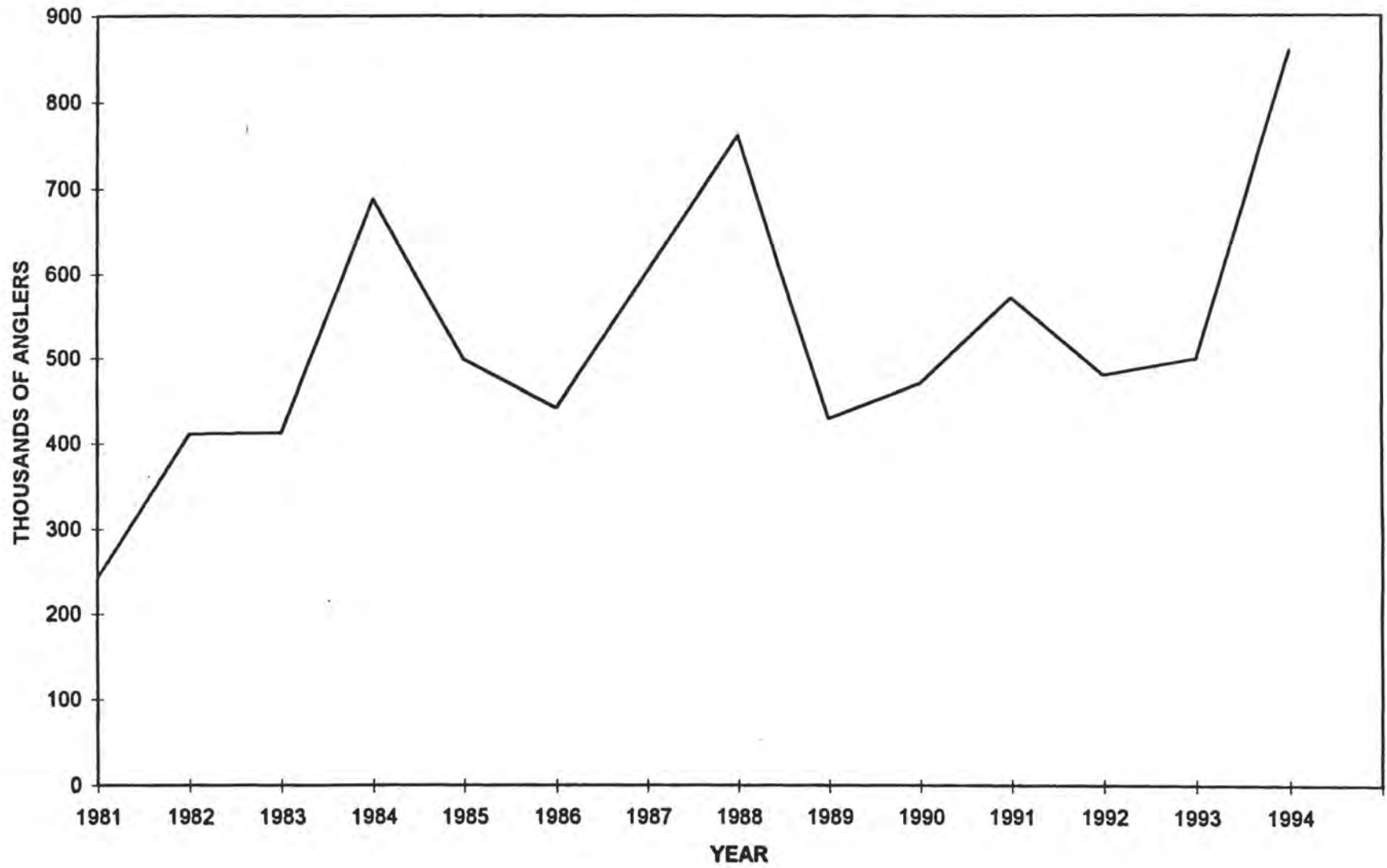
In contrast, the estimated number of out of state anglers declined from 306,000 in 1993 to 247,000. MRD reports indicated increases in pier attendance and charterboat passengers, both categories largely composed of out of state residents.

Estimated effort also was the highest to date (Fig. 9, which does not include headboat trips). Shore effort increased about 9%. This appears conservative given that reported pier attendance increased 31%. The MRFSS phone survey results reported that average trips per angler in the shore mode increased from 11 in 1993 to 16 in 1994, a 45% increase.

The MRFSS estimates included no charterboat effort for waves 2, 4, and 6, yet the mode estimate was still more than double the number of angler trips reported to the MRD. Charterboat effort reported to the MRD increased about 13%. The phone survey results indicated an increase in average trips per year from 0.43 to 0.57.

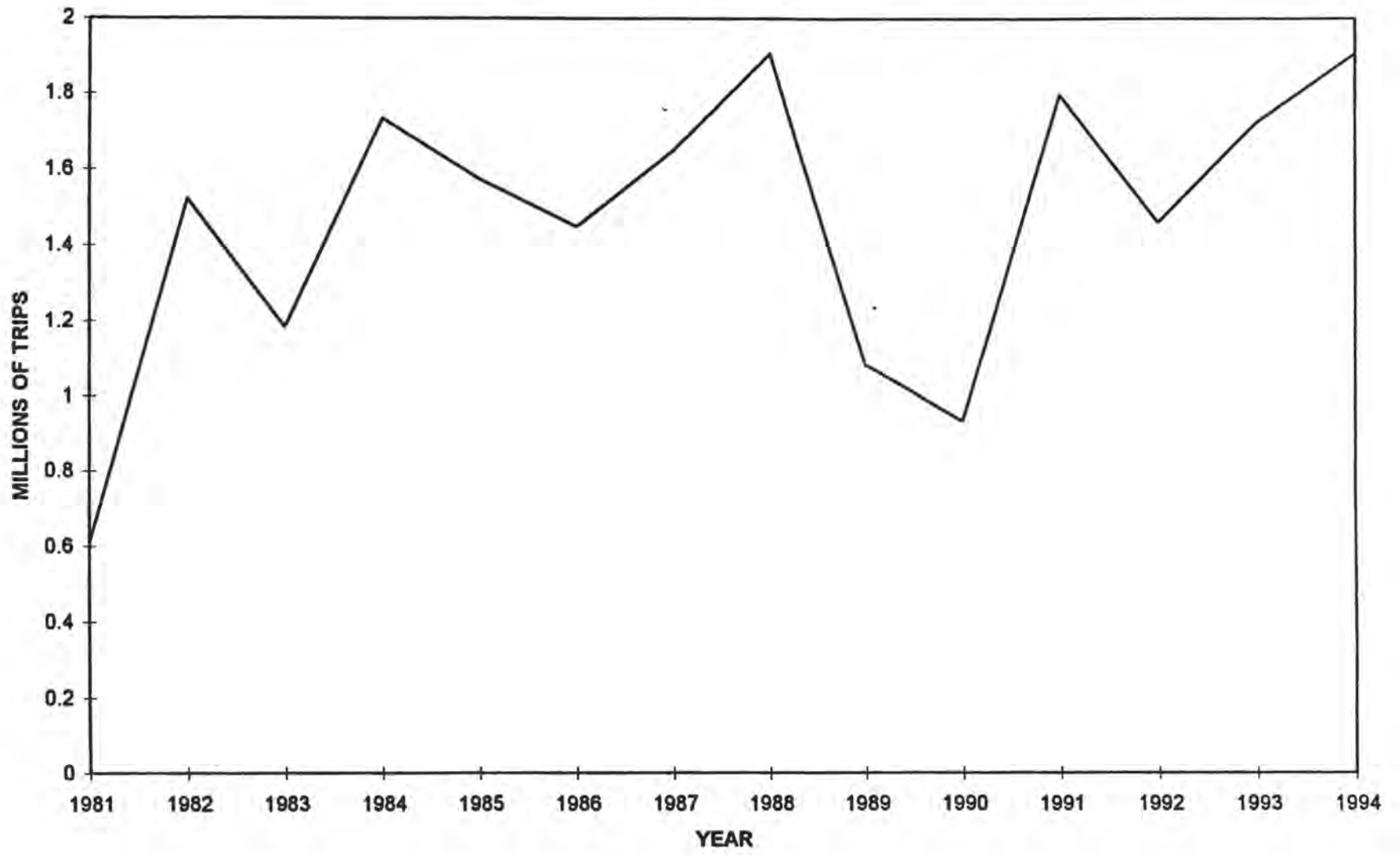
The estimated private boat effort increased 28% with major increases during each wave except 4 and 6. The indicated decrease (7%) in wave 6 effort was probably underestimated. The weather then was so bad that we were unable to make interview quotas with half of the MRFSS assignments rained out. The phone survey results suggested that average effort per angler declined from 35.95 trips

Fig. 8. Estimated participation in the South Carolina recreational hook and line fishery.



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Fig. 9. Estimated effort in the South Carolina recreational hook and line fishery.



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per year in 1993 to 29.89 in 1994. The large increase in estimated overall private boat effort probably reflects the unrealistically large increase shown for coastal resident participants.

Catch and Catch Rates

Estimated total landings of oceanic pelagics, particularly dolphin, were very low compared to those in 1993. This obviously reflected the absence of reported charterboat catches during waves 2 and 4. Charterboat landings of this group reported to the MRD were only slightly less than those reported in 1993 with the dolphin catch down just 2% in numbers of fish.

With the exception of black sea bass, estimated landings of major reef fish species were much lower than in 1993. Again, the missing wave data for the charterboat fishery were a contributing factor. MRD charterboat reports indicated moderate increases in the 1994 landings for most species, including red porgy and vermilion snapper. These species weren't reported, according to the MRFSS data.

King mackerel landings appeared to decline substantially from those in the last two years, according to all information sources. The low MRFSS figure obviously reflected the absence of three waves of charterboat landings. Numbers of fish caught by charterboats as reported to the MRD were 22% less than in 1993 and CPUE was consistently lower throughout the season. Commercial landings were also down appreciably during the peak summer recreational season.

Estimated Spanish mackerel landings tripled. This probably was attributable to sampling error. An unusually high percentage of the catch was reported released (and could not be verified), 69% compared to the typical 15% in 1993. The retained catch as estimated by the NMFS increased by only 10%. Charterboat landings reported to the MRD were about the same as in 1993 with CPUE somewhat lower.

Inshore sportfish landings increased for the principal species. Estimated red drum landings were high by historical standards and substantially above those in recent years (Fig. 10). The percentage of released fish (75%) was exceptionally high, however, and may have inflated the estimates excessively: these landings could not be verified. The estimated retained catch was about 10% less than that in 1993. CPUEs calculated from data from both surveys were comparable and the statewide index (Table 28) was relatively high. Statewide CPUE was 86% higher than in 1993 compared to an overall estimated catch that was 64% higher.

The estimated catch of spotted seatrout was also relatively large by recent standards (Fig. 11). Again, the percentage of released fish was abnormally high with the retained catch only 54% of that estimated in 1993. CPUE indices suggested that the total catch may have been overestimated. The Charleston County index was

Fig. 10. Estimated recreational catch of red drum.



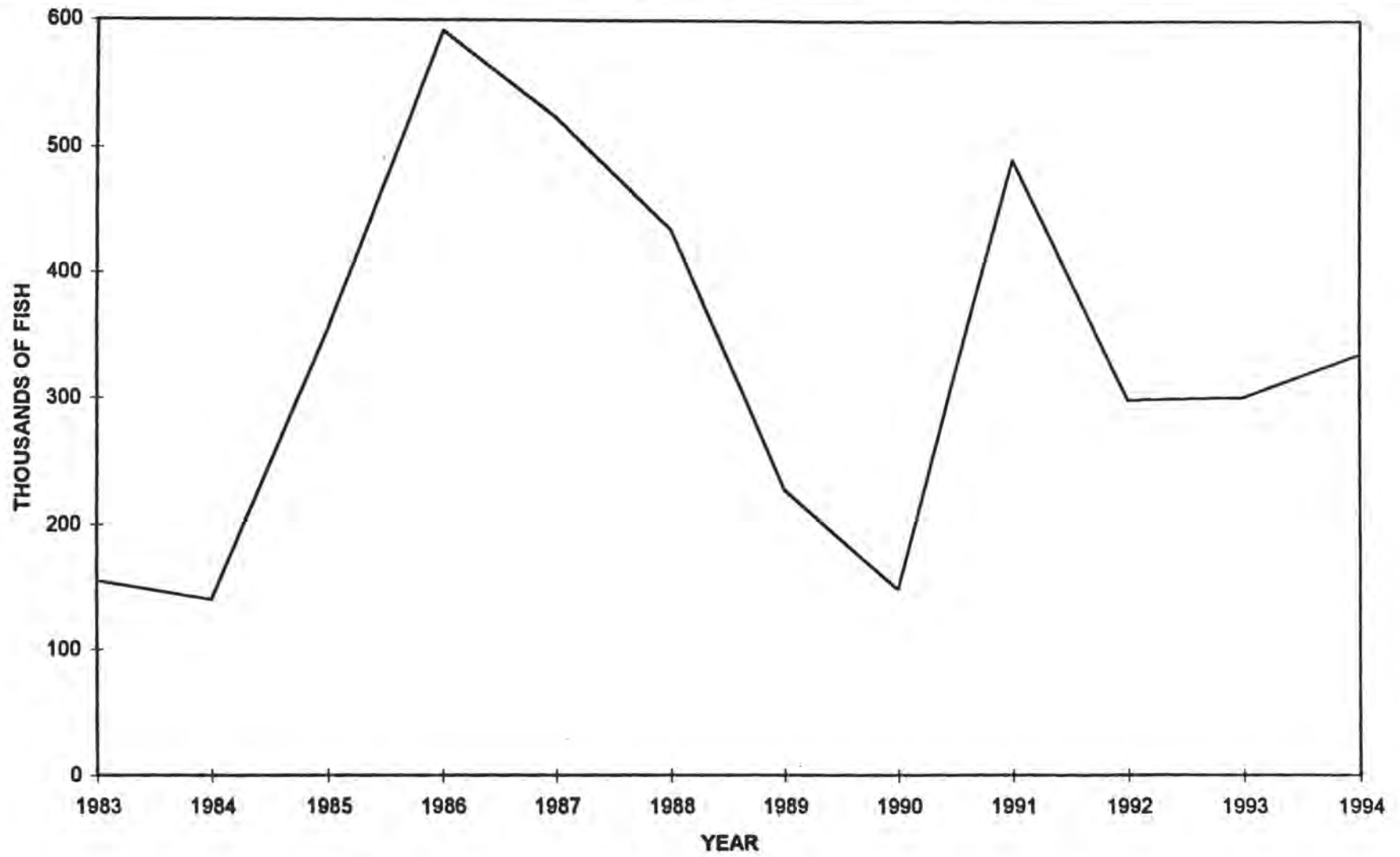
Table 28. CPUEs for red drum and spotted seatrout, 1990-1994.

Species	Area	Fish/angler				
		1990	1991	1992	1993	1994
Red drum						
	Beaufort County	2.20	0.90	1.12	1.46	2.15
	Charleston County	1.00	0.90	1.13	0.97	1.33
	Georgetown County	1.50	1.50	1.21	0.61	0.99
	Statewide	NA	1.10	1.15	0.90	1.67
Spotted seatrout						
	Beaufort County	1.50	3.10	1.65	1.72	0.90
	Charleston County	1.70	2.00	2.14	2.05	3.74
	Georgetown County	0.50	3.50	1.94	1.01	1.11
	Statewide	NA	2.30	2.03	1.92	1.90

Table 29. Mean lengths (in cm) of major recreational species as determined from MRFSS and SFS data.

Species	1988	1989	1990	1991	1992	1993	1994
Red drum	43.1	46.3	45.7	42.0	43.5	46.3	43.2
Spotted seatrout	36.5	37.7	37.1	36.6	36.9	36.8	36.9
Southern flounder	34.6	35.0	35.6	35.4	38.6	36.6	39.5
Sheepshead	32.6	NA	34.2	32.2	31.9	31.5	36.4
Black sea bass	26.4	25.9	NA	25.2	25.9	26.1	27.4
King mackerel	76.8	76.7	76.2	85.0	76.5	86.2	86.1
Spanish mackerel	42.2	41.2	42.0	45.7	46.4	43.6	43.1

Fig. 11. Estimated recreational catch of spotted seatrout.



relatively high, but those for other areas were lower than in recent years. Inclement weather during wave 6 probably contributed to reduced landings. Most of the catch was reported during wave 5, in contrast to normal years when the principal landings occur in wave 6.

The catch of southern flounder appeared to be considerably higher than in 1993. The CPUE was substantially greater in Georgetown County, where most of the directed effort was observed.

The estimated catch of sheepshead declined 36% from that in 1993. This decline appeared realistic, given that statewide CPUE was 44% lower.

Length Distribution

Mean lengths and size distributions of the principal recreational species continued to be consistent with those observed in recent years (Table 29). The maximum size limit probably depressed the average size of red drum slightly, since anglers reported releasing many fish over the 27 in (69 cm) maximum legal size that could have been retained in previous years.

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- Van Voorhees, D.A., J.F. Witzig, M.F. Osborn, M.C. Holliday, and R.J. Essig. 1992. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1990-1991. U.S. Dep. Commerce, NOAA/NMFS, Current Fisheries Statistics No. 9204.

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APPENDIX I

Since July, 1992, state law has required all charterboat operators to obtain a permit and submit monthly reports of daily fishing activity to the MRD. These reports are completed for each trip and include the number of anglers, hours fished, number of fish caught by species, number released by species, and pounds retained by species.

During 1994, the MRFSS obtained 276 interviews from charterboat anglers aboard 33 boats that were identified. These boats represented 22% of the active fleet identified through the MRD permit file. Area distribution was as follows, in percent of boats by county:

	Beaufort	Charleston	Georgetown	Horry
MRFSS	52	27	15	6
MRD	31	38	15	16

Distribution of effort as sampled in the MRFSS was as follows, in percent:

	Inland	Ocean < 3 mi.	Ocean > 3 mi.
MRFSS interviews	28	17	54
Estimated angler trips (MRFSS)	23	22	55
Reported angler trips (MRD)	18	39	43
Reported boat trips (MRD)	21	21	58

This distribution suggested that the 1994 MRFSS somewhat overestimated the level of effort in the FCZ compared to that in waters under state jurisdiction.

As in the two previous years, the MRFSS appeared to greatly overestimate the total number of angler trips, as follows:

	Wave						
	1	2	3	4	5	6	All
MRFSS	0	0	30,270	0	25,639	0	55,909
MRD	106	2,326	7,606	10,999	4,199	939	26,175

The absence of effort for waves 2, 4, and 6 appeared to be attributable to sampling artifacts.

The NMFS apparently assumed a massive, sustained level of effort by virtually the entire fleet. This is in marked contrast to the largely casual, limited operations observed by creel clerks and reported by most marinas and booking agents. Rather than adhere to a regular sailing schedule, many boats operated on an opportunistic basis hardly compatible with the level of effort implied by the NMFS estimates.

Wave 3 provided a good example. The average effort of the 115 boats that reported making at least one trip was 15 trips/boat during the 61-day interval with an average of 4.5 anglers/trip. In order to achieve the NMFS effort estimate, these boats would have had to have made approximately 6,727 trips or 59 trips/boat. Thus,

each active vessel would have had to have made a trip on almost every day of the wave. This is highly improbable, since the weather during most of May was bad. Even if all permitted vessels (roughly 140) had fished, they would have had to have averaged 48 trips/boat. This is very unlikely given that < 10 boats reported operating at that level.

MRFSS interviews were obtained for 70 boat trips on 33 boats for which the vessel was identified. MRD trip reports were available for 52 (74%) of these trips. Although some dates were not identical (+- two days), these trips were considered equivalent if the operator reported no other trips closer to the date indicated in the MRFSS interview. This approach was considered reasonable, since only a few trips fell into this classification and the boats involved made relatively few trips. For nine trips, the operators had submitted monthly reports that contained no trips close to the indicated date. For seven trips, operators had turned in reports indicating no activity for that month. No monthly report was received for the other two trips.

Individual trip comparison results are summarized below. N is the number of observations in each category. Comparable hours fished was +- 0.5 hour. Comparable numbers of fish caught were +- 10%. Species composition was considered comparable in the species listed accounted for at least two-thirds of the overall catch.

	All data	No. of anglers	Hours fished	Target species
N (1994)	3	36	18	51
% 1994	6	69	35	98
% 1993	0	50	14	86
% 1992	2	42	16	82

	Catch, comparable species	Catch, comparable no./spp.
N (1994)	40	18
% 1994	77	35
% 1993	58	32
% 1992	44	27

The usual difference in the number of anglers was +- one. The anglers interviewed typically overestimated the amount of time actually spent fishing by including running time. There was a high level of agreement on target species, since relatively few were involved and many trips were non-specific (i.e., the target was "any"). Comparability of catch information varied greatly depending on the variety and number of fish caught and the amount of fish released (for which identities and numbers could not be verified during the interviews). Agreement between interview data and trip report information was uniformly better than in previous years.

Aggregate results of these comparisons are shown in Table I-1. The percentages shown were calculated as $[(\text{MRFSS-MRD})/(\text{MRD})] \times 100$. There was close agreement in the total number of anglers, as in

Table I-1. Comparison of the 1994 MRFSS interview data and MRD report information for specific trips.

Category	MRFSS	MRD	% difference		
			1992	1993	1994
Number of anglers	221	226	+ 2	- 12	- 2
Hours fished	221.0	188.5	+ 54	+ 63	+ 17
Number of fish caught:					
Oceanic pelagics					
Dolphin	16	19	+ 25	- 6	- 16
Wahoo	4	4	0	0	0
Yellowfin tuna	8	6	+ 38	+ 50	+ 33
Sailfish	0	2	-	0	-
Reef fish					
Black sea bass	181	164	- 61	- 30	+ 10
Groupers	0	5	+ 4	- 7	-
Porgies	12	11	- 16	- 50	+ 9
Snappers	6	44	+200	-	- 86
Grunts	21	3	-	-	-
Triggerfish	2	1	+ 50	-	+100
Amberjack	10	3	- 29	- 40	+233
Coastal pelagics					
King mackerel	57	71	- 1	- 11	- 20
Spanish mackerel	94	73	- 31	- 10	+ 29
Bluefish	15	2	- 75	+ 57	+650
Barracuda	26	30	- 38	- 20	- 13
Little tunny/bonito	5	5	- 3	- 3	0
Inshore sportfish					
Red drum	41	19	- 80	+ 82	+116
Spotted seatrout	12	51	+ 64	+ 38	- 76
Sheepshead	102	98	NA	- 80	+ 4
Inshore bottomfish					
Kingfishes	8	4	NA	NA	+100
Black drum	3	8	NA	NA	- 63
Sharks	47	53	- 50	- 14	- 11

previous years. Effort (hours fished) was overestimated by the fishermen interviewed. The extent of agreement for numbers of fish caught varied greatly with few trends apparent over the three-year data set.

In terms of reliability, each data source had probable error elements. Many anglers were tired and/or somewhat inebriated when interviewed in the MRFSS. Most were out of state residents with little local fishing experience or knowledge of fish identity. If significant numbers of fish had been released, the anglers often couldn't recall well their number or identity.

Trip reports submitted to the MRD often were completed by boat operators (or their agents) at the end of the month from notes in their logs. There often was some confusion over exact dates, particularly if a boat had made many trips (although this would not have been a factor in wave totals).

Verification is frequently cited by the NMFS as justification for their procedures. The MRD trip reports were not verified and all information was accepted as submitted. The NMFS verification procedure, however, simply validated the fact that an individual was interviewed. It couldn't substantiate what species were caught or how many of each, only the angler's opinion. In this respect, the validity of the data obtained in the MRFSS was no better established than that of the information submitted on trip reports.

The estimated total charterboat catches based on MRFSS data and MRD trip reports are compared in Table I-2. Only estimates for waves 3 and 5 were included in the MRFSS figures, which simply enhances the conclusion that the NMFS catch estimates were greatly exaggerated.

Table I-2. Charterboat catch estimates (in numbers of fish) from the MRFSS and MRD trip reports. NR - None Reported.

Category	MRFSS waves 3 & 5	MRD waves 3 & 5	MRD All
Oceanic Pelagics			
Dolphin	7,939	2,491	3,360
Wahoo	992	181	357
Yellowfin tuna	2,977	484	759
Other	NR	87	138
Reef Fish			
Black sea bass	8,699	12,280	24,972
Gag	458	1,198	2,028
Other groupers	NR	781	1,470
Red snapper	NR	219	468
Vermilion snapper	NR	3,127	6,145
Red porgy	NR	1,236	2,537
Other porgies	NR	348	965
White grunt	458	664	1,144
Other grunts	NR	467	613
Triggerfish	NR	937	1,371
Spadefish	NR	177	395
Spottail pinfish	NR	276	727
Sand perch	NR	179	299
Amberjack	4,578	506	1,098
Coastal Pelagics			
King mackerel	10,077	2,827	6,039
Spanish mackerel	33,550	5,097	10,802
Bluefish	16,940	1,043	1,831
Crevalle jack	458	412	981
Barracuda	NR	744	2,455
Little tunny/bonito	916	337	928
Inshore Sportfish			
Red drum	NR	1,484	3,365
Spotted seatrout	NR	775	1,614
Weakfish	NR	81	183
Flounder, unclassified	NR	441	849
Sheepshead	NR	313	2,009
Tarpon	NR	55	228
Inshore Bottomfish			
Kingfishes	3,970	223	693
Spot	NR	66	917
Croaker	NR	165	287
Black drum	NR	57	246
Sharks			
Sharpnose	16,872	2,004	3,111
Blacktip	1,374	969	2,698
Unclassified	3,817	1,548	4,019
Miscellaneous			
Rays	916	114	229
Catfishes (marine)	6,871	430	1,497
Other	458	387	676