A Review of the Recreational Fishery for Blue Marlin, *Makaira nigricans*, and White Marlin, *Tetrapturua albidus*, in South Carolina, 1977-2000

Data Report Number 37

prepared by

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INTRODUCTION

South Carolina's entry into the sport of recreational fishing for billfish (blue marlin, *Makaira nigricans*, white marlin, *Tetrapturus albidus*, and Atlantic sailfish., *Istiophorus platypterus*, family Istiophoridae, occurred relatively recently. June 4, 1964 is recognized as the day SC entered the world of sportfishing for billfish. It was on this day that Mrs. L. K. Fitzgerald of Spartanburg landed the state's first recreationally caught blue marlin estimated at 225 pounds while fishing out of Georgetown aboard her husband's boat, The Tar Baby. In 1966 the first sportfishing competition for billfish in SC was held by Mr. Wallace F. Pate in Georgetown. From the one tournament held in 1966, the SC recreational fishery for billfish has grown to feature as many as 16 competitions that included billfish categories in a single year. The state's fishery now supports one of the largest competitive fishing series for billfish in the United States, the South Carolina Governor's Cup Billfishing Series. Today's pursuit of billfish by recreational fishermen in SC has grown into a major sport and an important contributor to the coastal economy.

Like the fishery for billfish nationally, the recreational fishery for billfish is a small component of South Carolina's saltwater recreational fisheries in terms of the number of annual participants. It is also considered a rare-event fishery due to the low frequency at which billfish are caught. There are two recreational user groups within the fishery: anglers fishing aboard privately owned vessels, and anglers fishing aboard charter boats that are for public hire. There are three general modes of fishing: private boat anglers fishing a normal day, charter boats carrying anglers who have hired the boat for a normal day of fishing, and private and charter boat anglers who are participating in a billfish tournament. In many other areas of the east coast, fisheries managers have found it not only hard to identify the anglers and vessels participating in the fishery but the ports and marinas involved as well. These factors have discouraged most fisheries managers from conducting research on the fishery.

In the early 1970s, researchers with the National Marine Fisheries Service's (NMFS) Southeast Fisheries Center Lab in Miami Florida established a cooperative effort with the SC Wildlife and Marine Resources Department [later to become the SC Department of Natural Resources (SCDNR)] to conduct a catch-effort survey of selected billfish tournaments held in the state. South Carolina's recent entry into the recreational fishery for billfish and its relatively small size allowed state researchers to identify the major ports, facilities, sportfishing clubs and even vessels involved in the fishery. As work with the recreational fishery for billfish progressed, the breadth of the survey expanded to include the entire fishery. This report presents findings on the capture of blue and white marlin in the SC recreational fishery for billfish from 1977 through 2000.

METHODS

In 1972, the Marine Resources Division (MRD) of the SCDNR joined in a cooperative effort with the National Marine Fisheries Service's Oceanic Gamefish Investigations [later to become the Recreational Billfish Survey (RBS)] to collect biological and catch/effort data on billfish

captures at selected billfish tournaments in SC. State biologists and creel clerks would attend the selected tournaments to conduct direct interviews with participating vessels upon their return from fishing. The event's list of participating boats was used to define the potential effort and to identify vessels to be surveyed during each event. A survey form (Appendix 1) was completed for each day of fishing for each vessel. When vessels could not be interviewed following the last day of fishing, a follow up telephone survey was used to capture data. Effort was categorized into boat-day units. A boat day was defined as 8 net boat hours of actual fishing. Time spent fighting marlin was subtracted from the vessels fishing time since all other fishing lines are removed from the water. The fishery assessment was further enhanced in 1979 with the implementation of the Oceanic Pelagic Survey (OPS). The OPS expanded the tournament vessel intercept survey to include collection of data on number, fork length and weight for tuna, dolphin, wahoo and other species kept or released by the fishery.

In 1977, data on the recreational billfishery was expanded in South Carolina to record all recreational billfish landed or released each year under a new state program, the Billfish Monitoring Program (BMP). Through a weekly telephone survey of key fishing centers and a state billfish citation program, along with the direct intercept survey of boats fishing tournaments targeting billfish, this program attempted to document South Carolina's tournament and non-tournament billfish captures from 1977 through 1998. Captured billfish included fish that were brought to the dock (landed) along with all fish released live or dead. Landed fish were only those that were harvested, i.e. brought to the dock. Released fish included all fish returned to the water regardless of whether they were alive or dead. A post-season follow-up survey sent to marinas, tackle shops, sportfishing clubs and individuals known to have captured billfish that year, was used to identify unreported captures.

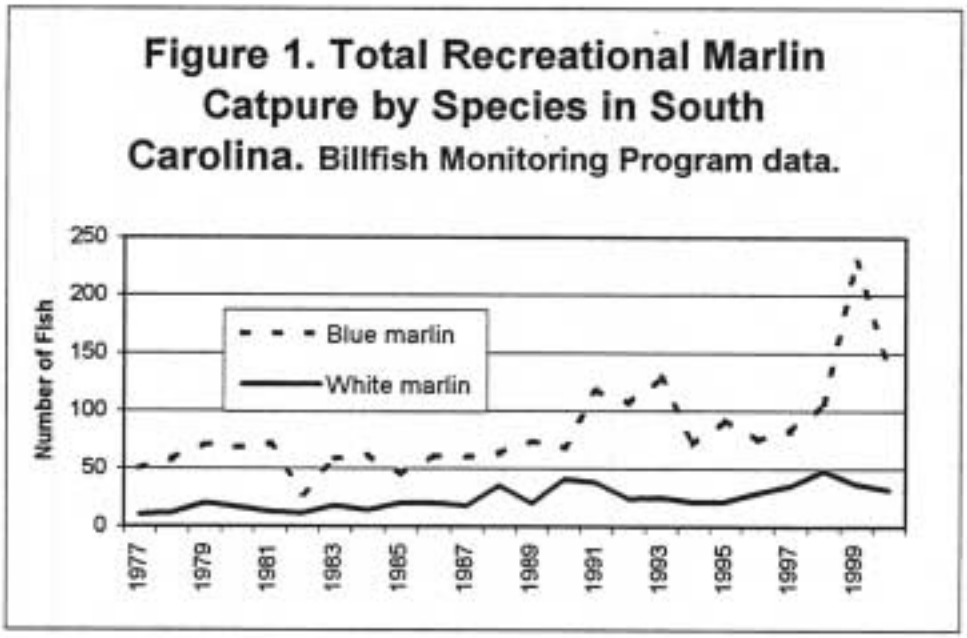
The implementation of the South Carolina Recreational Fisheries Conservation and Management Act in July 1992 created an additional source of data. This saltwater fishing license law included the establishment of a charter boat permit required of all charter and headboats operating out of SC. A condition of the permit is the mandatory reporting of effort and catch. The Charter Boat Log Book Program (CBLBP) requires captains to complete standardized reports for each trip and submit them monthly to SCDNR. Since 1993, data from the CBLBP has been instrumental in defining the role of charter boats within the state's billfish fishery.

The NMFS initiated a comprehensive recreational fishery survey of the East and Gulf Coasts, the Marine Recreational Fisheries Statistics Survey (MRFSS), in 1979 to collect data on fishing effort, catch composition and total catch. Conducted by a private contractor, the project stratifies direct intercept sampling based on the access method used to fish, and records where the actual fishing is carried out. While this project was never designed specifically to sample a rare event fishery such as billfish, it is the only regional program recording data on billfish captured outside of tournaments.

RESULTS

Annual Catch

From 1977 through 2000 the total annual recreational catch of blue marlin off SC has ranged from 28 to 230 fish per year (Figure 1) with an average of 82.8 fish per year. During this same period, the annual white marlin catch ranged from 10 to 48 fish per year (Figure 1), while averaging 24.2 fish per year. These data show the recreational marlin catch to be increasing. From 1977 through 1988, the average annual number of blue marlin recorded was 58 fish with an additional 17.3 white marlin reported. From 1989 through 2000, the number of blue marlin caught rose to an average of 107.8 fish per year, while the white marlin catch had risen to 31.0 fish on the average per year. Thus the number of marlin caught has almost doubled over the life of the BMP.



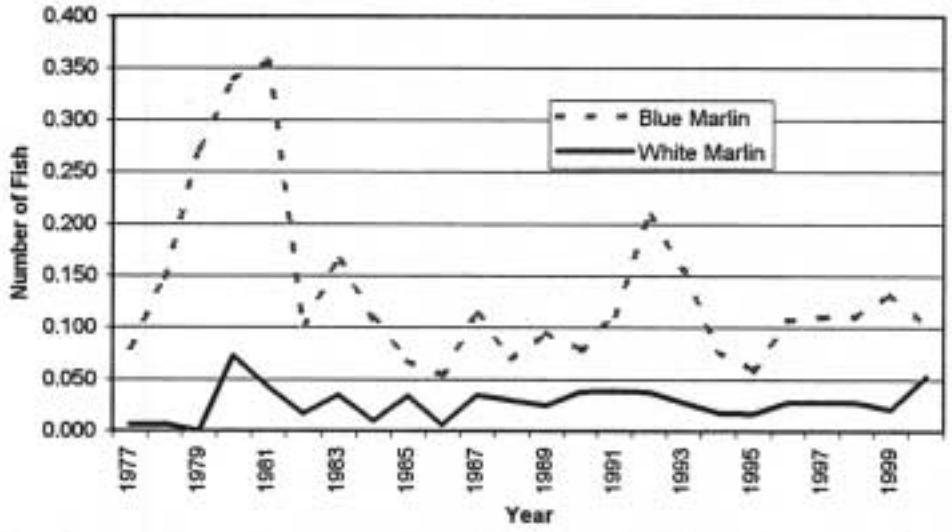
Catch Rates

Tournament Mode

Trends in annual catch-per-unit-of-effort (CPUE) were in direct contrast to the increasing trend in catch (Figure 2). The CPUE was based on the number of fish caught per boat day of fishing (FPBD) during selected billfish tournaments. While fishing methods changed slightly with the introduction of artificial lures for marlin, the time of year fished, the fishing grounds and the primary method of fishing (trolling dead natural baits) remained virtually unchanged. The

catch rate for blue marlin for the first half of the period surveyed ending with 1988, 0.156 FPBD, was 28 percent higher than in the second half, which had an annual average of 0.113 FPBD. In a comparison of the first 12 years to the last six years (1995 – 2000), the decline is more pronounced, falling 33 percent to 0.104 FPBD. White marlin catch rates exhibited a different pattern, increasing in the second half of the 24 year period. The annual average of 0.025 FPBD for white marlin caught from 1977 - 1988 rose 20 percent to 0.030 FPBD in the second half. A slightly smaller increase, 16 percent, is observed for the catch rate of white marlin when the first 12 years is compared to the catch rate for the last six years (0.029 FPBD).

Figure 2. Annual Catch Rates Observed for Marlin Caught in Selected Tournaments. Shown as Fish caught per 8 net boat hours of trolling.



Charter Boats

The CBLBP data provides information on the CPUE for marlin taken by charter vessels. Trips that targeted billfish, tuna, dolphin or wahoo were used to define qualifying trips (effort) where billfish could be caught, since these species occupy similar habitats and identical baits and techniques are used to catch them. Charter boat trips to "bluewater", as these trips are referred to by charter captains, usually involve 6 to 7 hours of actual fishing. The CPUEs observed annually ran from a low of 0.118 marlin per bluewater trip in 1997 to a high of 0.381 marlin per bluewater trip in 1999 (Figure 3). During the six year period starting in 1995, charter vessels had an overall average of 0.249 marlin caught per bluewater trip. A direct comparison to the tournament CPUE for the same period (0.133 marlin per boat day) shows charter vessels with a catch-per-unit-of-effort 187 percent higher.

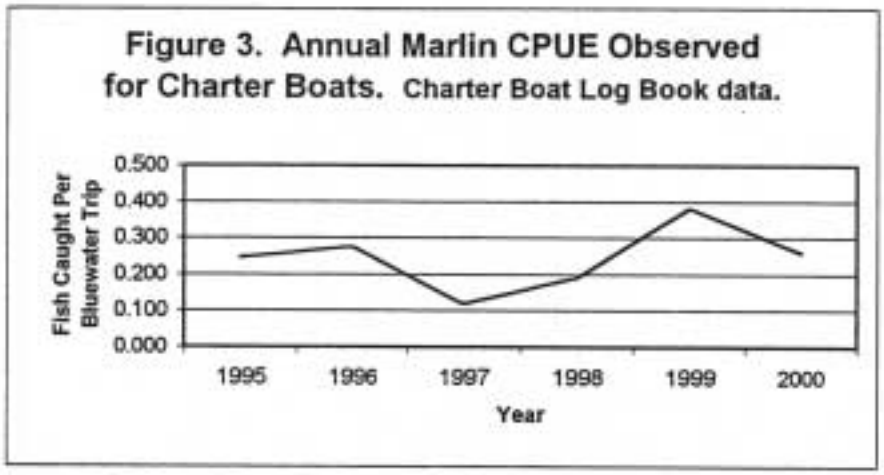


Figure 3. Annual Marlin CPUE Observed for Charter Boats. Charter Boat Log Book data.

Temporal Distribution

Recreational captures of marlin are not evenly distributed throughout the year. A summary of the monthly distribution of marlin captures recorded in the BMP from 1991 through 2000 shows the recreational fishery to be very compressed in time (Figure 4). This figure shows that marlins were captured by recreational anglers fishing off SC in every month except January, February and December. Over 87 percent of the marlin captures occurred during the three month period of May through July. The fishery reaches its peak in June and July when typically 30 percent of the annual marlin catch is made during each of these months. The late summer and fall, August through November, produces a slightly higher contribution to the total catch, 7.1 percent, than the early spring, March and April, which accounts for 5.7 percent.

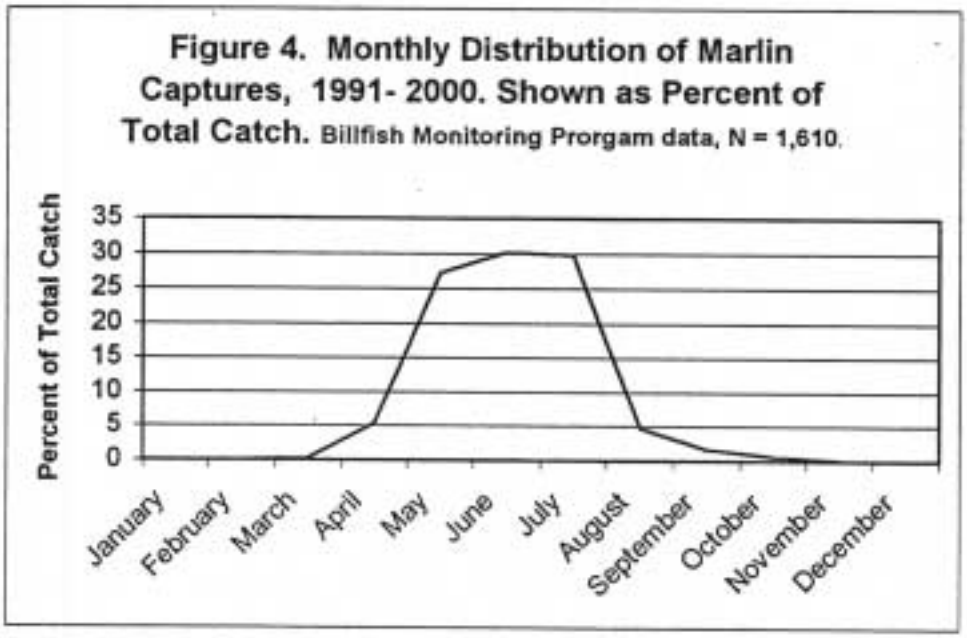
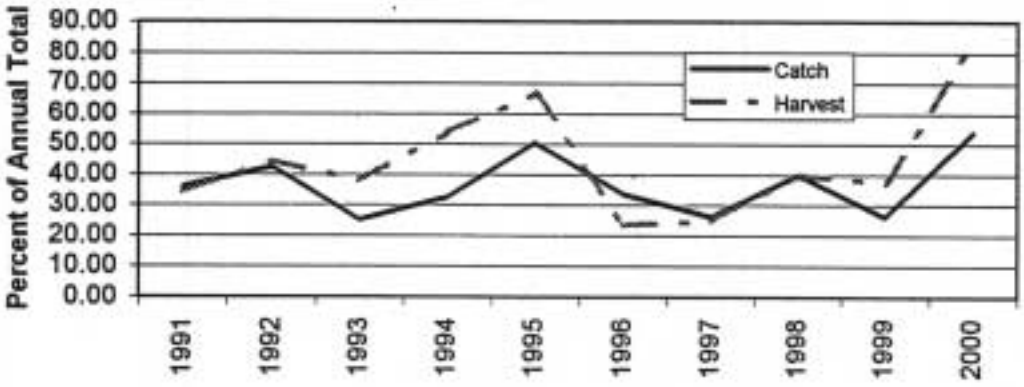


Figure 4. Monthly Distribution of Marlin Captures, 1991- 2000. Shown as Percent of Total Catch. Billfish Monitoring Prorgam data, N = 1,610.

The management year set for billfish by the National Marine Fisheries Service's Highly Migratory Species Section, June 1 to May 31, effectively divides the peak marlin fishing period in the Carolinas and Georgia. The SC marlin season normally starts in April with three or four major recreational fishing tournaments targeting billfish usually scheduled prior to June 1. Over the last ten years, 1991 – 2000, this period has accounted for 26 to over 50 percent of the annual marlin catch (Figure 5) with an average contribution of 36 percent . This period's contribution to the annual marlin harvest has ranged from 23 to 83 percent of the annual harvest over the last seven years accounting for an average of 40 percent of the harvest each year.

Figue 5. Comparison of the Early Season (January through May) Contribution to the Annual Marlin Catch and Harvest, Blue and White Marlin Combined. Billfish Monitoring Program data.



Fishery Trends

User Groups

There are two primary recreational user groups for marlin, charter and private boat fishermen. These groups utilize the marlin resources under three different modes of fishing. Two categories are distinct from each other, the typical private boats fishing for fun and charter boats fishing a normal for-hire trip. The third mode, tournament fishing, overlays the first two categories and clouds the motivation or purpose for the trip. While the portion of the total charter and private boat marlin catch taken during competitive fishing is not known, the proportion of marlin taken during tournament fishing versus non-tournament fishing, 1977 - 2000 and between charter and private boats during the last six years has been documented.

Tournament versus Non-tournament Anglers

Comparing the catch distribution for marlin, blue and white combined, taken by tournament versus non-tournament fishing (Figure 6) shows large variations during the 24 years covered. Competitive fishing contributed from 27 to 89 percent of the annual marlin catch over the period examined. Tournament fishing dominated the marlin catch in the early years, 1977 – 1988, contributing 64 percent of the total fish caught. In 1989 the fishery began a period where non-tournament fishing became the major contributor to the marlin catch, accounting for 58 percent of the marlin caught (1989-00). However, the overall catch was virtually evenly split, 50.1 percent tournament to 49.9 percent non-tournament. The average catch distribution during the last six years showed non-tournament fishing holding a slight edge, accounting for 57 percent of the catch.

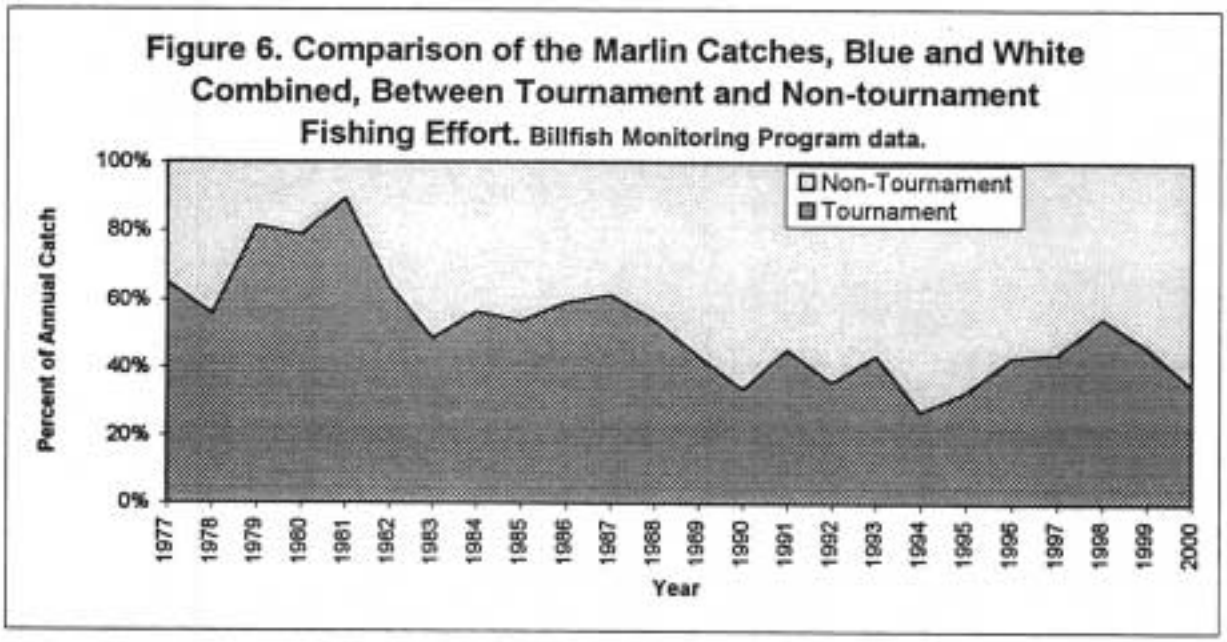
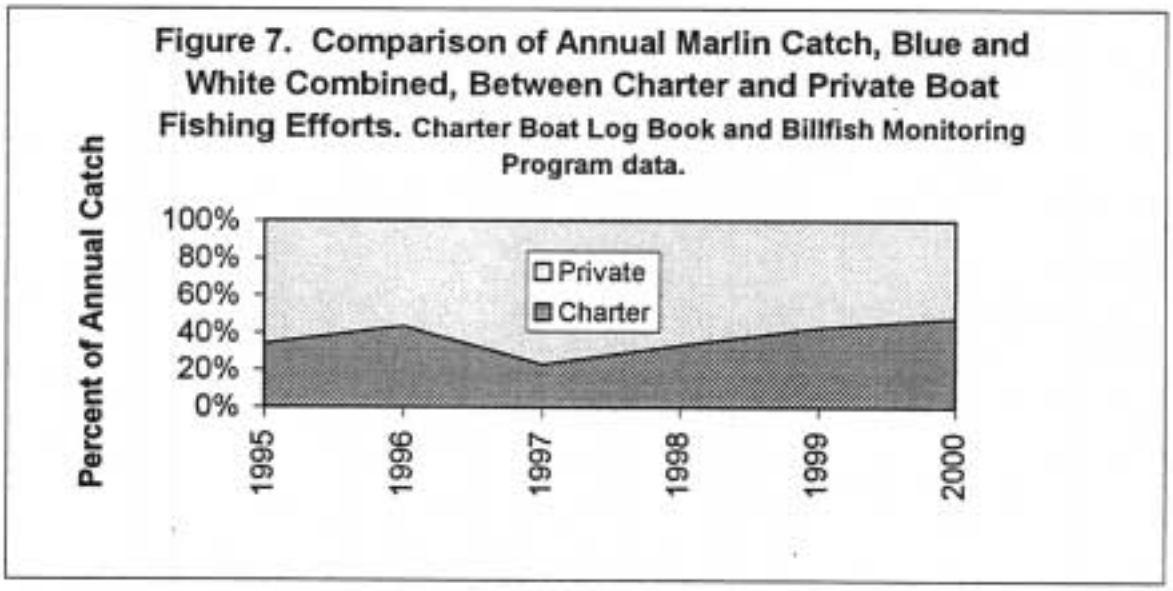


Figure 6. Comparison of the Marlin Catches, Blue and White Combined, Between Tournament and Non-tournament Fishing Effort. Billfish Monitoring Program data.

Charter Verses Private Boat Anglers

Data on the catch of billfish by charter vessels are available from two sources, the MRFSS and the SC Charter Boat Log Book Program (CBLBP). Because of inherent problems the MRFSS has with accurately sampling a rare-event fishery, it will not be used to profile the SC fishery, but will be discussed later. Data on the captures of marlin by charter boats were generated through the CBLBP for the six year period of 1995 through 2000. In this period, the for-hire-vessels captured from 23 to 48 percent of the annual marlin catch (Figure 7). Over the six years, charter boats accounted on average for 39 percent of the annual catch, while private boat anglers dominated the marlin fishery with 61 percent.

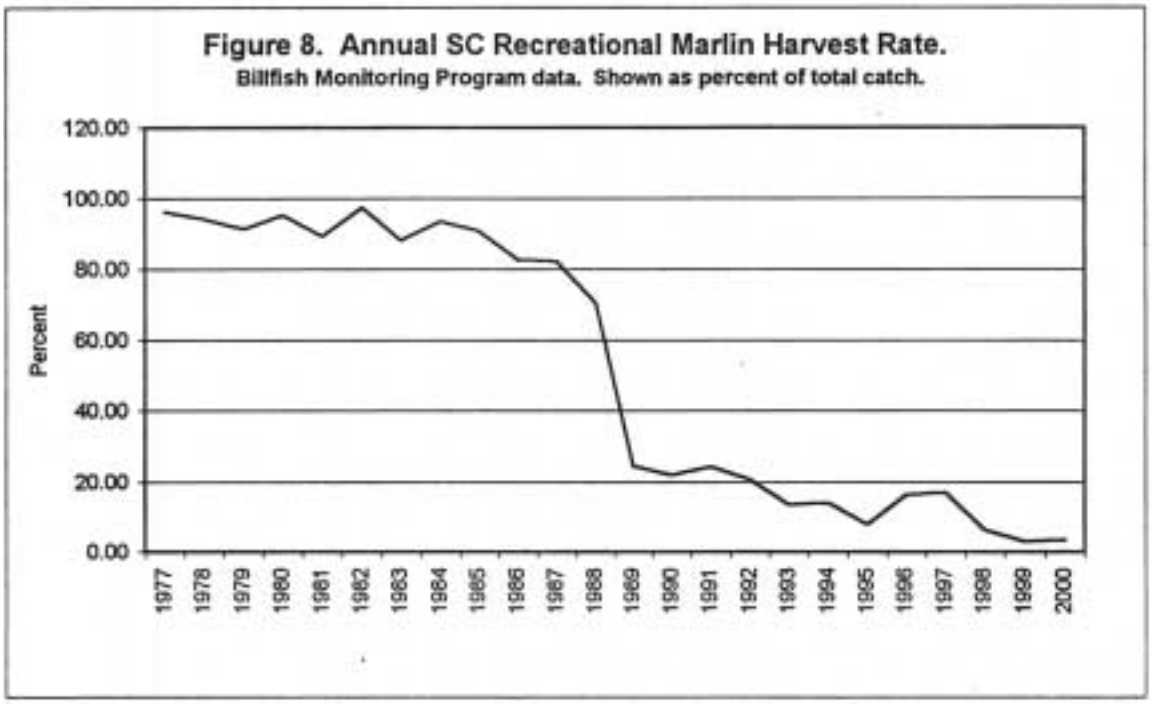
Figure 7. Comparison of Annual Marlin Catch, Blue and White Combined, Between Charter and Private Boat Fishing Efforts. Charter Boat Log Book and Billfish Monitoring Program data.



HARVEST RATES

Annual Fishery

Over the 24 years surveyed, the annual harvest rate (percent of total catch brought to the dock) ranged from over 97 percent down to 3 percent (Figure 8) with an average rate of 39.3 percent or 42 fish per year. In contrast to the increasing number of fish caught, the harvest rate declined sharply. From 1977 through 1988, the number of marlins (blue and white combined) brought to the dock averaged 66.1 fish per year or 87.8 percent of the recorded catch. During the last 12 years there was a radical drop in the number of fish brought in with the highest harvest rate observed during this period occurring in 1989 at 24.5 percent. During this latter period, the average harvest rate was 13.0 percent or 18 marlin per year. This was primarily due to the enactment of minimum size restrictions for billfish in October of 1988 by the NMFS. The initial size restriction, 86 inches lower-jaw to fork length (LJFL) for blues and 62 inches LJFL for whites, was intended to reduce the harvest rate by 50 percent. The minimum size for legal harvest has since been increased twice and inadvertently decreased once due to the inclusion of body robustness (curvature) into the FL measurement (BCFL) in 1999, resulting in the current 99 inches BCFL for blue marlin and 66 inches BCFL for white marlin. Narrowing the focus to the last six years, the harvest rate has declined even further to an average annual rate of only 7.6 percent or 11.7 marlin, of which all are blue marlin.



Tournament versus Non-tournament

Comparison of the contribution of competitive and non-competitive fishing modes to the historical harvest of marlin (Figure 9), clearly shows that tournament angling activity accounts for the majority of fish brought to the dock. During the 24 years covered, tournament fishing harvested the most marlin every year except 1983, when non-tournament fishing accounted for one fish more. Overall, tournament fishing effort resulted in an annual harvest of twice as many marlins (28 fish per year or 52.4 percent on average) as non-tournament fishing (14 fish per year or 26.1 percent on average). From 1977 to 1988, tournaments accounted for an average of 43.7 marlin harvested per year while non-tournament fishing was responsible for an average of 22.3 fish landed per year. A drop of over 70 percent was observed in the harvest of marlin in the second half of the period, 1989 to 2000, when tournament angling resulted in the harvest of 12.3 marlin per year on average, while the non-tournament angling harvest averaged only 5.7 fish per year.

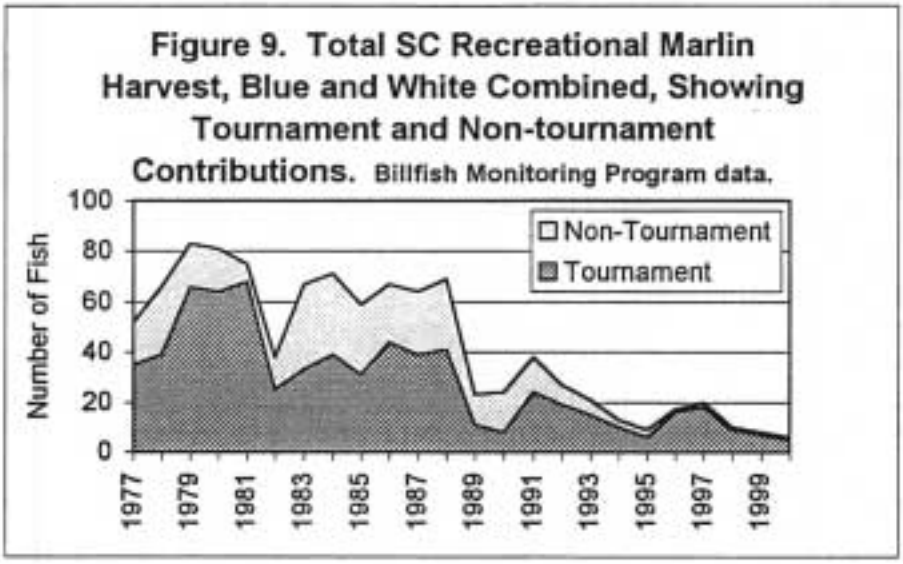


Figure 9. Total SC Recreational Marlin Harvest, Blue and White Combined, Showing Tournament and Non-tournament Contributions. Billfish Monitoring Program data.

Charter versus Private Boat

The CBLBP provides a look at the contribution by charter boats to the harvest of marlin in recent years in SC (Table 1). Overall, they averaged bringing 3.7 marlins, blue and white combined, per year to the dock. From 1995 through 2000, charter boats retained from 0.9 to 15.6 percent of the marlin they caught (Figure 10). During the six year period, charter boats captured an average of 38.6 percent of the marlin caught and were responsible for an average of 32.2 percent of the marlin harvested. Charter boats dominated the marlin harvest in two of the last six years. This user group was shown to account for 10 to 67 percent of the marlin harvested annually. Thus anglers aboard charter boats accounted for less than one third of the marlin brought to the docks during this period.

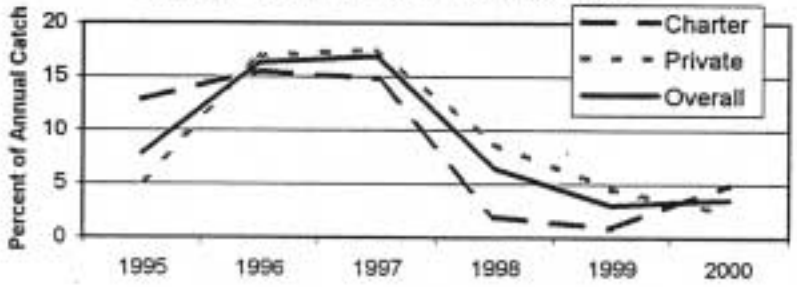
Table 1. Contribution of the Charter Boat Fishery to the Total SC Marlin Fishery. (Shown in number of fish.)

Year	Charter Boat		Total Fishery		Charter Contribution to Total Harvest (%)
	Caught	Retained	Caught	Retained	
1995	39	5	115	9	55.55
1996	45	7	104	17	41.18
1997	27	4	118	20	20.00
1998	52	1	155	10	10.00
1999	114	1	267	8	12.50
2000	81	4	169	6	66.67
Average	59.7	3.7	154.7	11.7	31.62

Comparison of the 1995 through 2000 marlin harvest rates by charter boats versus private boats showed that private vessels harvested a higher percentage of their catch (Figure 10). Charter vessels harvested from 0.9 to 15.6 percent of the marlin they captured. Anglers

aboard private vessels retained from 2.3 to 17.6 percent of their annual marlin catch. During this period, charter boat anglers averaged keeping 6.4 percent of the marlin they caught while private boat fishermen retained an average of 8.4 percent. In this same period, the total annual harvest rate ranged from 3.0 to 16.9 percent and averaged 7.6 percent.

Figure 10. Proportion of Annual Marlin Catch Harvested by Charter Boats, Private Boats and Overall. Billfish Monitoring Program and Charter Boat Log Book Program Data.



MRFSS CHARTER BOAT DATA

The MRFSS is the only federally operated survey that captures data on recreational billfish landings outside of the organized billfish competitions. However, it has historically been recognized as very weak in its ability to properly document rare-event fisheries, e. g. that for marlin. A comparison of the catch data reported by charter boats under the MRD's CBLBP and the corresponding NMFS's MRFSS estimates (Table 2), clearly demonstrates the program's inability to provide an accurate assessment for the marlin fishery in SC. The accuracy of MRFSS data for other highly migratory species with much higher occurrence levels, such as tuna, dolphin and wahoo, clearly show that the MRFSS data is of questionable reliability.

Table 2. Comparison of Charter Boat Catch Estimates of NMFS's MRFSS to Reported Landings Under the CBLBP. (Shown as number of fish.)

Species	95NMFS	95MRD	96NMFS	96MRD	97NMFS	97MRD	98NMFS	98MRD	99NMFS	99MRD
Dolphin	7000	4,891	12,868	33,721	16,480	5,385	18,403	3,632	18,071	6,204
Wahoo	<1,000	526	799	403	1562	524	3659	561	2310	1310
Yellowfin T.		592	541	566	784	268	11379	978	2353	1427
Blue marlin		35	0	30	0	16	0	33	0	98
White Marlin		4	0	15	0	11	0	19	0	16
Sailfish		55	0	93	373	33	348	80	159	131

DISCUSSION

Throughout the survey period, blue marlin dominated the SC recreational fishery for marlin with an average 3.4 captured for every white marlin caught. Annual marlin captures by recreational fishermen in SC rose significantly, 184 percent, during the last 12 years. The number of blue marlin reported captured annually off the state increased 186 percent between 1989 and 2000 compared to the previous twelve years. Similarly, white marlin catches have increased 179 percent in the last twelve years as compared to the earlier period of 1977 to 1988. The increase is even greater (208 percent for blue marlin and 195 percent for white marlin) when the comparison is narrowed to the period of 1995 - 2000 verses to 1977 – 1988. This clearly shows an increasing trend in marlin captures by recreational fishermen off South Carolina.

The increase in total number of fish caught should not be misconstrued as an increase in their overall abundance. A very clear decline in the annual marlin CPUE is shown over the review period by the surveyed billfish tournaments. With the observed CPUE for 1977-1988 averaging 0.181 FPBD for blue and white marlin combined, a decline of 21 percent, 0.143 FPBD, was noted for the last twelve years and a 27 percent decline, 0.132 FPBD was noted for the last six years. The marlin CPUE crashed in 1982 and only in 1992 was there any noticeable improvement observed. Thus, for blue marlin captures to have increased 208 percent in the 1995 – 2000 period, the declining catch rate would have required the fishing effort to have increased 264 percent over the average annual effort observed in 1977 – 1988. This clearly demonstrates a significant growth in the recreational fishery for billfish. While billfish tournaments clearly increased in participation, there had to be a corresponding growth in the non-tournament fishery for marlin since this segment of the fishery accounted for slightly over 55 percent of the average annual catch during this period. Fishery growth comes from three fronts - increased number of charter trips, increased number of private boat trips, and an increase in the number and size of tournaments targeting billfish. It is very likely that the promotion of recreational billfishing conducted by the South Carolina Governor's Cup Billfishing Series during 1989 to 2000, played a major role in the fishery's expansion .

The recreational fishery for marlin is very compressed in time, with 87 percent of the catch taken during three of the nine month fishery. Past CPUE surveys of billfish tournaments have shown this period to have the highest overall catch rates which would help to explain the high catch level. However, the largest billfish tournaments are also held during this same period, thus concentrating large amounts of effort, magnifying the period's catch and harvest levels. Any type of fishery closure during this period would have a significant impact on the state's offshore sportfishing industry.

Distribution of the annual catch of marlin varied greatly between the two user groups and among the three fishing modes. Charter boat anglers were responsible for a smaller segment (39 percent on average) of the annual marlin catch than their private boat counterparts. This is not surprising when you realize that charter vessels comprise a very small percent of the boats fishing offshore waters where marlin occur. However, this small fleet of offshore

vessels (probably less than 10 percent of the total fleet) was found to contribute a disproportionate share to the annual catch, 23 to 48 percent. Data from the CBLBP indicate that charter vessels are far more effective in catching marlin than the average vessel fishing in tournaments. Marlin catch rates based on charter trips to waters where marlin could be present show these vessels to have an average annual CPUE of over 185 percent higher than the average vessels fishing tournaments. This is in-spite-of the belief that boats competing in tournaments have the most experienced fishermen aboard which are equal in skills to charter boat crews. This suggests that experienced crews that fish frequently catch more marlin. This is probably a result of increased fishing effort per individual vessel combined with more experienced crews. Subsequently, any growth within this small user group would have the largest impact on the annual marlin catch.

South Carolina's recreational offshore fishery has made exceptional progress toward conserving the stocks of both blue and white marlin. During the 24 years covered in this report, the fishery has gone through a complete reversal in harvest trends, from a 97 percent kill-fishery to a 97 percent release-fishery. Annual release rates for the fishery have always exceeded the target level set by NMFS in its establishment and adjustments to the minimum legal size.

A higher level of harvest was consistently observed in the competitive/tournament mode of fishing than in the everyday angling mode. The average annual harvest rate for marlin dropped 70 percent between the first and last half of the survey period. In the last six years covered, the harvest rates had fallen to 17.1 percent for tournaments and 1.4 percent for non-tournament fishing with an overall average of 7.6 percent harvest. Of the two user groups utilizing the resource, private boat anglers were found to not only have accounted for the majority of the average annual marlin catch (60 percent), 1995 through 2000, but also to have retained an appreciably higher percentage of their catch, an average of 8.4 percent. During this period, charter boat anglers retained on average 6.2 percent of their marlin captures. Thus the private boat consumer group and the competitive/tournament fishing mode were the primary contributors to the harvest of marlin, while the charter boat user group were the most effective in catching marlin.

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Appendix 1. Survey instrument used in SC Billfish and Oceanic Pelagic Survey.

Tournament Name_____ Port of Departure_____

Boat name_____ Date_____

Hours Fished _____AM/PM TO _____AM/PM Wind Speed (knots)_____

No. of Persons_____ No. of Lines Fished_____ Wind Direction_____

Area Fished _____ Wave Height & Direction_____

Depth Water Fished_____ Sky Cover_____

Billfish Hooked but Lost				Total Non-Billfish Caught				
Species	Time Hooked	Time Lost	Bait	Species	Total Number	Number Released	Weight Est.	Water Depth

Billfish Caught or Released

Species	Time Hooked	Time Boated	L Jaw To Fork cm	½ Girth	Sex	Weight Lbs- Oz.	Bait Used	Additional Notes

Species	Non-Billfish Fork Lengths								

Non-Billfish Species

Species	Weight (lbs)	Total length	Fork Length	½ Girth	Sex	Notes