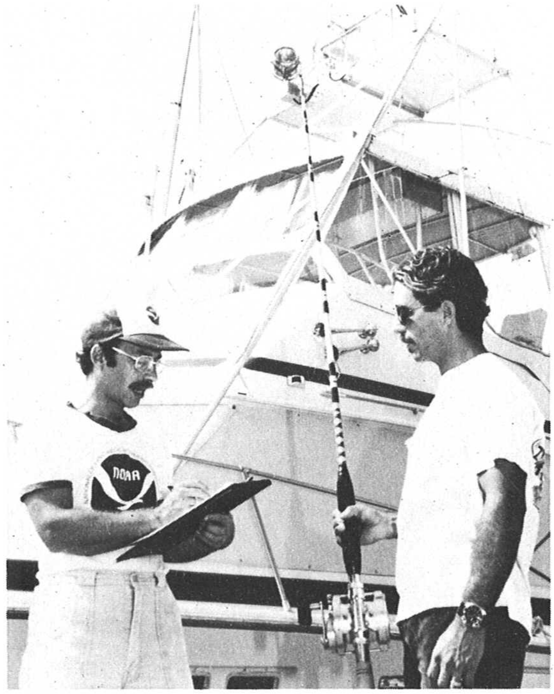
NOAA Technical Memorandum NMFS-SEFC-163

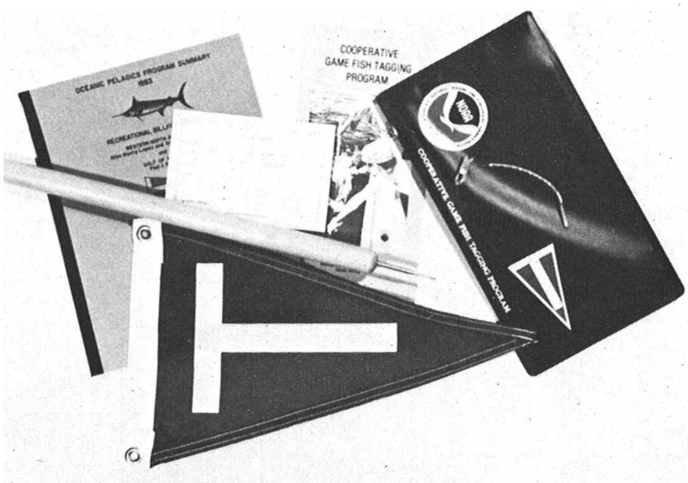
SEFC OCEANIC PELAGICS PROGRAM 1984



RECREATIONAL BILLFISH SURVEYS

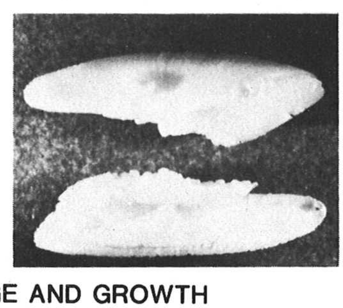
WESTERN NORTH ATLANTIC
Angelo R. Bertolino and Allyn Monty Lopez

GULF OF MEXICO
Paul J. Pristas and Deborah C. Fable



COOPERATIVE GAMEFISH TAGGING

Edwin L. Scott and Joseph P. Contillo



RESEARCH ON AGE AND GROWTH

Eric D. Prince and Dennis W. Lee

NOAA-NMFS
SOUTHEAST FISHERIES CENTER, MIAMI LABORATORY
75 VIRGINIA BEACH DRIVE
MIAMI, FL 33149
JULY 1985

NOAA Technical Memorandum NMFS-SEFC-163

Technical Memorandums are used for documentation and timely communication of preliminary results, interim reports, or special-purpose information, and have not received complete formal review, editorial control, or detailed editing.

SEFC Oceanic Pelagics Program 1984

Angelo R. Bertolino
Allyn Monty Lopez
Paul S. Pristas
Deborah C. Fable
Edwin L. Scott
Joseph P. Contillo
Eric D. Prince
Dennis W. Lee

July 1985

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Anthony J. Calio, Administrator
NATIONAL MARINE FISHERIES SERVICE
William G. Gordon, Assistant Administrator for Fisheries

SEFC Oceanic Pelagics Program

1984

CONTENTS

		Page
I.	Preface	1
II.	Recreational Billfish Surveys	4
	Western North Atlantic	4
	Gulf of Mexico	14
III.	Cooperative Gamefish Tagging	31
IV.	Age and Growth Research	47
V.	Appendix	63

PREFACE

The National Marine Fisheries Service (NMFS) Southeast Fisheries Center's Miami Laboratory has the responsibility of collecting and analyzing data on certain pelagic marine fishes[1]. This is part of a commitment by the United States to develop national programs for conserving and managing these species and to participate in cooperative international investigations through the International Commission for the Conservation of Atlantic Tunas (ICCAT). Information collected on these species is also used by regional Fishery Management Councils to formulate fishery management plans. The ICCAT is responsible for coordinating and guiding scientific investigations on stocks of tunas and tuna-like fishes, including billfishes, in the Atlantic Ocean and adjacent seas. Data collected through NMFS programs are used in population modeling and in annual assessments of the status of stocks of Atlantic billfishes and tunas, and these results are presented to the international scientific community at ICCAT each year.

The Oceanic Pelagics Program in the Fishery Biology Division of the Miami Laboratory is responsible for providing comprehensive biological profiles of tunas and billfishes for stock assessment. However, stock assessments of oceanic pelagics, as well as other species, are conducted by the Fishery Analysis Division of the Miami Laboratory. The three major activities of the Program are Recreational Billfish Surveys, Cooperative Gamefish Tagging, and Research on Age and Growth. We publish information on all three activities in order to provide a comprehensive report of our work to the fishing public. However, we hope the information in this report will not only be useful but will encourage anglers to participate in the various parts of our program. News releases about significant events will continue to be issued as they occur throughout the year.

Recreational billfish surveys have been conducted in the Gulf of Mexico since 1971 and in the Atlantic Ocean and Caribbean Sea since 1972 (Fig. 1). These surveys were initiated to monitor annual trends in recreational billfish catch and effort. A composite list of tournament and dock sampling sites arranged in chronological order is in Appendix 1 for all Atlantic, Gulf, and Caribbean areas that were included in the 1984 billfish survey. During 1984, 107 tournaments and 15 docks were monitored and 87,598 hours of effort were recorded. The recreational billfish survey section of this summary is presented in two parts. The first part is by Angelo R. Bertolino and Allyn "Monty" Lopez and covers the western North Atlantic (U.S. east coast, Bahamas, Caribbean Sea and Straits of Florida). The second part is by Paul J. Pristas and Deborah C. Fable and covers the Gulf of Mexico.

The Cooperative Gamefish Tagging Program was initiated at Woods Hole Oceanographic Institution in 1954 by Mr. Frank J. Mather, III. This program is a cooperative effort between recreational anglers, commercial fish-

---

[1]The primary species covered in this program summary include blue marlin, *Makaira nigricans*; white marlin, *Tetrapturus albidus*; sailfish, *Istiophorus platypterus*; and bluefin tuna, *Thunnus thynnus*. Additional information is also given for Atlantic spearfish, *Tetrapturus* spp.; broadbill swordfish, *Xiphias gladius*; and yellowfin tuna, *Thunnus albacares*.

ermen, and fishery scientists to tag and release oceanic pelagic fishes and provide basic information on their movements and migrations in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (Fig. 1). Beginning in 1973, the program was jointly funded and operated by Woods Hole and the National Marine Fisheries Service's Miami Laboratory. In 1980, the Miami Laboratory took over sole responsibility for the program. Since 1954, 100,616 fish of 30 different species have been tagged and released; 5,585 recaptures have been recorded. The Cooperative Gamefish Tagging Section of this summary was prepared by project leader Edwin L. Scott and Joseph P. Contillo.

Research on age and growth of oceanic pelagic fishes was first initiated at the Miami Laboratory in 1974. Bluefin tuna were of particular interest at that time; and more recently (1980), blue and white marlin have been targeted for studies on age and growth. New age and growth studies are being planned for swordfish, sailfish, and bluefin tuna (annual assessment). Although the section on research currently emphasizes work on age and growth, the topic area of our research program can be expected to change over time, as information needs on the biology of these fishes change. This type of research provides important information for assessment of the status of these fish populations. This section of the summary was prepared by Eric D. Prince and Dennis W. Lee.

All three activities of the Oceanic Pelagics Program are closely associated and are being conducted simultaneously in the same geographical region (Fig. 1). For example, many of the billfish tagged for cooperative gamefish tagging are tagged during the tournaments that are monitored by the billfish surveys. Conversely, tagged billfish that are recaptured after being at-large for extended periods are sampled for skeletal structures to aid validation of the accuracy of our ageing studies. In addition, many of the fish sampled for age and growth studies are obtained at tournaments or from docks monitored by the billfish surveys. Accordingly, activities within the Oceanic Pelagics Program are not only closely associated with each other but their success is highly dependent on cooperation from fishermen.

We extend our sincere appreciation to all cooperating parties for their help, and we hope the information provided in this report will be useful and encourage anglers to continue or start participating in the various program activities.

ERIC D. PRINCE
Oceanic Pelagics Program Leader

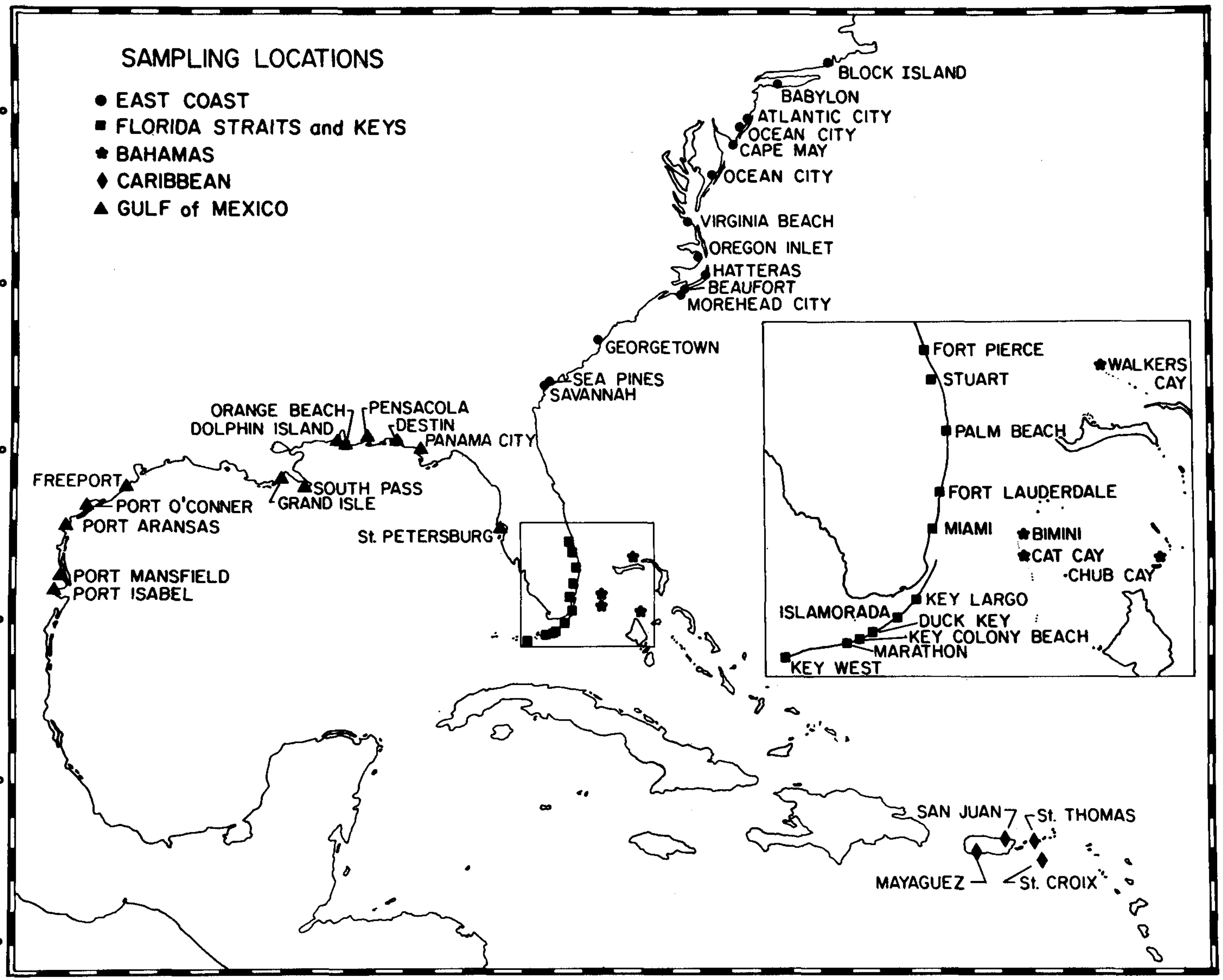


Figure 1 - Sampling locations for Recreational Billfish Surveys and general area of coverage for the Cooperative Gamefish Tagging Program and Research on Age and Growth of the Oceanic Pelagics Team, Miami Laboratory.

RECREATIONAL BILLFISH SURVEYS

WESTERN NORTH ATLANTIC

Angelo R. Bertolino and Allyn Monty Lopez

This is the 13th consecutive year we have conducted recreational billfish surveys in the western North Atlantic. Data from this region were collected by several different agencies. National Marine Fisheries Service personnel collected data from the Bahamas, the Caribbean, and the Florida Straits. The U.S. East Coast was covered by fishery reporting specialists working for NMFS, state biologists from South Carolina, and by Environmental Consultants Inc., Norfolk, Virginia. Biologists from the Florida Department of Natural Resources assisted in sampling billfish tournaments in the Florida Keys.

The data obtained from surveys of these areas include fishing effort; the number of fish hooked by species; the number of fish landed by species; largest, smallest, and average weights of fish by species; types of baits used and effectiveness of each bait; and various environmental data associated with each fishing trip. Hook per unit of effort values (HPUE) were calculated by dividing the number of fish hooked by the number of hours spent trolling. Calculations of HPUE for different baits -- natural bait (dead), artificial bait (lures), or both trolled simultaneously -- are discussed in each section. Angler success was calculated by determining the percentage of fish caught after being hooked. A fish that is recorded as caught (or landed) can be one that is boated or released. These calculations are not only expressed in overall effort but also by the type of bait used.

Changes in the amount of fishing effort recroded in the western North Atlantic can reflect different sampling intensities from year to year, can be a direct measure of fishing activity where the sampling was conducted, or could be a combination of both factors. For example, the 52,958 hr of trolling effort documented in the western North Atlantic in 1984 was the second highest amount of billfishing effort recorded since the survey began in 1972 (Fig. 1). The maximum effort recorded in 1983 (65,745 hr) was only about 1% more than this season but these two years were generally more than 2 times higher than most other years of the survey. The large increase in fishing effort in this region during the last two years is partly due to an increase in sampling coverage and intensity, particularly the special project conducted in 1983 as reported in last year's summary. However, we also feel there has been a steady increase in billfishing activity since about 1980. In 1984, 34% of the effort was recorded from the east coast, while 30%, 18%, and 17% of the effort was from the Bahamas, Caribbean, and the Florida Straits, respectively.

The East Coast of the United States

Sampling along the U.S. east coast in 1984 recorded 18,212 hr of fishing effort (Table 1). This amount was reduced from the effort documented in 1983 (27,751 hr) but still represents the second highest level of billfishing effort recorded during the past 13 yr of the survey (Fig. 1). The reduction of fishing effort in 1984 compared to the previous year is due primarily to a decrease in the level of sampling.

The overall number of fish hooked per unit effort in 1984 (0.108, Table 1) was a slight increase from 1983 (0.103). The values are generally within the commonly observed level recorded during the past 13 yr, which ranged from a low of 0.062 in 1972 to a high of 0.225 in 1980. Blue marlin HPUE dropped from 0.014 in 1983 to 0.008 in 1984 and represented the lowest hook rate recorded over the last 13 yr. However, white marlin HPUE increased slightly from 0.084 in 1983 to 0.098 in 1984 and was in the middle of the previously observed range of hook rates. In 1984, there were not sufficient data to calculate HPUE for sailfish.

The average weights for blue marlin, white marlin, and sailfish increased slightly in 1984 (313.5, 52.0, and 36.8 pounds, respectively, Table 2) compared to 1983 (291.9, 48.9, and 35.3 pounds, respectively). These data do not appear to represent any perceivable change in overall trends observed during past years (Fig. 2). At least one very large blue marlin was caught along the east coast in 1984; it weighed 901 pounds.

Anglers along the east coast were generally not as successful in landing their billfish in 1984 as they were in 1983. The overall angler success was 47% in 1984 compared to 64% in 1983 (Table 3). Angler success for blue and white marlin decreased from 55% and 65% in 1983 to 42% and 46% in 1984, respectively. The exception to this trend was sailfish, where angler success increased from 64% in 1983 to 90% in 1984.

Attempts to interpret HPUE for all species combined using different bait types should be made with the understanding that sailfish are caught almost exclusively on natural baits. In addition, the catches using artificial baits are dominated by marlin, although marlin are also caught on natural bait as well. These basic trends generally hold true throughout all sampling areas of the western North Atlantic. The 1984 HPUE using different bait types along the east coast generally reflected minor fluctuations compared to 1983, except for HPUE for natural baits which increased from 0.153 (1983) to 0.219 (1984, Table 4). The high angler success rate for sailfish in 1984 (90%) probably contributed to the increase in natural bait HPUE and CPUE (Table 4). Artificial bait HPUE decreased from 0.048 in 1983 to 0.036 in 1984, which HPUE using both baits simultaneously increased slightly from 0.051 in 1983 to 0.056 in 1984.

The Bahamas

The hours of fishing effort recorded in the Bahamas for 1984 (16,014 hr, Table 1) increased by 28% compared to 1983 (11,441 hr). This increase represents the most fishing activity recorded from this area during the 13 years of the survey and there has been a consistent increase in fishing effort recorded in this area during the last four years of study.

There was an overall decrease in HPUE from 0.042 in 1984 compared to 0.058 in 1983 (Table 1). However, the 1984 overall HPUE was well within the normal range recorded for the Bahamas during the 13 years of study. In addition, the long term trend in overall HPUE from this area was the most consistent (i.e., had the smallest variance), from year to year, of all areas. This consistency was also reflected in the 1984 HPUEs for blue marlin, white marlin, and sailfish (Table 1), which showed little variation from 1983 values, as well as from other years of the survey.

The overall average weight of blue marlin (both sexes combined) in 1984 (176.7 pounds, Table 2) was the lowest mean value recorded from the Bahamas since 1972. Only in two other years (1980, 1983) did the overall average weight of Bahamian-caught blue marlin fall below 200 pounds. However, two consecutive years of declining average weights is not necessarily indicative of a long-term trend. This decrease in weight was not evident with white marlin or sailfish for 1984, where modest increases of 2.3 and 4.8 pounds, respectively, were shown over 1983 weights. Average weights by sex are given in Table 2.

Overall, angler success in the Bahamas remained constant at 51% for both 1983 and 1984 (Table 3). There was a 1% increase in blue marlin caught in 1984 (45%) compared to 1983 (44%); while the percentage of white marlin caught increased by 6% from 58% in 1983 to 64% in 1984. Angler success of sailfish had the greatest increase from 68% in 1983 to 77% in 1984.

Data collected from the Bahamas provided relatively complete information on the types of baits trolled in 1984. The 1984 HPUEs for all bait types decreased compared to the previous year. For example, the 1984 HPUEs for natural baits, artificial baits, and both baits trolled simultaneously (Table 4) were 0.047, 0.043, and 0.033, respectively; whereas 1983 values were 0.062, 0.061, and 0.048. The values for HPUE and the percent fish caught in the Bahamas (Table 4) on natural and artificial baits are generally close except for both baits trolled simultaneously (Table 4). The CPUE for these same bait types indicates that catch rates for natural baits are higher than for artificials. As reported in past yrs, the 1984 HPUE (0.033) when trolling both baits together is generally lower compared to the other bait types (Table 4).

In 1984, the results from trolling both baits simultaneously showed that 38% of the blue marlin were hooked on natural baits and 62% were hooked on artificial baits. For white marlin, 50% were hooked on natural baits and 50% were hooked on artificial baits. All sailfish hooked were on natural baits.

In last year's program summary, we reported that the catch rates for artificials were considerably higher than for natural baits. Due to a calculation error, the CPUE for artificials should have read 0.030 instead of 0.500. Therefore, 1983 CPUEs for natural baits were higher than for artificials, which was also the case in 1984.

The Caribbean

Data from the Caribbean were collected during tournaments which were held during the most productive part of the 1984 fishing season (April-September). Although the 9,675 hr of fishing effort recorded in 1984 (Table 1) was a 50% reduction from the previous year (19,148 hr), the 1984 fishing effort was still more than 50% larger than previous effort recorded since 1972. The sharp decline in 1984 effort is because data were collected in the Caribbean from January through December in 1983 but not in 1984.

The 1984 total HPUE (all species combined) was 0.059, which is a slight drop from the previous year (0.063) and is the second lowest hook rate recorded during the past 13 yr. The HPUE for blue marlin and sailfish dropped slightly from 0.057 and 0.004 in 1983 to 0.053 and 0.002, respectively, in 1984 (Table 1). However, white marlin HPUE increased from 0.001 in 1982 to 0.003 in 1984 (Table 1).

The overall average weight of blue marlin and sailfish increased from 189.2 and 40.5 pounds, respectively, in 1983 to 192.0 and 46.0 pounds in 1984 (Table 2). Conversely, white marlin had a decrease in overall average weight of 54.4 pounds in 1983 to 49.8 pounds in 1984. However, all these data appear to be within the normal range of average weights for all three species recorded from the Caribbean since 1973. Average weights by sex for the Caribbean are given in Table 2.

The overall angler success (all species combined) in the Caribbean decreased from 69% in 1983 to 55% in 1984 (Table 3). This overall decrease was reflected about equally in the species success rates, which also decreased for the previous year in about equal proportions.

As in past years, the Caribbean had the highest HPUE for both baits trolled simultaneously compared to other areas (Table 4). Fishermen in the Caribbean (particularly in St. Thomas) generally "pickle" their baits in formalin and use techniques to rig and troll baits at higher than normal speeds. Thus, the combination of both baits trolled together at speeds that are more effective for artificial baits may result in high catch rates. This is also substantiated when comparing the CPUE by bait types with other areas (Table 4).

The Florida Straits

Sampling effort and coverage increased slightly and more hours of fishing effort (Table 1) were collected from the Florida Straits in 1984 (5,091 hr) than in 1983 (4,397 hr).

The annual Key West Blue Marlin Tournament (KWBMT) provides the only consistent data on marlin hook rates from the Florida Keys, since most billfishing effort in this area traditionally emphasizes sailfish. The hours of fishing effort documented for KWBMT for 1984 (2,556 hr) were about 1% less than reported in 1983 (2,631). The HPUE for blue and white marlin de- creased slightly from 0.022 and 0.003, respectively, in 1983 to 0.019 and 0.002 in 1984 (Table 1). These values are almost identical to marlin hook rates from this tournament in 1982, which was the first year we sampled the KWBMT. The 1984 HPUEs for both species of marlin are also very comparable to most of the average hook rates we observed from other areas in this geographical region.

We treat data from the Islamorada Sailfish Tournament as a special case by not including it in our HPUE calculations (Table 1) because it is the only Florida Straits live bait tournament we sample. This tournament is of general interest, however, because of its popularity and large size.

Fishing effort from the Islamorada sailfish tournament in 1984 (1,160 hr) decreased slightly from the previous year (1,286 hr). In 1984, 65 sailfish were hooked compared to 97 in 1983, which resulted in a decrease in HPUE from 0.075 to 0.056 in 1984. The HPUE for sailfish from this tournament is higher than for others in this area. This high HPUE might be explained by the fact that live bait is permitted and the probable high concentration of sailfish in this area when the tournament is held (November/December).

Additional data from other sailfish tournaments in the Florida Straits using natural (dead) baits, and to a lesser extent artificial baits, indicates 1,457 hr of fishing effort expended, 96 sailfish hooked, and a HPUE of 0.065 in 1984 (Table 1). The HPUE for all species combined in 1984 was 0.042, which was slightly less than 1983.

The overall average weight of blue marlin (264.9 pounds), white marlin (48.7 pounds), and sailfish (33.4 pounds) from the Florida Straits in 1984 (Table 2) were generally within the normal range of weights observed from other areas and during previous years. The average weights by sex for each species are also given in Table 2. The largest blue marlin from the Florida Straits in 1984 weighed 500 pounds compared to 328.8 pounds in 1983.

The overall angler success in the Florida Straits increased from 57% in 1983 to 62% in 1984 (Table 3). Angler success for blue marlin increased from 44% in 1983 to 50% in 1984; while white marlin angler success showed the greatest increase from 62% in 1983 to 86% in 1984. The unusually high success rate for white marlin is probably related to the small number (14) of white marlin hooked in the Florida Straits in 1984. Sixty-nine percent of the hooked sailfish were successfully landed in 1984 compared to 65% in 1983.

Information on the types of baits used indicate the highest HPUE was for natural baits, second highest was for artificial baits, and the lowest HPUE was for both baits fished simultaneously (Table 4). This trend was contrary to 1983 where the highest HPUE was for artificial baits followed by natural baits.

Acknowledgments

The success of this program is dependent upon the information collected from recreational fishermen. Therefore, a great deal of gratitude is extended to all of the anglers, crews, and tournament managers for their cooperation and patience in providing us with their fishing data. We particularly thank the South Carolina Wildlife and Marine Resources Department and the Florida Department of Natural Resources for their continued support. We also extend our thanks to the Bimini Big Game Fishing Club, the Cat Cay Club, the Chub Cay Club, the Walker's Cay Club, Club Nautico de San Juan, the directors of the Chuck Senff Marlin Tournament in St. Thomas, and Cayman Islands Million Dollar Month Tournament.

We recognize all of the samplers contributing to this program for working so diligently throughout the year.

Table 1. Hook per unit effort (HPUE) of billfishes by species and geographical area recorded in NMFS recreational surveys of the northwest Atlantic in 1984.

Species	U.S. East Coast	Bahamas	Caribbean	Florida Straits
Blue Marlin	0.008	0.031	0.053	0.019[1]
White Marlin	0.098	0.007	0.003	0.002[1]
Sailfish	--	0.003	0.002	0.065[2]
Overall	0.108	0.042	0.059	0.042[3]
Hours of fishing effort	18,212	16,014	9,675	5,091[3]

[1]Data were from Key West Blue Marlin Tournamant only.

[2]Data were from all Florida Straits billfish tournaments sampled except Key West Blue Marlin and Islamorada Live Bait Tournament.

[3]Data were from all Florida Straits billfish tournaments sampled except Islamorada Live Bait Tournament.

Table 2. Average weights (pounds) by species and geographical area, recorded in northwest Atlantic recreational billfish surveys, 1984.

Species	U.S. East Coast	Bahamas	Caribbean	Florida Straits	All Areas Combined[1]
Blue Marlin					
Male	192.5	131.4	139.0	110.7	135.0
Female	300.5	228.4	297.0	328.5	258.6
Overall	313.5	176.7	192.0	264.9	203.7
White Marlin					
Male	--	46.5	49.0	--	47.1
Female	--	62.0	53.0	50.0	60.7
Overall	52.0	56.3	49.8	48.7	52.9
Sailfish					
Male	--	39.4	--	35.5	39.0
Female	--	44.0	--	--	44.0
Overall	36.8	42.3	46.0	33.4	40.4

[1]Average weights of all fish weighed in 1984 by species.

Table 3. Number of billfish (by species) hooked, caught, lost, and percent caught by geographical area in the northwest Atlantic, 1984.

Species	U.S. East Coast	Bahamas	Caribbean	Florida Straits
Blue Marlin				
Hooked	158	500	514	88
Caught	67	226	281	44
Lost	91	274	233	44
% caught	42	45	54	50
White Marlin				
Hooked	1798	126	31	14
Caught	843	81	16	12
Lost	955	45	15	2
%caught	46	64	51	86
Sailfish				
Hooked	11	57	28	100
Caught	10	44	20	69
Lost	1	13	8	31
% caught	90	77	71	69
Overall				
Hooked	1967	683	573	202
Caught	920	351	317	125
Lost	1047	332	256	77
% caught	47	51	55	62

Table 4. Hours trolled, hook per unit effort (HPUE), percent fish caught, and catch per unit effort (CPUE) for three types of trolling baits (natural bait, artificial bait, and both simultaneously) used in the four geographical areas of the northwest Atlantic, 1984.

Bait Type	Hours trolled	HPUE	Percent fish caught	CPUE
		East Coast		
Natural	6,598	0.219	45	0.099
Artificial	6,698	0.036	61	0.022
Both Simultaneously	4,904	0.056	45	0.024
		Bahamas		
Natural	6,654	0.047	51	0.024
Artificial	7,354	0.043	48	0.020
Both Simultaneously	1,788	0.033	63	0.020
		Caribbean		
Natural	846	0.051	74	0.037
Artificial	1,049	0.058	62	0.036
Both Simultaneously	1,445	0.078	64	0.044
		Florida Straits[1]		
Natural	252	0.043	54	0.023
Artificial	1,622	0.024	62	0.015
Both Simultaneously	189	0.015	50	0.010

[1]Data from Key West Blue Marlin Tournament only.

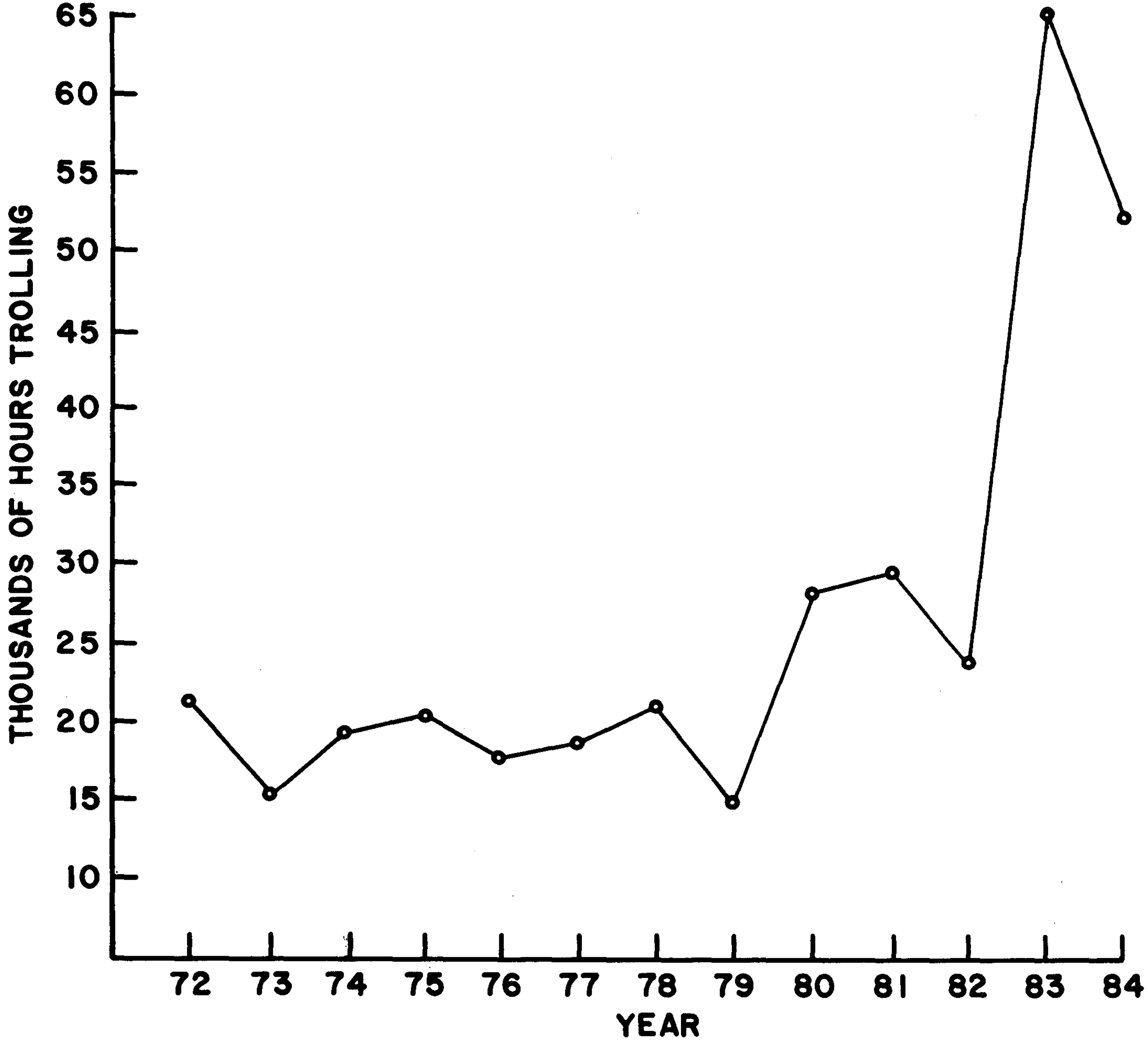


Figure 1 - Number of hours reported trolling for billfishes in the four geographical areas in western Atlantic, 1972-1984.

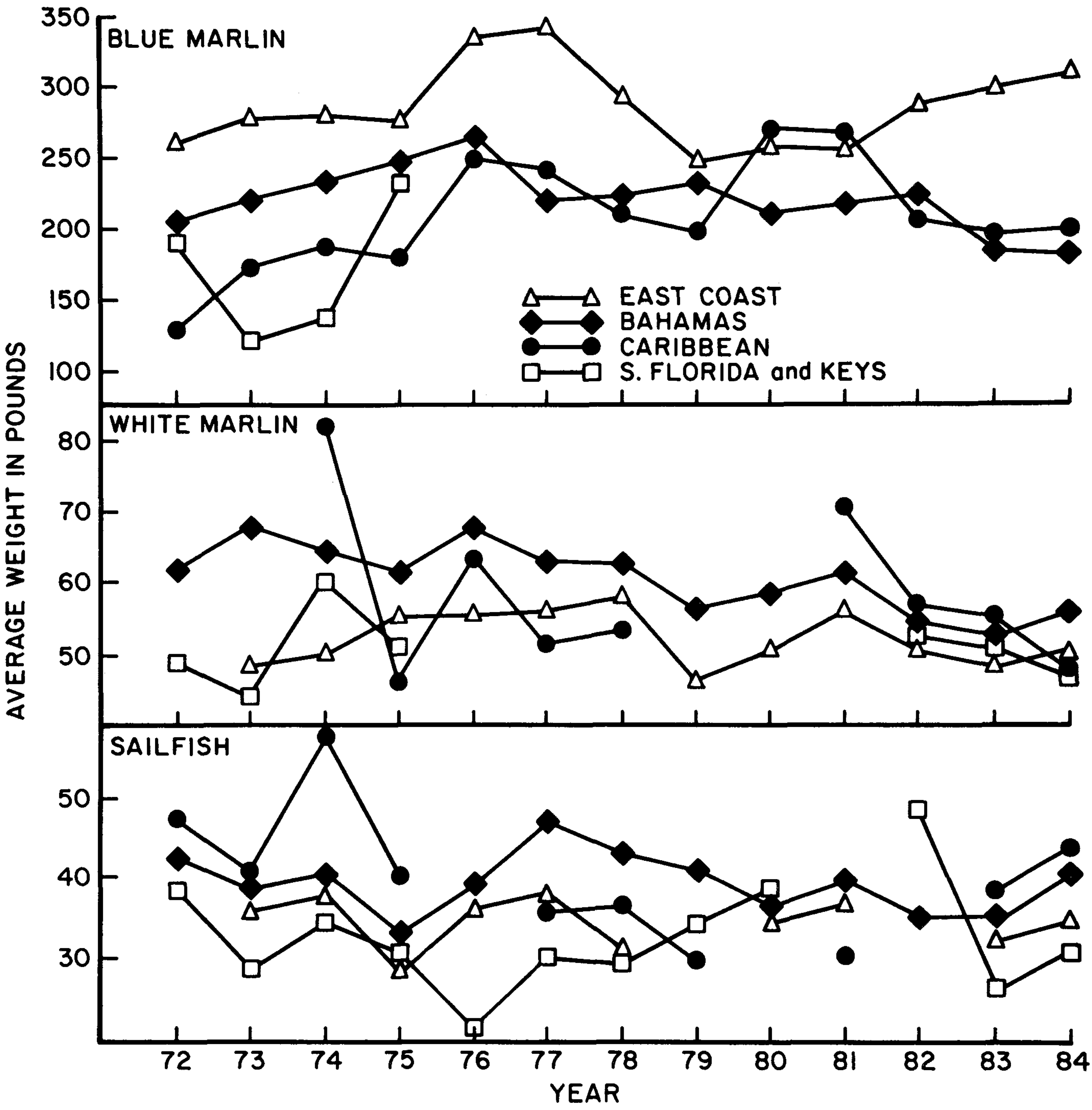


Figure 2 – Average weights (pounds) of billfishes from the U.S. east coast (Δ), Bahamas (◆), Caribbean (●), and South Florida and Keys (□), 1972 - 1984.

RECREATIONAL BILLFISH SURVEYS

GULF OF MEXICO

Paul J. Pristas and Deborah C. Fable

The recreational fishery survey of oceanic big game fishes in the Gulf of Mexico completed its 14th consecutive year in 1984. The survey was conducted by port samplers working out of six locations throughout the northern Gulf: Port Aransas, Texas; Grand Isle and South Pass, Louisiana; Mobile, Alabama-Pensacola, Florida; Destin and Panama City, Florida. Port samplers traveled throughout their area to collect data on catch and effort, environmental conditions, and biological samples. These data are listed by port, when feasible. In the northwestern Gulf, East Texas includes the ports of Galveston and Freeport; Central Texas includes Port O'Connor, Rockport, and Port Aransas; and South Texas includes Port Mansfield, Port Isabel, and South Padre Island. Data collection by NMFS personnel was assisted through the voluntary reporting of many individuals in the private sector.

Catch and Effort

Catch and effort data collected during the season are shown in Table 1. The 30,575 hr of recorded big game fishing effort was the third highest amount of effort recorded from the six ports since the study began in 1971. The maximum effort recorded from these ports was 31,343 hr in 1978; 3% more than this season. The amount of effort recorded in 1984 was 45% greater than the average amount (21,073 hr) collected during the previous 13 yr. Figure 1 shows the yearly amount of fishing effort gathered between 1971-84. Although the amount of data collected on fishing effort is influenced by weather, sampling intensity, and numerous other factors, there appears to have been a steady increase in big game recreational fishing activity since 1974. In 1984, 45% of the effort was recorded from the northeastern Gulf, while 28% and 27% was from the northcentral and northwestern Gulf, respectively.

In 1984, a total of 1,757 billfishes were reported caught (includes releases) while trolling in the northern Gulf (Tables 1 and 2). Anglers released about the same percentage of their catches during the 1984 season (32% or 562 fish) as they had in 1983 (34% or 665 fish). Of the 465 blue marlin reported caught, 20% (95 fish) were released. Anglers also reported releasing 40% (394 fish) of their white marlin catches (991 fish) and 25% (72 fish) of their sailfish catches (291 fish). Of these three species, blue marlin are the most difficult to land, with only 49% (428 fish) of the hooked fish being boated or released (Table 1), compared to 67% (863 fish) of the white marlin and 75% (246 fish) of the sailfish.

Our index of apparent relative abundance is based on the number of fish hooked-per-hour-of-trolling (HPUE). This index is calculated by dividing the number of billfish hooked by the number of hours trolled (Table 1). Many factors can affect this index and results may not necessarily be indicative of the relative or total numbers of billfishes available in the Gulf of Mexico. For the three areas, the highest HPUE for blue marlin and for sailfish (0.041, 0.032) was recorded in the northwestern Gulf. The highest HPUE for white marlin (0.067) was reported from the northeastern Gulf. Figure 2 shows the yearly HPUEs for blue marlin, white marlin, and sailfish for the past 14 years. For blue marlin, the 1984 HPUE (0.029) was 12% above the 1983 and 14-yr average HPUE (0.026). This increase, after two successive yearly decreases in HPUE, indicated continual fluctuation with no discernible increasing or decreasing trends for blue marlin. The 1984 HPUE (0.042) for white marlin decreased 9% from the previous year (0.046) and was 5% below the 14-yr average HPUE (0.044). The continuing fluctuations in HPUEs for white marlin are similar to those for blue marlin. For the seventh consecutive year, the HPUE (0.011) for sailfish has remained below the 14-yr average HPUE (0.019). The 1984 sailfish HPUE decreased by 15% compared to the previous year (0.013) and contributed to the decrease in the 14-yr average (0.019) compared to the 13-yr average (0.020). The low HPUE for sailfish in 1984 supports the long-term observation of a decreasing trend in the apparent availability of sailfish in the northern Gulf. For all three species combined, the 1984 HPUE (0.082) decreased 5% from the previous season's HPUE (0.086) and 7% from the 14-yr average HPUE (0.088).

In order to document more accurately the catches of billfishes throughout our study area, we began recording driftfishing effort in 1978 when this activity first became popular. Since this effort is primarily directed towards swordfish and entails a different style of fishing, these data were not analyzed in terms of catch rates but are summarized in Tables 3 and 4. The 531 hr of driftfishing reported in 1984 (Table 3) represented a 10% decrease from the driftfishing effort recorded in 1983. The 1984 effort was 22% below the average number of hours (679 hr) spent driftfishing during the previous 6 yr. Catches of swordfish (6 fish) decreased by more than one-half compared to 1983 figures (14 fish). The catch of 6 swordfish reported in 1984 was 24% below the 6-yr average catch recorded since 1978.

Size Composition

Biological data, such as weight, length, and sex are collected whenever possible in conjunction with catch and effort information. Weight data are presented in Table 4 for the largest, smallest, and average weights of billfishes recorded in 1984, with Figure 3 showing the yearly average weights from 1971-84. While collecting data during the season, there appeared to be an exceptionally high number of large (>500 pounds) blue marlin in the catches. This observation was reflected in the average weight (267.5 pounds) of blue marlin in 1984 (Table 4), which was higher than it had been during the previous four seasons (Fig. 3). The increase in size and increase in the HPUE for blue marlin during the 1984 season is generally indicative of a good fishing year. Although both the largest (109.7 pounds) and smallest (28.0 pounds) white marlin exceeded last year's corresponding weights, the average weight (51.3 pounds) of white marlin only increased 0.1 pounds. This slight increase was not sufficient to raise the cumulative yearly average, which has been decreasing since 1978. With the exception of 1978, the yearly average weight of white marlin has remained very close to 51-52 pounds during the last 9 years. For sailfish, the trend in size composition was similar to white marlin. For example, the average weight (41.6 pounds) of sailfish increased 0.4 pounds between 1983 and 1984, but was not enough to raise the cumulative yearly average (43.3 pounds), which decreased 0.1 pounds. As in most years of this study, the average weight of sailfish did not vary greatly from the cumulative yearly average.

Bait Preference

To help answer the frequently asked question of which bait or baits were "best" for billfishes, we collected data on the types of baits (i.e., natural or artificial) used, the number of hours each type was trolled, and the numbers of billfishes hooked on each bait type. We use HPUE (Table 5) as a measure of preference, even though a fish may strike a bait for reasons other than feeding. Results for each of the species varied among the three Gulf areas. When data for all three areas were combined, the results for blue marlin were not as definitive as in 1983 when artificial baits had the highest HPUE values while trolled alone and in conjunction with natural baits. In 1984, the combined results showed the highest HPUE (0.041) for blue marlin was on artificial lures when both bait types were trolled simultaneously. More detailed examination of this result indicates that nearly 70% of the fish were hooked on artificial baits when both bait types were trolled at the same time. When the two bait types were fished independent of each other, the HPUE (0.029) for each was the same. However, when all data were combined, 93% of the blue marlin were hooked on artificial baits. The hook rates for white marlin appeared to contradict this trend. The highest HPUE (0.049) was for natural baits only. However, when both baits were trolled simultaneously, the HPUE (0.036) for artificial baits was 64% higher than the HPUE (0.022) for natural baits. These results for white marlin were identical to those in 1983. When effort is not included and all data are combined, 89% of the white marlin were hooked on artificial baits. Sailfish bait preference did not change from the preceding season. Natural baits had the highest HPUE values for sailfish when fished independently and also while being trolled simultaneously with artificials. This tends to support the observations by some anglers that sailfish appear to prefer smaller natural baits over the larger artificial lures. If this is true, the more frequent use of artificial baits in recent years may be one factor contributing to the decline in the HPUEs of sailfish (Fig. 2).

The highest HPUE (0.117) for all species of billfishes combined was for natural baits only, but the HPUE (0.055) for artificial baits was 57% higher than that for natural baits (HPUE = 0.035) when both were trolled at the same time. While interviewing anglers, we often stress the importance of determining the amount of time they fished various baits, as well as recording the number of hook-ups. If fishing effort for each type bait is ignored, bait preference results would show 11% of the billfishes were hooked on natural baits and 89% were hooked on artificial baits.

Feeding Activity

The HPUE of billfishes is used as a measure of feeding activity although, as stated in the discussion of bait preference, other factors besides feeding may be involved when a billfish strikes a bait. The HPUE by hourly periods of the day during which 50 hr or more of fishing occurred is shown in Figure 4. Consistent with past findings, the period between 1000 hr and 1200 hr was the most active period for the three species combined. This trend has been observed during most years of our study. In general, the midmorning peak was followed by fluctuations in feeding activity with peaks in midafternoon (1400 hr) and early evening (1800 hr). Blue marlin were most active during the 1800 hr period, while the highest HPUE for white marlin and sailfish was reported for the 1000 hr period.

Fishing Areas

Charts 1-3 show distribution and abundance data reported during the 1984 season, and indicate where fishing was best during the year. Preliminary analyses of the distribution of billfishes raised by anglers compared to environmental data from satellites, indicate that higher abundance of Gulf of Mexico billfishes may occur in areas of upwelling currents. This appears to be particularly relevant in the northwestern Gulf. Further studies of these data are being conducted and will be reported when completed. The charts provide data for 10-min latitude-longitude squares in which 10 hr or more of trolling effort were recorded. Indices of low, mid, and high rates were obtained by dividing the numbers of billfishes "raised" per square by the number of hours trolled within that square. The three levels of angler contact rates with billfish in the northeastern, southwestern, and northcentral Gulf are listed on each chart.

In 1984, the fishing area in the northeastern Gulf (Chart 1) diminished 3% from the preceding season. Billfishes were reported raised in 93% of the area fished, 20% (15 of 76 squares) of which were high value squares. With one exception, all of the high value squares occurred east of longitude 87° west, a result similar to 1983. The 1984 HPUE (0.097) for billfishes in the northeastern Gulf (Table 1) was below the 1983 value and the 22% of low value squares in 1984 was considerably less than the 62% low value square reported in 1983.

In the northcentral Gulf (Chart 2), the fishing area increased 16% (9 squares) from the previous season. The primary difference was the activity above 29° north latitude and below 28° north latitude in 1984. Contrary to 1983 when all of the high value squares were east of 89° west longitude, the six (9%) squares indicating high abundances in 1984 were all west of this longitude. Both high and mid value squares decreased 3% and low value squares decreased 1% compared to 1983.

The 1984 fishing area in the northwestern Gulf (Chart 3) decreased considerably from the previous season. Anglers reported fishing in 32% fewer squares than in 1983. However, reports indicated billfishes were raised in 94% of the squares in 1984 compared to 87% in 1983. The single high value (0.461) resulted from eight billfishes being raised in an area where less than 20 hr of trolling effort were recorded. Although high and mid value percentages decreased while the percent of low value squares increased between 1983 and 1984, the decrease in the percent of empty squares along with an increased HPUE (Table 1) suggests that recreational anglers may have enjoyed a successful 1984 season.

Related Observations

1. The earliest landings of billfishes this year were reported about five weeks later than in the 1983 season. During the South Texas Big Game Fishing Club's first tournament on April 28, 1984, the first blue marlin was tagged and released from the Quien Sabe; the first boated white marlin was aboard the Magic Maker; and anglers aboard the Momentum tagged and released the first white marlin of the season.

2. The largest blue marlin (Table 4) in 1984 was caught and certified as a new Texas state record on September 1, 1984. This 824.0-pound blue marlin was caught by John F. Etier fishing aboard the Spike It during the South Texas Big Game Fishing Club's September tournament.

3. No "Grand Slams" (i.e., catches of blue marlin, white marlin, and sailfish in a one-day trip) were reported this season. Three were recorded in 1983.

ACKNOWLEDGMENTS

This report would not have been possible without the outstanding cooperation extended to the National Marine Fisheries Service port samplers by the captains, mates, and recreational anglers. We appreciate the special efforts of Betty Tubbs, Port Isabel; Dick Ingram, Port O'Connor; Jim Hubbard, Freeport; Dr. Greg Savoy, western Louisiana; Bill Wade, Orange Beach; George Ballard and Ron Cabassa, Pensacola; Gordon Ranum, Fort Walton Beach; Susan Destin and Mary Mittler, Destin; and Juanita Millard and Troy Coston, St. Petersburg for supplying additional records.

The dedicated service of our port samplers resulted in about 3,594 interviews during 1984. The 1984 port samplers were Julie Findley, Port Aransas; Rick Kasprzak, Grand Isle; Joe Yurt, South Pass; Jim Benton, Mobile/Pensacola; and Richard Kersten, Destin.

Table 1. Hours trolled and billfishes raised (R), hooked (H), and boated/released (B/R) in the northern Gulf of Mexico, 1984.

	Hours trolled	Blue marlin			White marlin			Sailfish			Swordfish			Spearfish			All species combined		
		R	H	B/R	R	H	B/R	R	H	B/R	R	H	B/R	R	H	B/R	R	H	B/R
Northeastern Gulf	13,756	525	344	136/24	1,400	919	359/241	98	66	36/16	4	4	4/0	0	0	0/0	2,027	1,333	535/281
Panama City	2,143	100	65	23/0	303	201	94/13	19	16	9/2	0	0	0/0	0	0	0/0	422	282	126/15
Destin	5,345	242	126	55/12	630	315	136/108	50	26	17/6	4	4	4/0	0	0	0/0	926	471	212/126
Pensacola	1,829	58	49	30/1	145	109	65/16	13	9	7/0	0	0	0/0	0	0	0/0	216	167	102/17
Mobile	4,439	125	104	28/11	322	294	64/104	16	15	3/8	0	0	0/0	0	0	0/0	463	413	95/123
Northcentral Gulf	8,600	301	193	72/29	267	165	71/58	6	5	2/1	0	0	0/0	2	2	2/0	576	365	147/88
South Pass	7,960	274	169	61/26	239	143	61/50	5	4	1/1	0	0	0/0	2	2	2/0	520	318	125/77
Grand Isle	640	27	24	11/3	28	22	10/8	1	1	1/0	0	0	0/0	0	0	0/0	56	47	22/11
Northwestern Gulf	8,219	395	337	139/28	239	213	108/26	337	259	150/41	0	0	0/0	0	0	0/0	971	809	397/95
East Texas	185	7	4	0/0	8	8	4/3	0	0	0/0	0	0	0/0	0	0	0/0	15	12	4/3
Central Texas	4,574	267	226	94/13	152	137	71/3	199	148	75/23	0	0	0/0	0	0	0/0	618	511	240/39
South Texas	3,460	121	107	45/15	79	68	33/20	138	111	75/18	0	0	0/0	0	0	0/0	338	286	153/53
Total all areas	30,575	1,221	874	347/81	1,906	1,297	538/325	441	330	188/58	4	4	4/0	2	2	2/0	3,574	2,507	1,079/464

Table 2. Numbers of billfishes reported as boated or released (/) with no accompanying data on fishing hours in the northern Gulf of Mexico, 1984.

	Number					
	Blue marlin	White marlin	Sailfish	Swordfish	Spearfish	All species combined
Northeastern Gulf	815	50/64	10/2	311	0	71/72
St. Petersburg	2	0	2	0	0	4
Panama City	0	2	1	0	0	3
Destin	2	11/5	2	0	0	15/5
Pensacola	3/3	12/23	4	1/1	0	20/27
Mobile	1/2	25/36	3/2	2	0	31/40
Northcentral Gulf	3	1	1	0	0	5
South Pass	0	0	0	0	0	0
Grand Isle	0	0	0	0	0	0
Western Louisiana	3	1	1	0	0	5
Northwestern Gulf	12/9	8/5	18/12	0	0	38/26
East Texas	6/3	4	5	0	0	15/3
Central Texas	5	4	7/2	0	0	16/2
South Texas	1/6	0/5	6/10	0	0	7/21
Total all areas	23/14	59/69	31/14	3/1	0	116/98

Table 3. Summary of recorded driftfishing for big game fishes in the northern Gulf of Mexico, 1984.

	Hours fished	Number of recorded catches* Swordfish	Blue marlin	White marlin	Sailfish	All three species
Northeastern Gulf	442	2	0	0	1	3
Panama City	9	1	0	0	0	1
Destin	35	0	0	0	0	0
Pensacola	9	0	0	0	0	0
Mobile	389	1	0	0	1	2
Northcentral Gulf	39	1	0	0	0	1
South Pass	39	1	0	0	0	1
Grand Isle	0	0	0	0	0	0
Northwestern Gulf	50	3	0	0	0	3
East Texas	0	0	0	0	0	0
Central Texas	8	0	0	0	0	0
South Texas	42	3	0	0	0	3
Total all areas	531	6	0	0	1	7

* Includes releases

Table 4. Weights (pounds) of billfishes recorded in conjunction with fishing effort in the northern Gulf of Mexico, 1984.

	Panama City	Destin	Pensacola	Mobile	South Pass	Grand Isle	East Texas	Central Texas	South Texas	Total all combined
Blue marlin										
Largest	538.0	736.7	568.5	512.8	540.0	531.5	0	592.0	824.0	824.0
Smallest	82.0	123.0	75.0	104.3	55.0	66.7	0	52.5	52.1	52.1
Average	264.1	283.6	263.9	266.1	264.9	276.7	0	259.0	271.3	267.5
White marlin										
Largest	68.0	83.0	84.0	87.0	109.7	79.0	97.0	88.0	83.5	109.7
Smallest	33.5	33.4	28.0	31.0	40.6	40.0	43.6	34.0	31.9	28.0
Average	46.8	50.0	50.9	49.2	56.4	62.0	64.9	53.8	53.4	51.3
Sailfish										
Largest	48.0	54.0	62.5	42.0	39.6	42.3	0	60.0	75.5	75.5
Smallest	34.7	31.0	31.5	34.5	39.6	42.3	0	24.5	21.0	21.0
Average	40.1	41.2	41.4	37.7	39.6	42.3	0	40.3	43.4	41.6
Swordfish										
Largest	25.5	20.0	0	20.8	13.8	0	0	0	236.5	236.5
Smallest	25.5	16.0	0	20.8	13.8	0	0	0	22.0	13.8
Average	25.5	18.3	0	20.8	13.8	0	0	0	132.7	57.0
Spearfish										
Largest	0	0	0	0	47.5	0	0	0	0	47.5
Smallest	0	0	0	0	40.0	0	0	0	0	40.0
Average	0	0	0	0	43.8	0	0	0	0	43.8

Table 5. Hours trolled and numbers of billfishes hooked-per-hour-of-trolling (HPUE) with various baits fished in the northern Gulf of Mexico, 1984.

	Natural bait only		Artificial bait only		Both simultaneously		
	Hours trolled	HPUE	Hours trolled	HPUE	Hours trolled	Nat. HPUE	Art. HPUE
Northeastern Gulf	744		11,271		2,066		
Blue marlin		.013		.026		.005	.015
White marlin		.087		.064		.023	.040
Sailfish		.020		.003		.005	.002
All three species		.121		.093		.033	.057
Northcentral Gulf	0		8,853		18		
Blue marlin		0		.022		0	0
White marlin		0		.019		0	0
Sailfish		0		.001		0	0
All three species		0		.041		0	0
Northwestern Gulf	761		6,993		739		
Blue marlin		.043		.041		.008	.012
White marlin		.011		.024		.020	.026
Sailfish		.059		.028		.012	.012
All three species		.113		.094		.041	.050
All three areas	1,504		27,117		2,822		
Blue marlin		.029		.029		.006	.041
White marlin		.049		.039		.022	.036
Sailfish		.040		.009		.007	.005
All three species		.117		.076		.035	.055

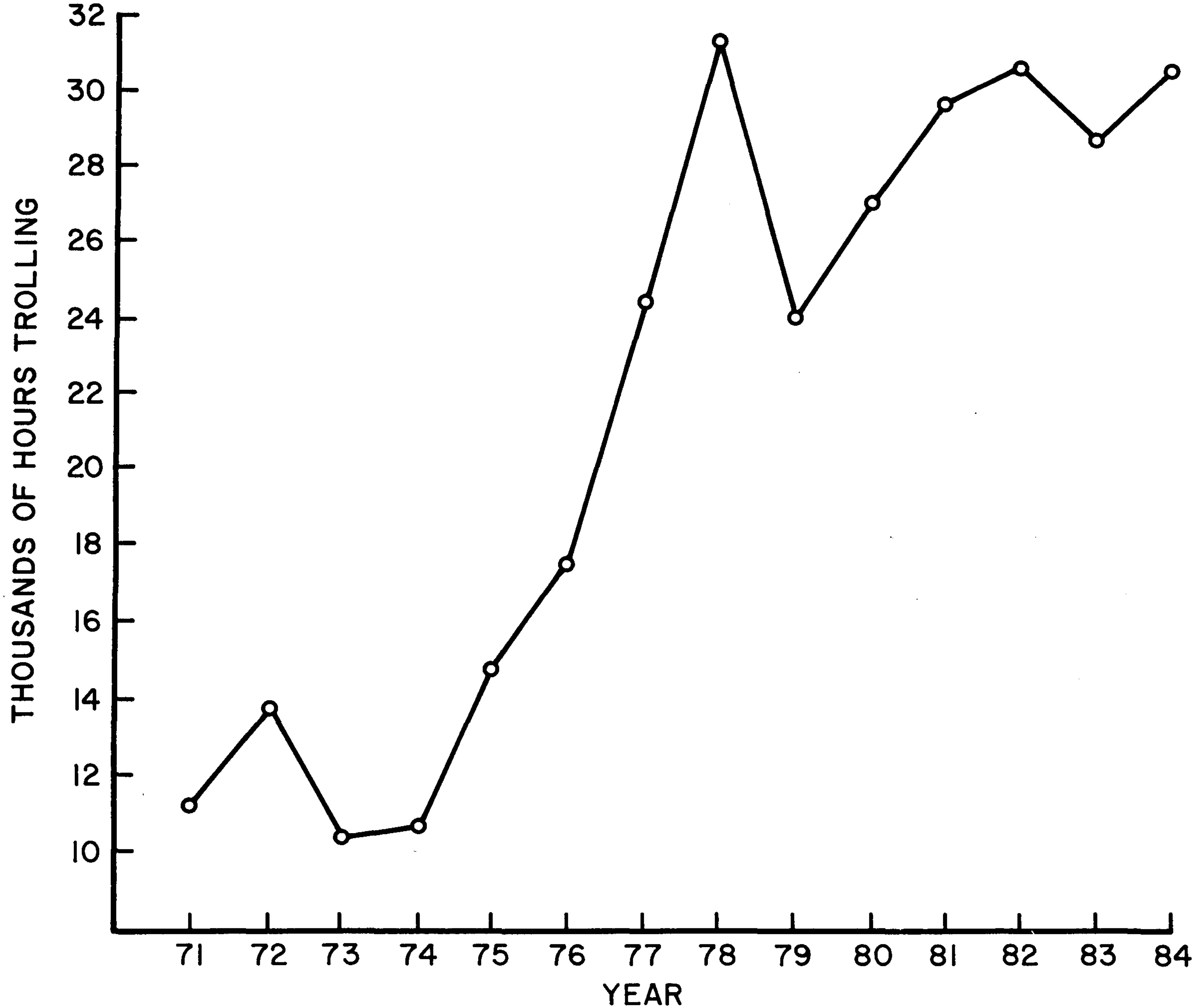


Figure 1 - Number of hours reported trolling for billfishes in the northern Gulf of Mexico, 1971 - 1984.

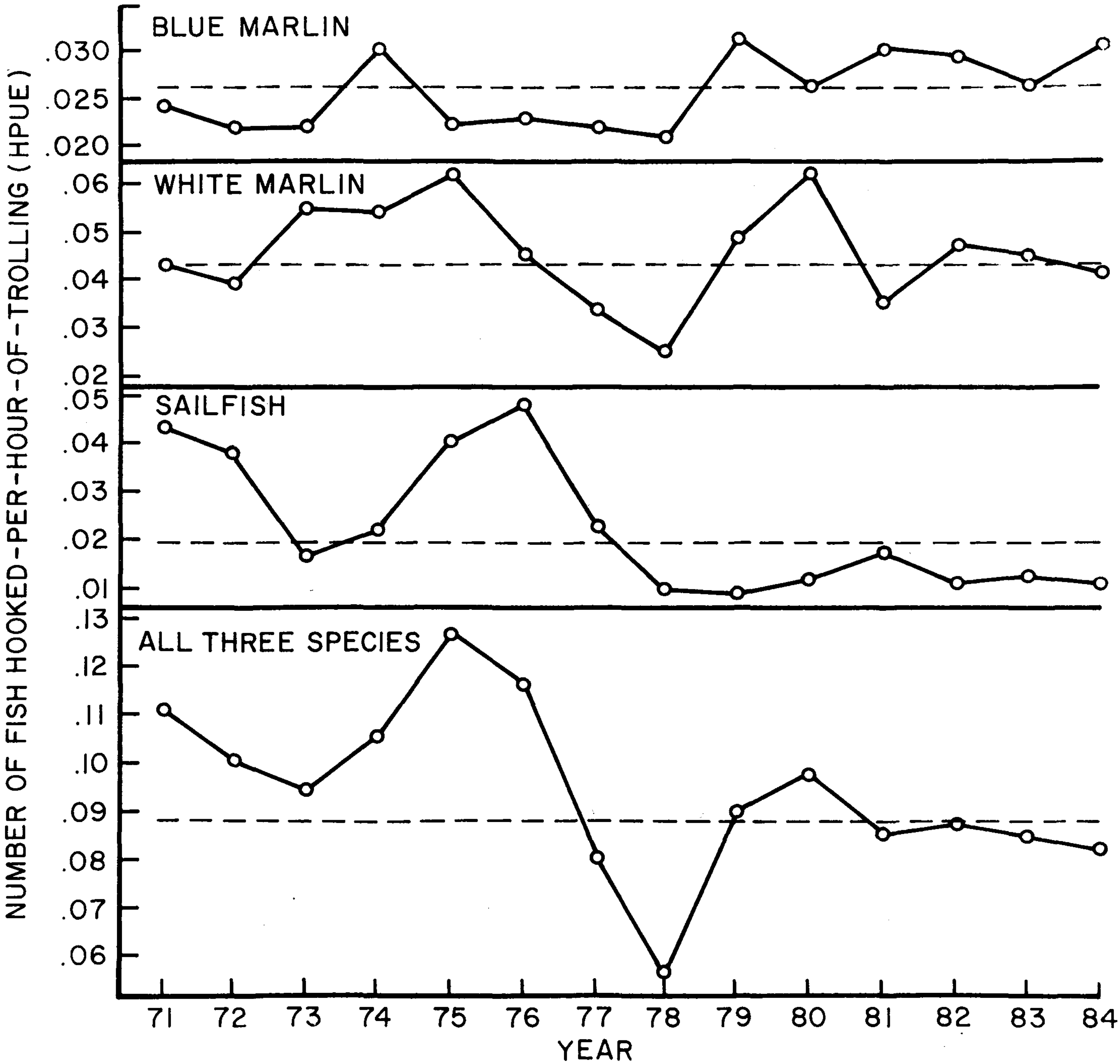


Figure 2 - Number of billfishes hooked-per-hour-of-trolling (HPUE) in the northern Gulf of Mexico, 1971-1984. Dashed line indicates 14-year average for each category.

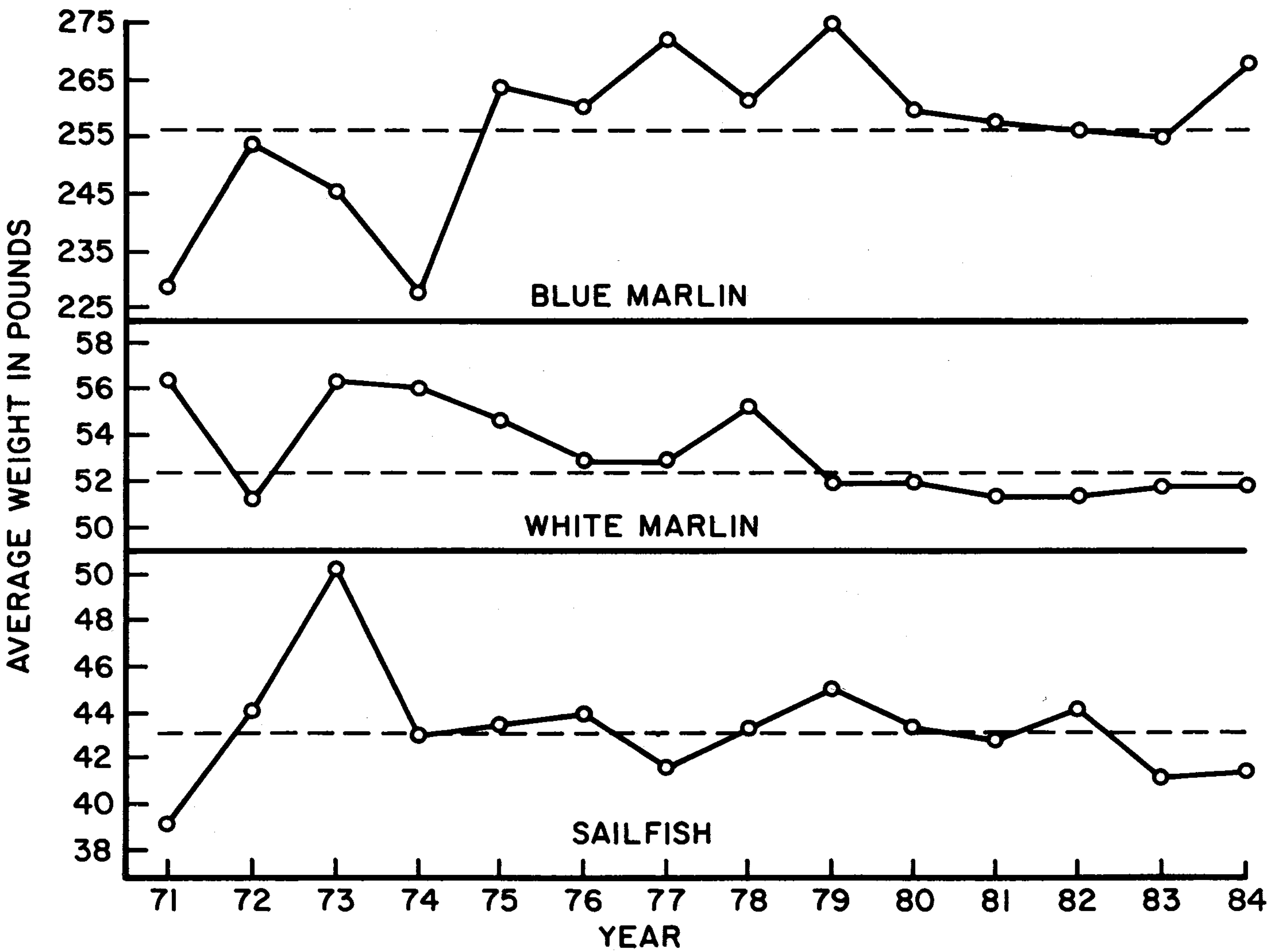


Figure 3 - Average weight (pounds) of billfishes in the northern Gulf of Mexico, 1971 - 1984. Dashed lines indicate 14-year average for each category.

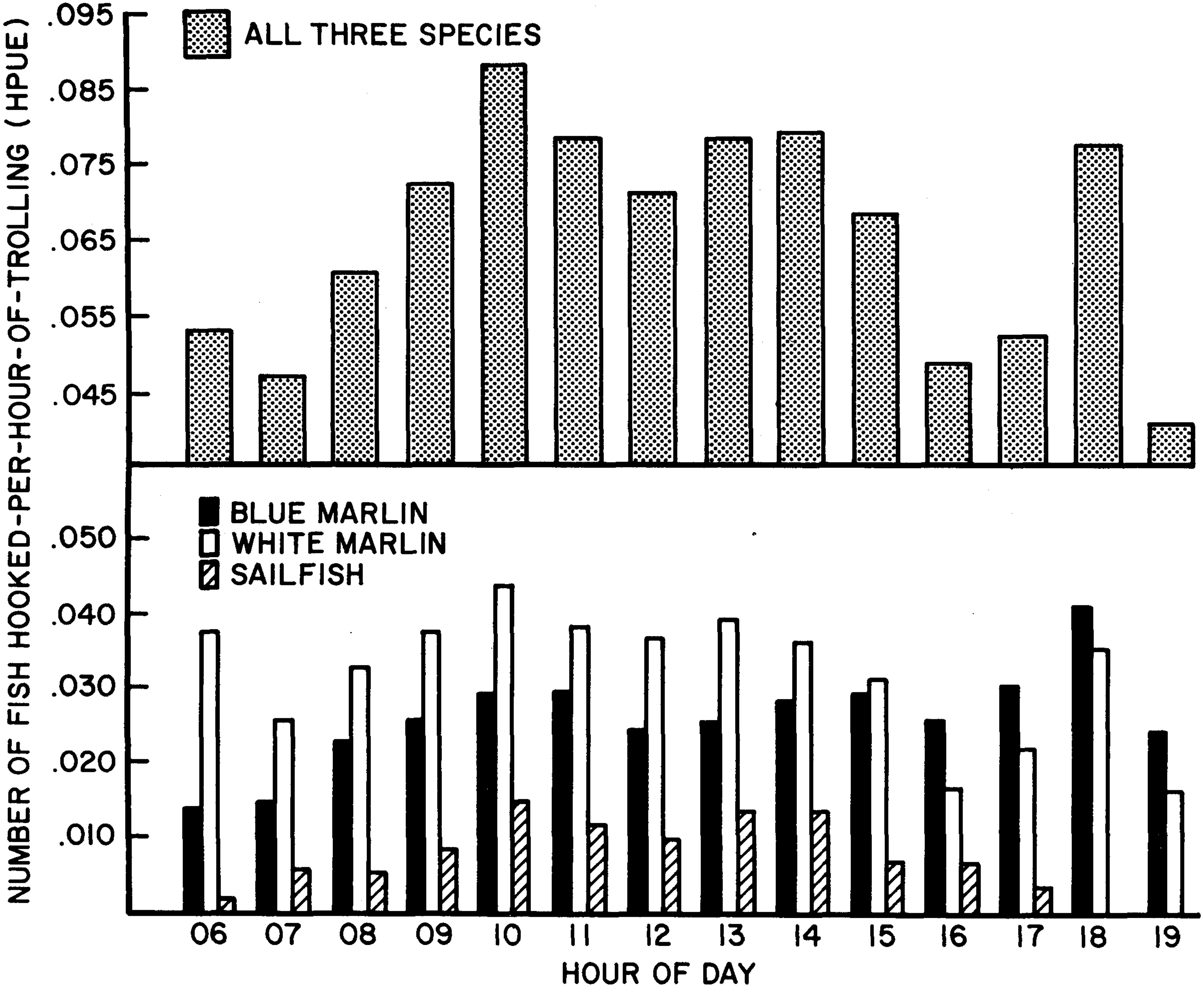


Figure 4 - Numbers of billfishes hooked-per-hour-of-trolling (HPUE) by time of day in the northern Gulf of Mexico, 1984.

LEGEND

Fishing area bound by heavy black lines

Numbers of fishes raised-per-hour-of-trolling.

.001-.089

.090-.179

≥.180

No fishes raised in squares without symbols.

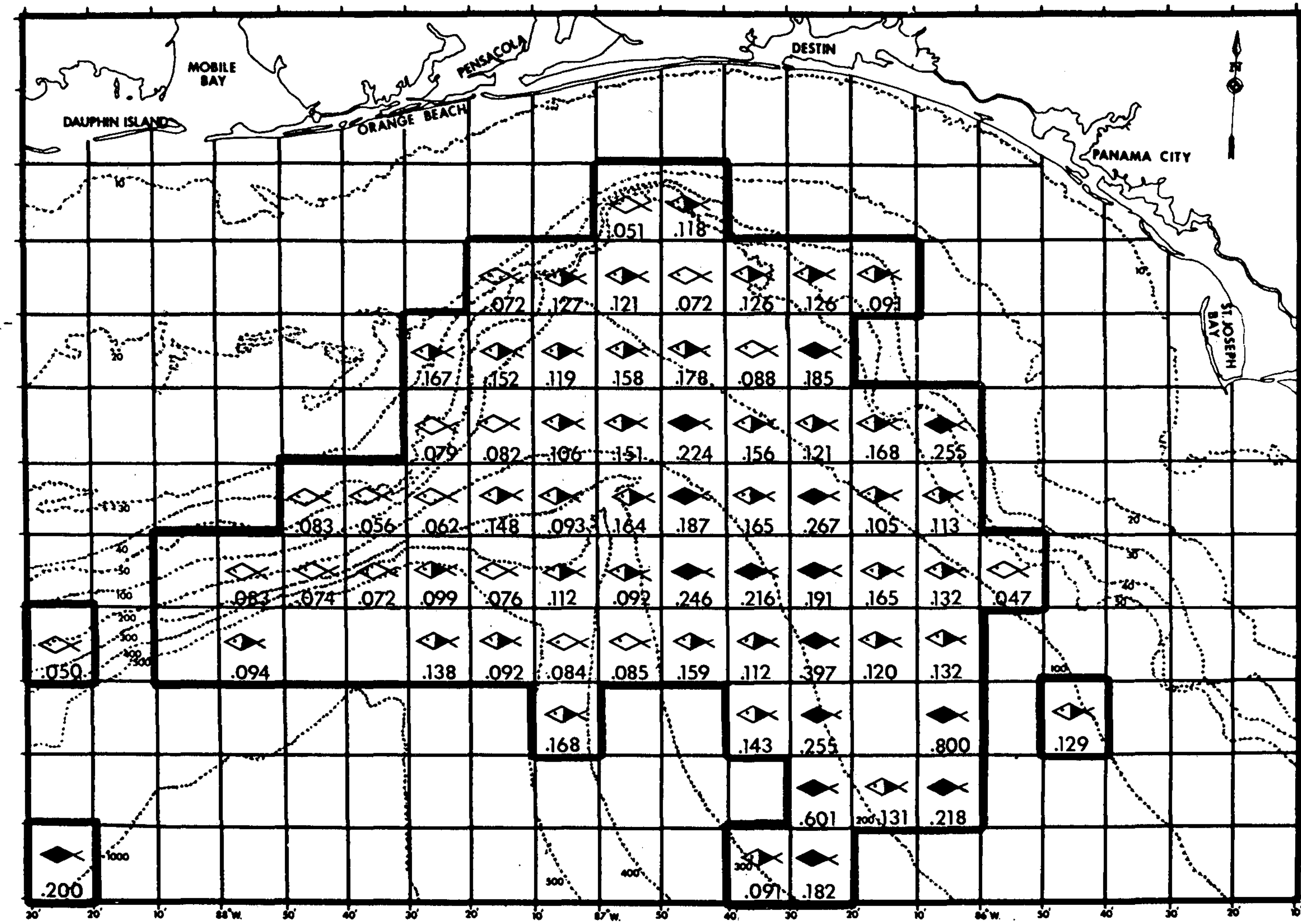


Chart I- Numbers of billfishes raised-per-hour-of-trolling in the northeastern Gulf of Mexico by 10-min squares, 1984.

LEGEND

Fishing area bound by heavy black lines. Numbers of fishes raised-per-hour-of-trolling.

001-.059

.060-.119

$\geq$.120

No fishes raised in squares without symbols.

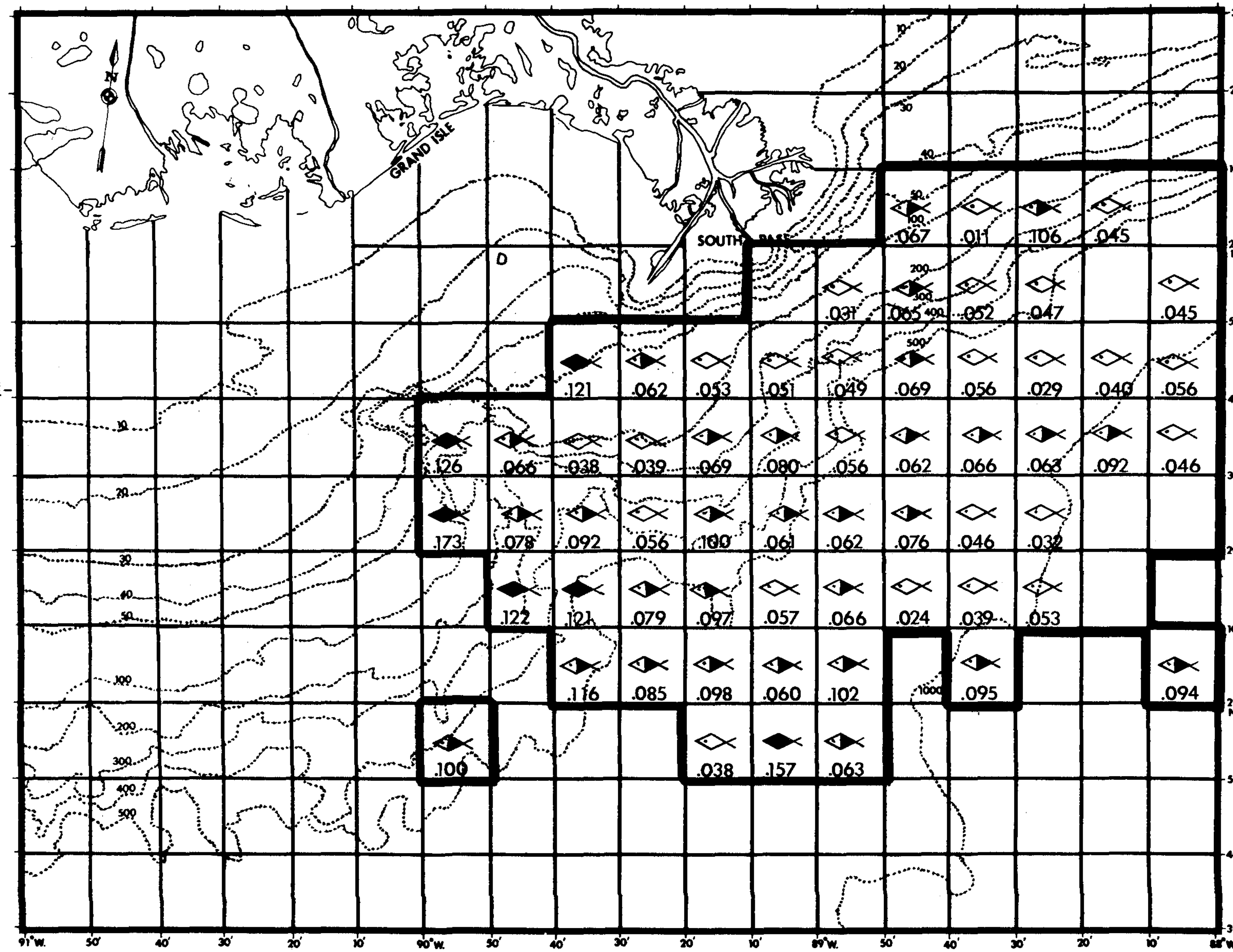
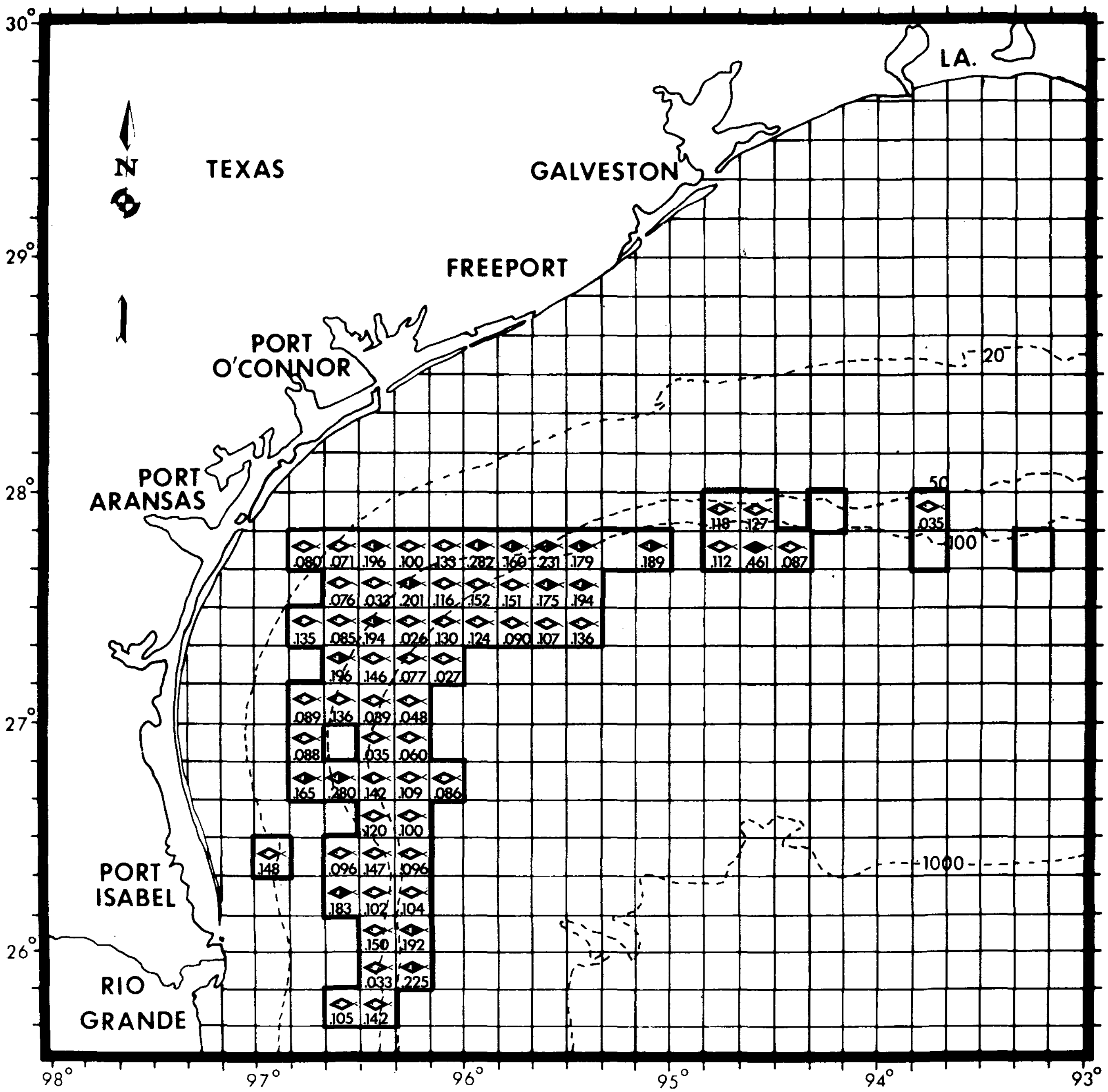


Chart 2- Numbers of billfishes raised-per-hour-of-trolling in the northcentral Gulf of Mexico by 10-min squares, 1984.



LEGEND

Fishing area bound by heavy black lines.
No fishes raised in squares without symbols.

.001 — .154 fishes raised-per-hour-of-trolling.
.155 — .309 fishes raised-per-hour-of-trolling.
≥ .310 fishes raised-per-hour-of-trolling.

Chart 3 - Numbers of billfishes raised-per-hour-of-trolling in the northwestern Gulf of Mexico by 10-min squares, 1984.

COOPERATIVE GAMEFISH TAGGING PROGRAM

Edwin L. Scott and Joseph P. Contillo

This report summarizes the activities of the Cooperative Game Fish Tagging Program (CGFTP) for 1984. Program cooperators tagged and released 4,246 fish of 30 species. Billfish led the list with 3,724 fish tagged and released, including 2,186 sailfish, 969 white marlin, 505 blue marlin, 58 swordfish, 3 black marlin, and 3 striped marlin. There were 447 tunas tagged and released, and these included 245 yellowfin, 85 bluefin, 82 blackfin, and 35 other miscellaneous tunas. There were also 75 other fishes of 16 miscellaneous species tagged and released.

We have compiled names and addresses of organizations that conduct analogous fish tagging programs in different geographical areas or for different species. These are listed in the Tagging Box section. Please contact the appropriate groups if you plan to tag in a different area or tag a target species of another agency.

Sailfish

There were 2,186 sailfish tagged and released in 1984. As in previous years, southeast Florida had the greatest number of sailfish tagged and released (758). Cozumel, Mexico, was second with 584 sailfish tagged and released, and Cancun, Mexico (second last year), was third this year with 524 sailfish tagged and released. Venezuela moved up to fourth this year with 191 taggings. There were 50 sailfish tagged in the Gulf of Mexico, 13 in the Bahamas, 13 off the Virgin Islands and Puerto Rico, 10 off the northeast Florida coast, 5 off the mid-Atlantic Bight area (Cape Cod, Massachusetts, to Hatteras, North Carolina), 1 off Costa Rica, and 1 off Bermuda. There were 36 Pacific sailfish tagged and released.

There were 22 sailfish recaptured in 1984 (Table 1). Fifteen of the recaptures were from the Stuart-Palm Beach, Florida, area. Thirteen of these fish were recaptured in the same area of release; 6 had been at large for less than 1 year, 5 for 1-2 years, 1 for 2-3 years, and 1 for 3-4 years. The other 2 Stuart-Palm Beach tagged sailfish were recaptured off the Florida Keys; 1 had been at large for 1-2 years and 1 for 2-3 years.

Five sailfish tagged and released off the Florida Keys were recaptured in 1984. One of these was recaptured in the same area of release after being at large for less than 1 year. The other 4 were recaptured off southeast Florida; 2 were at large for less than 1 year, 1 at large for 1-2 years, and 1 at large for 10 years 10 months.

This last recapture established a new time-at-large record for a tagged sailfish. Ronald Harrison of Boca Raton, Florida, recaptured this fish on January 14, 1984, off Boynton Beach, Florida; it had originally been tagged and released off the Florida Keys on March 5, 1973, by angler W.L. Tindall, Jr., and Capt. Budd Carr. The 10 years and 10 months the sailfish was at large is 6.5 years greater than the previous record and provides important new information on the growth and longevity of Atlantic sailfish. For many years, researchers believed that sailfish had a rapid growth rate and a life span of only 3 or 4 years. Scientists at the Florida Department of Natural Resources (FDNR) in West Palm Beach, however, recently showed that sailfish live considerably longer than previously believed and suggested that their maximum life span might be as great as 9 or even 10 years. This recapture definitely establishes that sailfish can indeed live a long time and extends the known longevity to at least 13-15 years.

The recaptured fish was a female and weighed 54 pounds, a difference of 14 pounds from an estimated release weight of 40 pounds almost 11 years ago. The entire specimen was saved and made available to scientists at the Miami Laboratory through the courtesy of J.T. Reese Taxidermy of Fort Lauderdale, Florida. Several skeletal structures, including dorsal spines, vertebrae, and inner ear bones (otoliths) were removed from the fish for age determination. These structures were analyzed by scientists at the Miami Laboratory for validation of previous ageing studies (see section on research for more details).

It is extremely important for scientists to examine any recaptured tagged billfish or tuna and anglers are urged to freeze any specimen if possible and contact Dr. Eric Prince at the Southeast Fisheries Center's Miami Laboratory. Call collect (305) 361-4248 (work) or (305) 598-0944 (home) any time day or night. Sampling procedures do not prevent the fish from being mounted or eaten and any reasonable costs in storage or shipment will be reimbursed.

The two remaining recaptured sailfish were from different areas. A sailfish tagged and released off Cancun, Mexico, was recaptured in the same area 4 days later. This is the third recapture of a Cancun release and all have been recaptured in the same area. A sailfish tagged and released off Cozumel, Mexico, was recaptured off Ft. Pierce, Florida, 6 months after its release. This is the fourth Cozumel release that has been recaptured off the Florida coast. In addition, a sailfish that was recaptured in 1983, but was not reported until 1984, was tagged off Bimini, Bahamas, on November 20, 1982, and was recaptured 387 days later off the northwestern coast of Cuba.

White Marlin

There were 969 white marlin tagged and released in 1984; sportfishermen tagged 936, commercial fishermen 7, and NMFS observers on Japanese longliners tagged and released 26 fish.

Venezuela was the leading area this year with 352 white marlin tagged and released. The Gulf of Mexico was second with 313 taggings. In addition, 190 were tagged off the mid-Atlantic Bight, 30 off Cozumel and Cancun, Mexico, 26 off the Bahamas, 15 off the Virgin Islands and Puerto Rico, 22 off the Florida east coast, 4 off Bermuda, and 17 in the northwest Atlantic.

There were 11 white marlin recaptures in 1984 (Table 1). Six of the recaptures were made in the Gulf of Mexico; all had been tagged and released in the northeastern Gulf of Mexico. Seven white marlin were at large for less than 1 year, 3 were at large for 1-2 years, and 1 was at large for almost 4 years.

The longest distance traveled by a white marlin in 1984 was about 1,350 miles. The fish was tagged and released off the southern coast of the Dominican Republic (18°20'N, 69°49'W) and was recaptured about 570 miles east of Atlantic City, New Jersey (39°29'N, 64°32'W); it had been at large for 43 days.

Blue Marlin

There were 505 blue marlin tagged and released in 1984. The Virgin Islands was the leading tagging area with 241 taggings and the Bahamas was second with 56. Twenty-four blue marlin were tagged off the Louisiana coast, 21 off the Texas coast, 30 off the Florida Panhandle, 24 off the coast of Venezuela, 20 off Bermuda, 17 off Costa Rica, 6 off Cozumel, Mexico, 1 off Cancun, Mexico, 1 off Hispanola, 35 off south Florida, 8 off north Florida, 13 off the mid-Atlantic Bight, 4 in the northern west Atlantic, and 2 off Abidjan, Ivory Coast, West Africa. There were 2 Pacific blue marlin tagged and released off the southern tip of Baja California, Mexico.

The four recaptured blue marlin in 1984 set a record for the largest number of blue marlin recaptures in one year for the CGFTP. The most important recapture was of a blue marlin tagged and released off St. Thomas, Virgin Islands, on September 29, 1983, by Annette and Joe Lopez. This fish was recaptured off the Ivory Coast, Africa (01°30'N, 02°22'W), on February 29, 1984, by a French purse seiner. This is the second documented transatlantic migration of a billfish in the history of the CGFTP. The first blue marlin that was known to make a transatlantic migration was also tagged off St. Thomas and recaptured 6 months later off the Ivory Coast by a French purse seiner. This second recapture is particularly important in that it suggests a consistent seasonal migrational pattern for Atlantic blue marlin and demonstrates the cosmopolitan nature and international status of this species in the Atlantic Ocean and adjacent seas. The relatively short time recorded by both fish to cross approximately 4,500 miles of open ocean, a minimum average of about 30 miles per day, suggests a strong behavioral force directing these movements. The Gulf of Guinea (off coastal Africa) contains large concentrations of skipjack tuna during the northern hemisphere winter months, and these long distance movements of blue marlin may be related to their feeding behavior.

A blue marlin tagged off San Salvador, Bahamas, June 20, 1983, was recaptured off the coast of Barbados after being at large for 315 days. The remaining 2 recaptures were tagged and released off St. Thomas, Virgin Islands, one was recaptured 2 years later off San Juan, Puerto Rico, almost 1,000 miles southward, and the other marlin was recaptured almost 7 years later off the southern coast of the Dominican Republic, this sets a time-at-liberty record for a blue marlin. We DESPERATELY need anglers to save any tagged blue marlin recaptures for our ageing work.

Swordfish

There were 58 swordfish tagged and released in 1984. Commercial fishermen tagged and released 40, foreign observers aboard Japanese longline vessels accounted for 17 taggings, and 1 fish was tagged by a recreational angler.

The southeast U.S. coast was the leading tagging area with 22 swordfish releases. Two were off the northeast Florida coast, 10 off the mid-Atlantic Bight and northeastern United States, 1 in the Gulf of Mexico, 2 in the Bahamas, and 21 in the western north Atlantic.

There were 7 swordfish recaptures in 1984 (Table 1). Three swordfish were recaptured off the northeastern United States, 3 off the Carolinas, and 1 off Marathon, Florida. Times-at-large for these swordfish were: 1 for less than 1 year, 2 for 1-2 years, 3 for 2-3 years, and 1 for 3-4 years.

The longest distance traveled by a swordfish in 1984 was 1,250 miles, it was tagged and released September 14, 1981, at 40°21'N, 67°06'W (Georges Bank area) and was recaptured April 15, 1984, off Marathon, Florida.

Bluefin Tuna

Program cooperators tagged and released 85 bluefin tuna in 1984. All of the releases, except 1, occurred off the northeastern coast of the United States. The other release was off Cat Cay, Bahamas. There were 15 recaptures; 14 off the northeastern coast of the United States, and one recapture off Marathon, Florida. The recapture off Marathon is the first recorded recapture of a giant bluefin from this area. We have had 7 recaptures of giant bluefin off the Dry Tortugas but these occurred in February (2) and March (5). There is a yearly migration of giant bluefin off Cat Cay and Bimini, Bahamas, each year from April to June, but it is unusual for a bluefin to be caught on this side of the Florida Current.

Time-at-large for bluefin tuna ranged from 11 months to 9 years 10 months. One fish was at large for less than 1 year, 2 for 1-2 years, 2 for 2-3 years, 3 for 3-4 years, 2 for 4-5 years, 1 for 5-6 years, 1 for 6-7 years, 1 for 7-8 years, 1 for 8-9 years, and 1 for 9 years 10 months.

Scientists generally classify bluefin tuna into 3 size groups; small fish (0-145 pounds), medium fish (146- 299 pounds), and giants (300 pounds and up). Tag recapture information from bluefin tuna, particularly times-at-large, appears to be related to these size classifications. For example, there were 3 bluefin released as small fish and at recapture were classified as still in the small fish category. Times-at-large were: 337 days, 395 days, and 907 days. There were 6 bluefin that were small fish at release and medium fish at recapture. Times-at-large were: 1,305 days; 1,327 days, 1,358 days, and 1,520 days. There were 4 fish released as small fish and recaptured as giants. Times-at-large were: 2,561 days, 2,620 days, 2,995 days, and 3,558 days. There was 1 fish released as a medium fish and recaptured as a giant. It had been at large for 1,822 days. There were 2 fish released as giants and recaptured as giants, times-at- large were: 364 days and 2,161 days. One fish was recaptured that weighed 635 pounds and was at large for 739 days, but did not have a weight recorded at release.

Other Tunas

There were 245 yellowfin tuna tagged and released in 1984; 133 from the Gulf of Mexico, 50 from the mid-Atlantic Bight, 47 from Bermuda, 14 from the Bahamas, and 1 off the south Florida coast. There were 20 yellowfin recaptured in 1984, 19 from Bermuda and 1 from the northeast Gulf of Mexico. All of the Bermuda recaptures had been released off Bermuda and the times-at-large ranged from 8 days to 389 days. A yellowfin tagged off Grand Isle, Louisiana, was recaptured 418 days later about 100 miles east of its release point.

There were 82 blackfin tuna tagged and released in 1984; 63 off Bermuda, 8 off the southeast Florida coast, 5 in the Gulf of Mexico, 2 off the mid-Atlantic Bight, 2 from the Bahamas, and 2 off Cancun, Mexico. There were 8 blackfin recaptures reported in 1984; all were recaptured near their release sites in Bermuda. Times-at-large ranged from 15 days to 392 days.

It would appear that the yellowfin and blackfin tuna return to the same area each year from May through September, peak months for recapture were June and July. This is particularly true for yellowfin tuna off Bermuda, where recapture rates were over 50% in 1984.

Bait Box

There has been a great deal of discussion about the use of live bait doing more physical harm to fish than dead bait. In reviewing the recapture data for sailfish caught in 1984, we compared the use of live bait vs. dead bait which is usually a trolled bait. In 1984, 1,632 were caught using dead bait, of these 11 were recaptured (0.67%). There were 463 sailfish tagged and released using live bait, of these 11 were recaptured (2.37%). It would appear that using live bait does not have a detrimental effect on the catch rate. On the contrary, percentage wise, fish caught using live bait seem to have a better chance of survival than those that were caught using dead bait. We would appreciate participants in the tagging program indicating the type of bait used in the appropriate section provided on the release card.

The increasing use of high speed lures in marlin fishing raises an important problem that we feel we should highlight. The relatively high cost of lures and the care and precision used to position and wrap the hooks make it unlikely that many fishermen are going to simply cut the leader and release the fish as they normally do when fishing with bait. The loss of a $1.00 hook can't compare to the loss of a $30.00 lure and two carefully prepared hooks. Consequently, we see two things happening. First is perhaps a reduction in the number of fish tagged. It is certainly easier and surer to gaff the fish and bring it in the boat than it is to lean over the rail of a pitching boat and try to remove hooks from a thrashing marlin. Second, we believe that the additional handling required to remove the hooks will likely result in an increase in injuries to the fish and possibly a lowering of the survival rate after release.

We don't have any easy answers to this problem and can only urge you to be as efficient and fast as possible in releasing the tagged fish. The best compromise would be to slide the lure up the leader to the swivel then cut the leader as you normally do. You would save the lure but of course would lose the rigged hooks. If anyone has a red hot idea on how to deal with this situation, we would certainly be glad to hear it and perhaps publish it in our next annual report.

We are pleased to note that many of our cooperators are building their own tagging sticks. Some of these sticks are true works of art, with diamond wraps matching their rods and other innovative decorations. However, we also have noticed that the stainless tagging pins on some of these sticks are not extending out far enough from the end of the pole. The resulting placement of the tag barb in the fish is not deep enough and runs a real risk of working itself out and being shed. The pin should extrude at least two inches (2") from the end of the pole to ensure proper penetration. Please check your sticks and adjust your pins if necessary to the proper length.

Several years ago we asked that you stop tagging amberjacks. At that time amberjacks were not being harvested very heavily and we felt it would be more productive to focus all our attention on the billfishes and tunas. Since then, however, amberjacks have become a relatively important commercial product, particularly in the south Florida area where rapid ethnic changes in the population and an overall increasing demand for seafood have brought heavy pressures on our amberjack stocks. We would encourage you to tag amberjacks if you want, and the data will provide us with important monitoring capability on amberjack stock dynamics.

Finally, an important step was taken recently to initiate cooperative studies on billfishes by Mexican and U.S. scientists. At the recent annual reunion in Cancun of MEXUS-GULF, an acronym signifying cooperative research by Mexican and U.S. scientists on various commercial species in the Gulf of Mexico and Caribbean, a recreational fisheries working group was formed to deal with species of recreational importance to both nations. The first effort was directed at a cooperative tagging and data collection program at Cozumel during five billfish tournaments held this spring and summer. This is a significant step forward for the identification of recreational fisheries as an equal partner with commercial fisheries in international marine research activities and the CGFTP is proud to be a part of it.

Tagging Box

In 1976, we began to acknowledge the effort by CGFTP program participants. Program participants are included again this year in Tables 2 and 3. We cannot give participants credit for fish tagged and released unless we receive the tag-release cards. We send you acknowledgment cards as a check to ensure that we have received the release cards. Due to operational changes, tag-release cards will only be sent to the captain. If a name is not listed for captain, acknowledgment cards will be sent to the angler. If you wish a card to be sent to both angler and captain, please note this in the remarks section.

The tag-release acknowledgment cards are sent to the party(s) that tag and release fish to inform them that we have received the tagging information. If you do not receive an acknowledgment card, please inform us as soon as possible. The tag-release cards are occasionally lost in the mail, and if we can find out about the loss in time, there is a chance that we can work together to retrieve the lost data.

If you wish to tag fish in the Pacific Ocean, or to tag fish not included in our program, contact the following:

Sharks - Atlantic Ocean

Cooperative Shark Tagging Program
Mr. Jack Casey
NOAA/NMFS
Northeast Fisheries Center
Narragansett Laboratory
P.O. Box 522A
Narragansett, RI 02882

Unrestricted Species (angler pays nominal fee for tags)

American Littoral Society Fish Tagging Program
American Littoral Society
NOAA/NMFS
Sandy Hook Laboratory
Highlands, NJ 07732

Billfishes - Pacific Ocean - U.S.

Cooperative Marine Game Fish Tagging Program
Mr. James L. Squire, Jr.
NOAA/NMFS
Southwest Fisheries Center
La Jolla Laboratory
P.O. Box 271
La Jolla, CA 92027

All species recognized by IGFA - Australia

New South Wales State Fisheries
Box N211
Grosvenor St. Post Office
Sydney, NSW 2000, Australia

We thank all anglers and captains who have participated in our tag and release program. You not only conserve a great natural resource by releasing your catch, but by tagging you also help us in our research efforts to better understand the problems of increased fishing pressure. We hope that 1985 will bring you good fishing and good tagging.

Table 1. Tagged oceanic pelagic fishes recaptured during 1984 as part of the Cooperative Gamefish Tagging Program, National Marine Fisheries Service, Miami Laboratory. Method of fishing is given as rod and reel (R/R), longline (LL), free floating (FF), harpoon (HP), purse seine (PS), handline (HL), bottomline (BL), and mackerel trap (MT). Country abbreviations are: Japan (JAP), Mexico (MX), United States (US), Dominican Republic (DR), Bahamas (BF), Cuba (CU), France (FR), and Barbados (BB). Estimated days at-large are in brackets.

Release Date	Recapture Date	Days at Large	Tagger Captain	Method	Finder Captain	Method
			Sailfish			
Isla Mujeres, MX 4-22-84	Contoy Island, MX 4-25-84	4	H. Manley M. Aman	R/R	E.F.V. Hinschel ---	R/R
Stuart, FL 1-29-84	Jupiter, FL 2-3-84	6	A.D. Davis C.T. Cooper	R/R	W. Doerzabacher ---	R/R
Tavernier, FL 1-27-84	Hollywood, FL 3-16-84	49	T. Cantwell ---	R/R	E. Colville ---	R/R
St. Lucie, FL 1-17-84	Dania, FL 3-9-84	52	C. Browne ---	R/R	R.J. Moudy --	R/R
Jupiter, FL 1-26-84	Boynton, Bch., FL 5-3-84	98	S. Brower C.E. Bouchard	R/R	S. McKinley --	R/R
Boca Raton, FL 12-16-83	Ft. Lauderdale, FL 4-27-84	123	A.G. Summers A.G. Summers	R/R	R. Delegal P. Roydhouse	R/R
Cozumel, MX 3-16-84	Ft. Pierce, FL 9-3-84	171	H. Manley M. Aman	R/R	W.W. Jackson T. Montgomery	R/R
Stuart, FL 8-15-83	Palm Bch., FL 3-18-84	216	M.G. Price J. Whiticar	R/R	G. Holt L.R. Dukes	R/R
Islamorada, FL 2-3-84	Key Biscayne, FL 10-12-84	252	F. Hurlburt S. Gorenflo	R/R	J.C. Dobson ---	US HL
Palm Bch., FL 1-7-84	Palm Bch., FL 11-29-84	327	J. Sisserson E. Lemke, Jr.	R/R	P. Squadrite ---	R/R
Islamorada, FL 1-15-84	Islamorada, FL 12-18-84	338	T. Cantwell T. Cantwell	R/R	R. Gollel ---	R/R
Jupiter, FL 12-11-82	Boca Raton, FL 1-15-84	401	L. Gillespie ---	R/R	G. Nieman ---	R/R

Table 1. Continued.

Release Date	Recapture Date	Days at Large	Tagger Captain	Method	Finder Captain	Method
			Sailfish			
St. Lucie, FL 1-31-83	Pompano Bch., FL 3-3-84	397	N. Smith ---	R/R	K. Delegal ---	R/R
Palm Bch., FL 12-19-82	Tavernier, FL 2-10-84	419	J.P. Cotter, III C.E. Bouchard	R/R	L. Robertson ---	R/R
Stuart, FL 1-26-83	Ft. Lauderdale, FL 4-12-84	442	M. Peppler F.C. Warren	R/R	B. Burdine B. Robinson	R/R
Islamorada, FL 2-11-82	Ft. Lauderdale, FL 1-8-84	697	J.R. Fowee R.A. Mathias, Jr.	R/R	B. Herman ---	R/R
Palm Beach, FL 12-18-82	Stuart, FL 12-8-84	721	G. Albritton G. Albritton	R/R	A. Gardner ---	R/R
Stuart, FL 12-9-81	Ft. Lauderdale, FL 1-28-84	781	A. Gardner A. Gardner	R/R	J. Plachter	R/R
Stuart, FL 1-6-82	Miami Beach, FL 4-1-84	815	F.W. Griggs R. Parker	R/R	G. Ticktin ---	R/R
Juno Beach, FL 11-18-81	Islamorada, FL 2-13-84	818	A.B. Konick ---	R/R	F. Hurlburt S. Gorenflo	R/R
Ft. Lauderdale, FL 12-16-80	Palm Beach, FL 2-5-84	1147	J. Vreeland B. Robinson	R/R	G. Stroud ---	R/R
Duck Key, FL 3-5-73	Boynton Bch., FL 1-14-84	3968	W.L. Tindall B. Carr	R/R	R. Harrison F. Pratt	R/R
West End, Bahamas 1-20-82	21° 46'N 78° 28'W 12-12-83*	556	B. Kitchen W.B. Kitchen	R/R	C. Delago ---	CU HL
			White Marlin			
18° 20'N 69° 49'W 6-12-84	39° 20'N 64° 32'W 7-25-84	43	T.G. Homrighauson M. Barletta	R/R	Capt. T. Miura ---	Jap LL
29° 30'N 86° 40'W 8-17-84	28° 28'N 85° 40'W 10-30-84	74	K. Zuich B. Teems	R/R	R. Whitmire ---	US BL

Table 1. Continued.

Release Date	Recapture Date	Days at Large	Tagger Captain	Method	Finder Captain	Method
			White Marlin			
Port Eads, LA 6-24-84	28° 54'N 88° 16'W 12-15-84	175	D. Burrus R. Catalano	R/R	T.R. Rajulaid ---	US LL
Oregon Inlet, NC 9-2-83	Bimini, Bahamas 3-22-84	202	D. Johnson ---	R/R	C. Whealton ---	R/R
Baltimore Canyon 9-4-83	Bimimi, Bahamas 4-20-84	229	J.C. Shattuck R. Harker	R/R	J. Hardy D. Peoples	R/R
Pensacola, FL 8-7-83	South Pass, LA 6-21-84	320	A.C. Phillips D. Kushion	R/R	H.E. Trapp, Jr. ---	R/R
Norfolk Canyon 7-23-83	27° 00'N 79° 31'W 6-12-84	325	P. H. Connors ---	R/R	M. Black ---	US LL
Pensacola, FL 8-29-83	28° 40'N 88° 10'W 9-12-84	380	C. Del Valle C. Peyton	R/R	T.R. Rajulaid ---	US LL
South Pass, LA 7-9-83	Destin, FL August 1984	[402]	G.B. Riviere, Jr. A.P. Howard	R/R	D.B. Maloney, Jr. ---	R/R
28° 20'N 89° 55'W 7-29-83	28° 40'N 88° 10'W 9-25-84	424	F. Terry T. Torrence	R/R	T.R. Rajulaid ---	US LL
Ocean City, MD 8-18-80	Ocean City, MD 8-15-84	1458	J. Joy E. Joy	R/R	N/A	R/R
			Blue Marlin			
St. Thomas, VI 9-29-83	01° 30'N 02° 22'W 2-29-84	153	A. Lopez J. Lopez	R/R	D. Raneu ---	FR PS
San Salvador, BF 6-20-83	Barbados 4-30-84	315	T. Schramm J. Kondziela	R/R	I. Bynoe ---	BB HL
St. Thomas, VI 8-16-81	San Juan, PR 8-18-84	1098	H. Skinner S. Herbert	R/R	L. Camero ---	PR R/R
St. Thomas, VI 1-8-77	Santo Domingo, DR 12-23-84	2907	R. Glister B. Garnsey	R/R	A. Castro ---	DR R/R

Table 1. Continued.

Release Date	Recapture Date	Days at Large	Tagger Captain	Method	Finder Captain	Method
			Swordfish			
Boynton Bch., FL 10-14-83	39° 40'N 69° 30'W 6-25-84	254	R. Edlin ---	US LL	J. Vogel ---	US LL
41° 40'N 65° 50'W Sept 1982	36° 20'N 74° 40'W 1-25-84	497	F. Condit ---	US LL	J. Vogel ---	US LL
Nantucket, RI 9-22-82	40° 00'N 69° 00'W 8-9-84	687	M. Bartlett ---	US LL	J. Vogel ---	US LL
40° 18'N 67° 44'W 9-14-81	35° 40'N 75° 00'W 3-10-84	908	NMFS Observer ---	JAP LL	D. Harris ---	US LL
40° 21'N 67° 06'W 9-14-81	Marathon, FL 4-15-84	944	NMFS Observer ---	JAP LL	N/A ---	US LL
40° 07'N 68° 19'W 8-28-81	34° 00'N 74° 00'W 12-15-84	1205	NMFS Observer ---	JAP LL	D. Ghigliotty ---	US LL
36° 05'N 74° 41'W 8-26-81	40° 30'N 69° 35'W August 1983*	[1084]	NMFS Observer ---	JAP LL	E. Page ---	US HAR
			Bluefin Tuna			
Montauk Pt., NY 10-3-83	Block Island, RI 9-5-84	338	M. Aiken A. Anderson	R/R	P. Taylor D. Slater	R/R
41° 04'N 70° 52'W 8-28-83	Montauk Pt., NY 9-6-84	375	F.J. Mather, III Dr. T. Brooks	R/R	D. Van De Water ---	R/R
Montauk Pt., NY 9-13-83	Montauk Pt., NY 9-23-84	376	J. McDuff A. Anderson	R/R	J. Sinning, Jr. ---	R/R
Block Island, RI Sept. 1982	40° 30'N 73° 30'W 9-24-84	740	V. Caturo ---	R/R	R. Bauer	R/R
Block Island, RI 8-7-81	40° 04'N 66° 50'W 1-31-84	908	M. Bevil A. Anderson	R/R	NMFS Observer ---	JAP LL
36° 31'N 75° 23'W 6-24-80	40° 42'N 62° 51'W 1-20-84	1305	Scientific Staff ---	US PS	N/A ---	JAP LL

Table 1. Continued.

Release Date	Recapture Date	Days at Large	Tagger Captain	Method	Finder Captain	Method
			Bluefin Tuna			
36° 31'N 75° 23'W 6-24-80	40° 04'N 68° 10'W 2-11-84	1328	Scientific Staff ---	US PS	NMFS Observer ---	JAP LL
Va. Beach, VA 6-20-80	39° 45'N 67° 23'W 1-17-84	1306	B. Neal B. Marson	R/R	NMFS Observer ---	JAP LL
36° 31'N 75° 23'W 6-24-80	Montauk Pt., NY 8-31-84	1529	Scientific Staff ---	US PS	J.R. Miller ---	R/R
38° 28'N 74° 19'W 7-13-79	41° 10'N 70° 50'W 7-29-84	1843	Scientific Staff ---	US PS	L. Davis ---	R/R
42° 47'N 70° 31'W 7-20-78	43° 30'N 70° 20'W 6-21-84	2163	Scientific Staff ---	US PS	G. Olsen ---	US MT
38° 03'N 74° 49'W 7-9-77	41° 10'N 70° 50'W July 1984	2563	Scientific Staff ---	US PS	M. Jackson ---	US HL
30° 02'N 74° 43'W 7-9-77	42° 10'N 70° 10'W 8-28-84	2607	Scientific Staff ---	US PS	R. Millard ---	US HL
38° 50'N 74° 20'W 7-8-76	40° 08'N 73° 50'W 9-18-84	2994	Scientific Staff ---	US PS	P.C. Cameron ---	R/R
40° 06'N 73° 41'W 8-15-74	24° 30'N 81° 00'W May 1984	3560	Scientific Staff ---	PS PS	J. Frawley ---	US LL

*reported in 1984

Table 2. Captains who made outstanding contributions to CGFTP in 1984 by assisting in the tagging of 10 or more blue marlin (BM), white marlin (WM), sailfish (SF), tunas (TN), and swordfish (SW). Angler column signifies fish tagged by captains while fishing as anglers and is included in the total.

Captains	Species					Total	Tagged as Angler
	BM	WM	SF	SW	TN		
Mike Aman	5	72	260			337	
Al Johnston, IV	91	63	74			228	
Barkey Garnsey	2	154	62			218	4
Phil Tedder	1	4	169			174	3
John H. Cochrane, III	3		135		11	149	1
Armando Gasse		1	103		1	105	37
Allan J. Card	12	3			89	104	1
Skip Libbey	1	2	92			95	9
Ron Hamlin	18	19	54		1	92	2
Fred Rushin	3	8			73	84	1
Mike Benitez	69	2	2			73	
William P. McDow		8	47			55	6
Bruce Ponton		1	51			52	1
Dietmar Kossman	5	7	35			47	2
Allen Gallo		8	33	1	4	46	1
Charles E. Bouchard	2	8	35			45	17
Tim Sperling		22	21			43	
Bill Casto			35			35	5
O. B. O'Bryan	31	3				34	1
Bud Tredo			29			29	
Gary Wilkes	8	1	18			27	1
Charles Ladnier	1	4			20	25	3
Daniel M. Gutherie	2		22			24	
Fred Riffe	2	19	2			23	
Mike Ardito	2	12	7			21	
Roger Greene	1	5	1		14	21	
Jack Morrow	18		3			21	
Martin Snow		19	2			21	4
Frank J. Braddick					20	20	
Butch Standeven			20			20	1
Oscar Young		2	18			20	
Kidd P. Crawford, Sr.			18		1	19	
Rich Hellmuth			19			19	
Al Petrosky	13	1	5			19	
Ralph Vick, Sr.		1	18			19	
Lee Alonzo		1	16		1	18	3
Jimmy Boswell		8	9		1	18	
Joel Green	2	5			11	18	
Joe Jett	2	3	12		1	18	
Socko Gorenflo			17			17	1
Rob P. Edlin	3	1	2	10		16	
Jim Hawthorne			16			16	4

Table 2. Continued

Captains	Species BM	WM	SF	SW	TN	Total	Tagged as Angler
Ray Parker			16			16	
R.A. "Dick" Radis			10		6	16	1
David Berard	1		13			14	
John E. Daigle	6	4			4	14	
Charles E. Waring		2	12			14	2
Keith R. Winter					14	14	6
Harry H. Bush		3	10			13	5
Chip Coffin	6	2	2	3		13	
Charles Peyton, Jr.		2	11			13	
John Rose	1		12			13	
Brent Shaver	1	10	2			13	
Bill Staros	2		11			13	
Larry C. Dukehart			12			12	
P.E. "Mike" Finch		10	2			12	
Chuck Reed	1		11			12	1
Ronald L. Ellis			11			11	5
Tommy W. Norred		10	1			11	
Charles Peyton, Sr.	1	6	3	1		11	1
George Poveromo	1		9		1	11	5
Carlos Quesada			11			11	
Nelson Applegate			10			10	
George Chasmar			10			10	5
Barry Covin	1	2	7			10	
Joe Mott				10		10	
Bob Pelosi			9		1	10	1
Gary Richardson	2	5	3			10	2
Chip Shafer			10			10	

Table 3. Anglers who made outstanding contributions to CGFTP in 1984 by assisting in the tagging of 10 or more blue marlin (BM), white marlin (WM), sailfish (SF), tunas (TN), and swordfish (SW). Captain column signifies fish tagged by anglers while fishing as captains and is included in the total.

Angler	Species					Total	Tagged as Captain
	BM	WM	SF	SW	TN		
Stewart Campbell		91	14			105	
Hank Manley	1	21	68		1	91	1
Gretchen Hillenmeyer	4	9	73		1	87	
Jerry Dunaway	63	6				69	
Gary Reede	6	14	33			53	10
Donald S. Leas, III	1	3	37			41	
R. Deering Howe		8	29			37	
Nick Smith			36			36	10
J. Richard Jeck			15		12	27	
Fred Sorrento			23			23	
Ed Bass			22			22	
Larry Biendenharn			21			21	
Roland Dixon		2	17			19	
Carl Koontz		13	6			19	
Jack Latrobe		7	12			19	
Tom O'Connel		1	18			19	
Mark Shackelford	2	8	8		1	19	
Mike Everly	2	3	13			18	
Trip Manley		2	16			18	4
William A. Read	1		16		1	18	
Tim Cantwell			17			17	4
Forest A. Norman					17	17	
David Moss	3		14			17	
David Cochrane			16			16	
Angelo Durante, Jr			16			16	
Dick Raffo, Sr		14	2			16	
Billy Bush	5		10			15	6
Richard Hausknecht			15			15	
Chris Hodge		9	6			15	
M.S. Jennings	2	1	12			15	
George Reiger					15	15	
Katie Riffe		9	6			15	
Ed Joy			14			14	
Wayne Wendell			14			14	
Sue C. Haycox		12	1			13	
George A. Purnell			13			13	
Zachary Wilson	5	1	7			13	
Helen Grant	1		11			12	
Dodie Hawthorne			12			12	
John Phillips	10	2				12	
Harvey M. Weil	1	4	7			12	1
Kirk Wiles			12			12	1

Table 3. Continued.

Angler	Species BM	WM	SF	SW	TN	Total	Tagged as Captain
Laura Bostwick		11				11	
Fred Mayo	11					11	
Dan A. Huges, Sr.		1	10			11	
Lloyd Lasster			11			11	
Allesandro Poma			11			11	
Gloria Applegate			10			10	
Nogie Bass			10			10	
Jack Christison			10			10	
Bud German			10			10	
Chet Jenkins			10			10	
Bill Knight		8	2			10	
James Porter		1	9			10	
Dan Susjner			10			10	
Bill Thacker			10			10	

AGE AND GROWTH RESEARCH

Eric D. Prince and Dennis W. Lee

Introduction

Age and growth research is an important component of fishery science. For example, in order to assess the well-being of an entire population of fish, its often necessary to separate catch or landing statistics by age, so each year-class can be followed through the fishery as they get older. In this way, assessment models can be used to determine the health or general status of each component of the population and management recommendations can be adjusted accordingly.

The approach we use to determine the age and growth rate of fish is analogous, in principle, to the methods used in dendrology for estimating the age of trees. The number of concentric rings in the trunks of trees from temperate regions are generally representative of yearly growth (i.e. one ring is equal to one calendar year). The spacing between these rings is proportional in size to the rate of growth for that particular year; the larger this spacing, the faster the rate of growth. Fastest growth usually occurs in summer and slowest growth in winter. In much the same manner, the age and growth rate of fishes are estimated by counting concentric rings or growth bands which form in their skeletal tissues, such as spines, fin rays, vertebrae, scales, or inner ear bones called otoliths. One problem in using this approach to age fish is that the time span between the formation of growth bands in skeletal structures needs to be determined. This is referred to as validating the accuracy of age determination methods, it is a critical part of ageing studies, and is one of the major themes we address in this portion of the program summary.

Our Save It For Science Program

Several NMFS programs on oceanic pelagic fishes traditionally depend entirely on the cooperation of recreational and commercial fishermen. Specifically, the success of the Cooperative Gamefish Tagging Program and the Recreational Billfish Surveys are two examples where participating anglers have played a significant role for many years. More recently, fishermen have been saving skeletal structures from tag-recaptured tuna and billfish (Table 1) and unusually small and large billfish for our studies on age and growth. These rare catches occur only a few times each year but when they do, fishermen who save these special fish for our program make significant contributions. In fact, in many cases the ONLY way we can validate the accuracy of our ageing methods, correctly interpret the growth bands on skeletal structures, or determine maximum longevity is to examine skeletal structures from tag-recaptured tuna and billfish, and very small and very large billfish.

Age Validation

The use of skeletal structures from recaptured tagged tunas and billfishes for age and growth validation studies are based on the premise that these fishes, which have been at-large for known periods, are essentially fish of known age. This condition usually exists only if the fish is tagged when it is very young or at a small size, where age can be accurately determined based only on size. Information from tagging records can then be accumulated to closely establish the fish's true age. If skeletal structures are recovered from these types of tag-recaptures, then they can be examined for growth bands and comparisons can be made between the age known from tagging records and age estimated from skeletal structure analysis. Thus, the relative accuracy of our ageing techniques can be established.

How You Can Help

Anglers capturing a tagged tuna or billfish or an unusually small or large billfish (see Table 2 for size categories by species) should contact us immediately BEFORE DISPOSING OF THE FISH. We will accept collect calls at any time, day or night, and make whatever arrangements are necessary to obtain the fish. Contact Dr. Eric Prince or Mr. Dennis Lee at the Southeast Fisheries Center's Miami Laboratory at (305) 361-4248, 361-4225, or Dr. Prince at his home (305) 598-0944. In many cases, anglers catching tagged fish or very small fish are releasing them and valuable scientific data are being lost. In other instances, tagged fish or very large fish are being eaten or mounted and the skeletal structures we use in our ageing studies are being thrown away. Our sampling methods will not interfere with taxidermy procedures, nor will the sampling affect the amount of edible flesh. We prefer to sample the fish ourselves. However, when the fish can't be sampled by Miami Laboratory personnel, the following procedures should be followed for marlin and sailfish, tuna, and swordfish:

Sampling Marlin and Sailfish

1. CUT OUT TAG or if fish is an UNUSUALLY SMALL OR LARGE SPECIMEN (as indicated in Table 2) and provide information below (items 2-7);

2. DATE, location caught;

3. LOWER JAW FORK LENGTH in inches or centimeters (Fig. 1);

4. TOTAL WEIGHT (round weight) in pounds or kilograms;

5. Determine SEX as shown in Figure 2 or cut a small 2-4 inch piece of gonad cross section and include with the sample;

6. The FIRST 6 DORSAL SPINES are the most important skeletal hardpart for marlin and sailfish. These can be taken by grabbing the tallest spine, pulling forward to spread the spine system, and cutting the tissue separating spines 6 and 7. Continue making a parallel cut 4-6 inches deep along each side of the spine down to the spine roots so the entire perimeter of the spines has been encircled. This will release the spine system so they can be pulled out by hand. DO NOT CUT THE SPINES AT THE SKIN SURFACE since the spine roots (Fig. 1) are important to us.

7. The HEAD UNIT illustrated in Figure 1 has 3 kinds of hardparts -- DORSAL SPINES, OTOLITHS (inner ear bones inside the skull), and ANTERIOR VERTEBRAE (1-6). All these parts can be conveniently taken in ONE unit by cutting off the bill at the nostrils, fileting the meat away from the backbone to the 6th vertebrae, and separating this from the rest of the body (Fig. 1). The lower jaw and gills can be removed to save storage space.

8. All samples need to be FROZEN or REFRIGERATED.

Sampling Tuna

1. CUT OUT TAG and provide information below (Items 2-7);

2. DATE, location caught;

3. FORK LENGTH in inches or centimeters (Fig. 3);

4. Total WEIGHT (round weight) in pounds or kilograms;

5. Determine SEX as shown for billfish in Figure 2 or cut a small 2-4 inch piece of gonad cross section and include with the sample;

6. Cut off HEAD behind gills;

7. Cut off CAUDAL PEDUNCLE (tail) at sixth finlet as shown in Figure 3;

8. All samples need to be FROZEN or REFRIGERATED.

Sampling Swordfish

1. CUT OUT TAG or if fish is an UNUSUALLY SMALL OR LARGE SPECIMEN (as indicated in Table 2) and provide information below (items 2-7);

2. DATE, location caught;

3. LOWER JAW FORK LENGTH in inches or centimeters (as indicated for marlin in Fig. 1);

4. TOTAL WEIGHT (round weight) in pounds or kilograms.

5. Determine SEX as shown for billfish in Figure 2 or cut a small 2-4 inch piece of gonad cross section and include with the sample.

6. The FIRST 6 ANAL SPINES are the most important skeletal hardpart for swordfish (see Fig. 1). These can be taken by grabbing the tallest spine, pulling forward to spread the spine system, and cutting the tissue separating spines 6 and 7. Continue making a parallel cut 4-6 inches deep along each side of the spine down to the spine roots so the entire perimeter of the spine has been encircled. This will release the spines so they can be pulled out by hand. DO NOT CUT THE SPINES AT THE SKIN SURFACE since the spine roots are important to us;

7. OTOLITHS (inner ear bones) are inside the skull and the head can be taken by cutting the bill off at the nostrils and cutting the head off behind the gill plates. The head can be trimmed by cutting off the lower jaw and gills so that only the skull (area between the eyes) is left.

8. All samples need to be FROZEN or REFRIGERATED.

Shipping Samples

It is possible that funds can be made available for reimbursement of costs incurred while providing these samples. However, clearance of these costs would have to be made through the Miami Laboratory. Please contact us ANY TIME day or night:

Dr. Eric Prince or Dennis Lee
National Marine Fisheries Service
Southeast Fisheries Center, Miami Lab
75 Virginia Beach Drive
Miami, Florida 33149

Phone (office) (305) 361-4248 commercial
or 361-4225 commercial
350-1248 FTS

Phone (home) (305) 598-0944

Table 1. Tag-recaptured oceanic pelagic fishes where skeletal structures were recovered for age and growth studies, National Marine Fisheries Service, Southeast Fisheries Center's Miami Laboratory, 1980-84.

	Release Data				Recapture Data					Skeletal structures
Species	Date	Location	Size	Angler	Date	Location	Size	Angler	Time at large	recovered
White Marlin	9/26/70	Maryland	35 lb	A. Yellot	7/10/82	New York	65 lb	F. Muoid	11 yr, 6 mo	spines, vertebrae
	5/6/80	Mexico (Cozumel)	25 lb	J. Rybovich	6/27/81	Louisiana	47 lb	A. Stumpf	1 yr, 2 mo	spines, vertebrae otoliths
	10/31/81	Florida	50 lb	D. Winter	9/19/82	Florida (Destin)	51.5 lb	A. Stimson	10.5 mo	spines, vertebrae otoliths
	6/17/82	Louisiana	55 lb	W. Billops	9/17/82	Florida (Destin)	60.5 lb	B. Lloyd	4 mo	spines, vertebrae otoliths
Bluefin Tuna	8/5/65	New Jersey	25 lb	Canadian Scientists	5/28/81	Bahamas (Cat Cay)	493 lb	K. Jenkins	15 yr, 8 mo	caudal vertebrae
	6/24/80	Virginia	25 lb	U.S. Scientists	2/11/84	New Jersey	159 lb	Japanese Longliner	3 yr, 8 mo	caudal vertebrae
Albacore	8/17/78	Spain	11 lb	Spanish Scientists	12/30/84	New Jersey	51 lb	Japanese Longliner	6 yr, 4 mo	spines, vertebrae otoliths
	6/23/80	France	11 lb	French Scientists	12/31/74	New Jersey	42 lb	Japanese Longliner	4 yr, 6 mo	spines, vertebrae
Sailfish	3/5/73	Florida (Islamorada)	40 lb	W. Tindall	1/14/84	Florida (Boynton Bch)	54 lb	R. Harrison	10 yr, 10 mo	spines, vertebrae otoliths

Table 2. Size categories of interest for age and growth studies of blue marlin, white marlin, sailfish, and swordfish, National Marine Fisheries Service, Southeast Fisheries Center's Miami Laboratory, 1984.

Species	Size Categories of Interest	
	Small Sizes (equal to or less than)	Large Sizes (equal to or greater than)
Blue marlin	$\leq$ 50 lbs	$\geq$ 500 lbs
White marlin	$\leq$ 30 lbs	$\geq$ 90 lbs
Sailfish	$\leq$ 20 lbs	$\geq$ 80 lbs
Swordfish	$\leq$ 10 lbs	$\geq$ 500 lbs

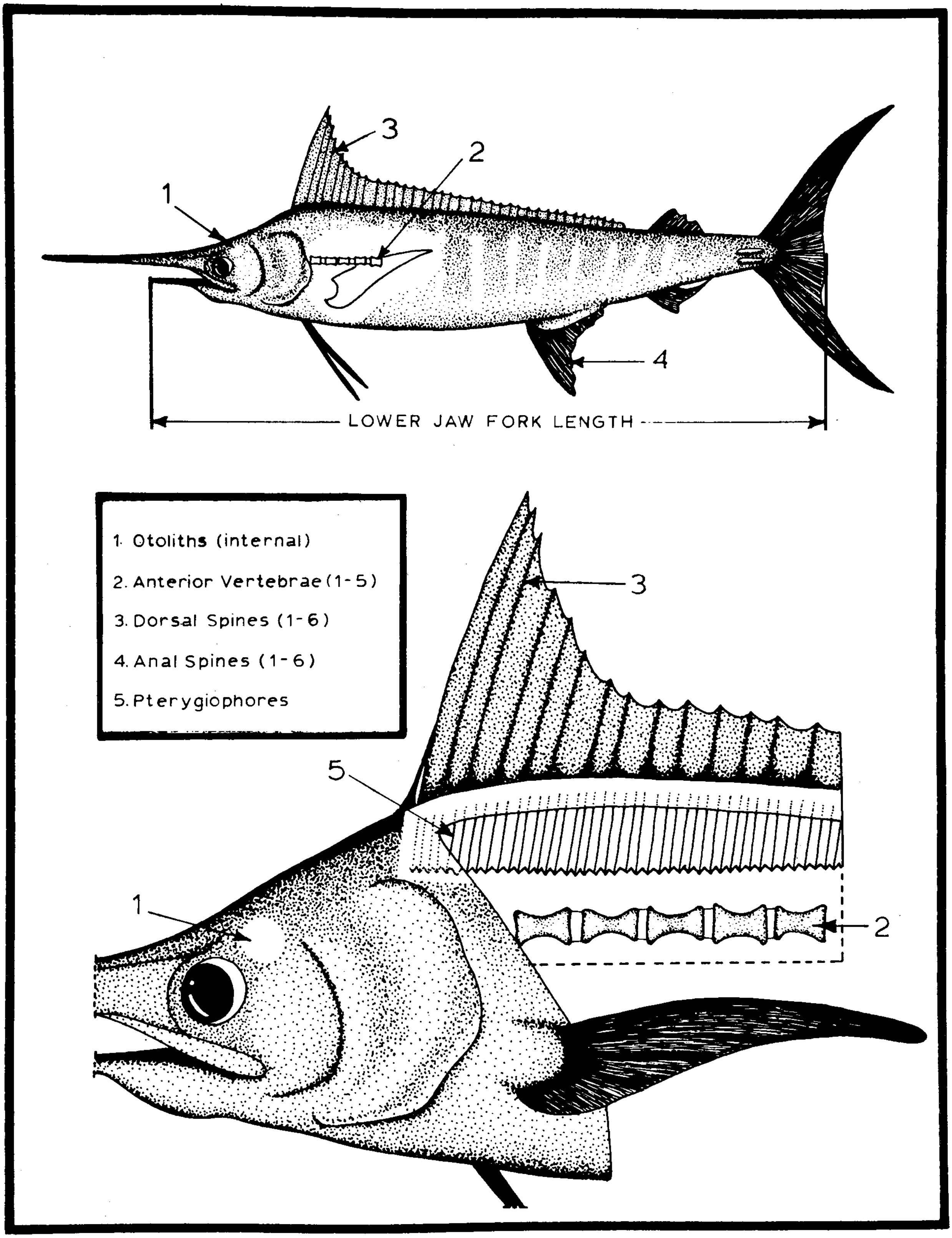


Figure I – Skeletal structures and measurements necessary from billfish for age and growth studies, National Marine Fisheries Service, Miami Laboratory. See text for explanation of procedures.

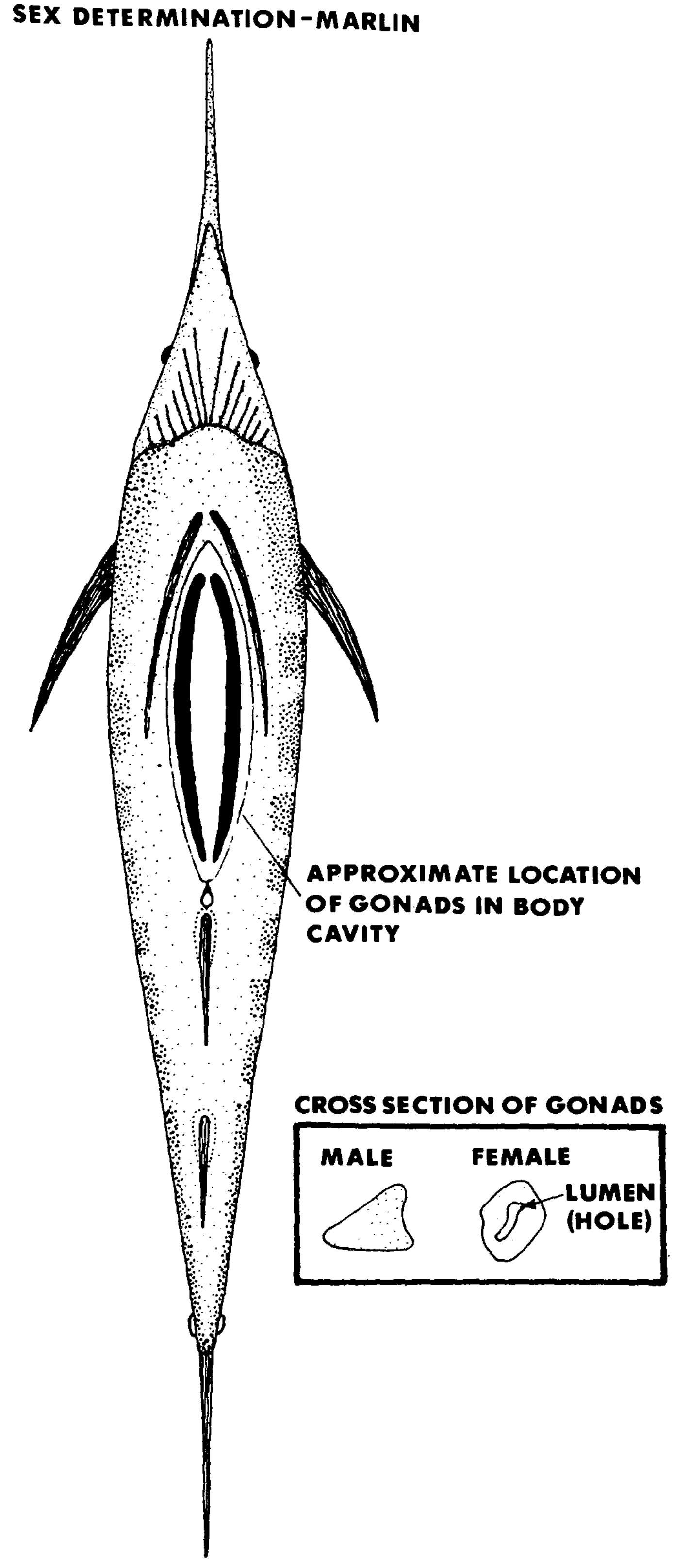


Figure 2 – Schematic showing the location of gonads and sex determination in Atlantic billfish. Sex determination in Atlantic tunas can be taken in a similar manner. If sex is in doubt, cut out a small piece of gonad and save it with the rest of the sample.

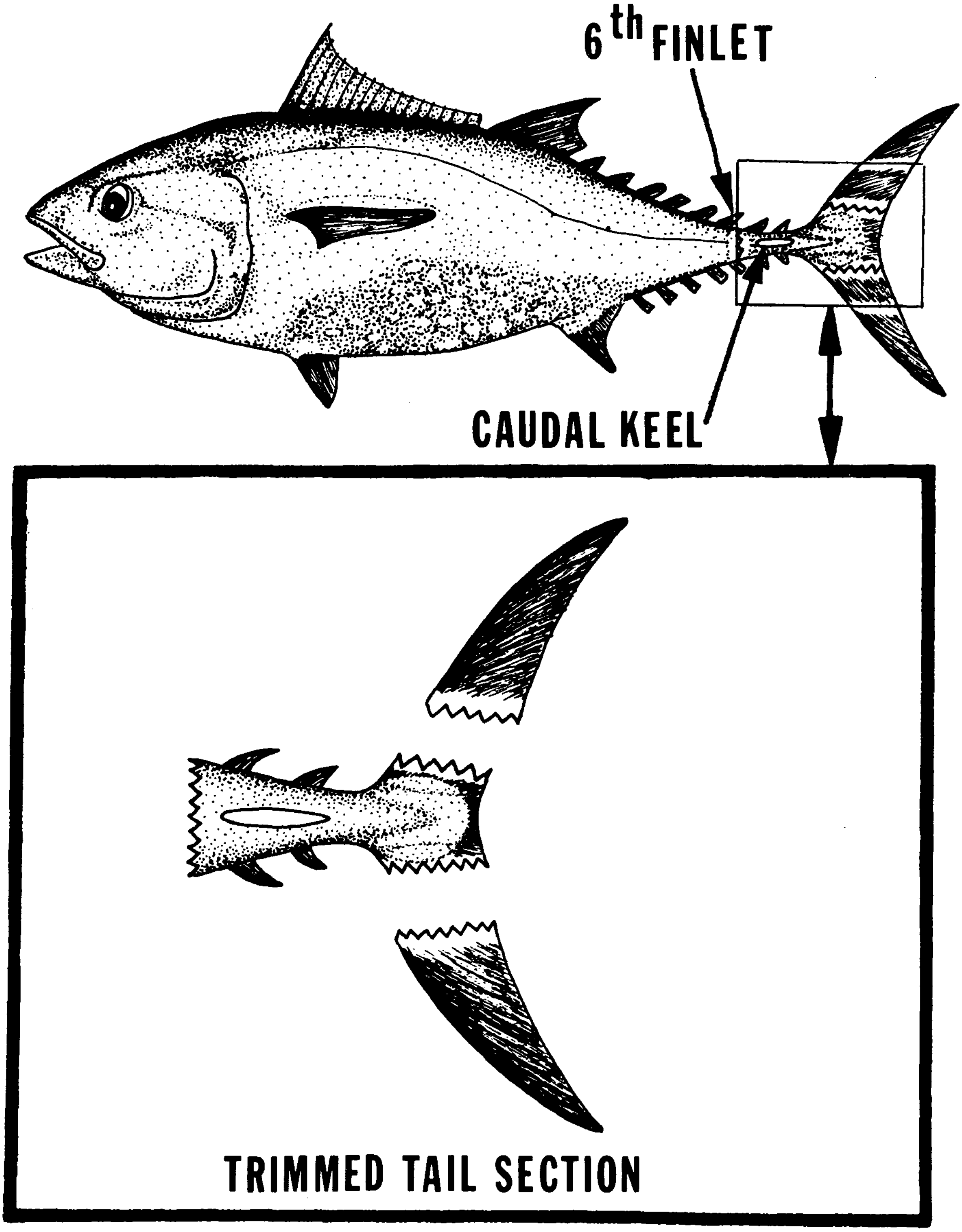


Figure 3 – Removing the caudal penduncle (containing vertebrae) from Atlantic bluefin tuna for age and growth studies. The head (containing otoliths) should also be saved by cutting behind the gill covers and fork length taken in inches or centimeters by measuring from the tip of the nose to the fork of the tail.

New Ageing Projects

The Miami Laboratory has been emphasizing research on age and growth of blue and white marlin since 1980. Prior to these projects, the primary target species for age and growth research was Atlantic bluefin tuna. Because of the continuing heavy fishing pressure on bluefin tuna and most species of billfishes, there is a persistent need for more detailed data on age and growth and several new ageing projects are being planned to start during 1985 in response to these needs.

Routine Bluefin Tuna Ageing

The primary objective of this project is to age bluefin tuna by analyzing skeletal structures (caudal vertebrae), and to provide an age/length key so that landings can be partitioned by age based on their size. An important aspect of this project is to make age estimates on the entire size range of currently harvested fish so that the resultant age/length key is up to date. This project will continue on an annual basis so that current information can be used every year in assessing the status of bluefin tuna populations in the western Atlantic Ocean. Data collection is planned to start in June 1985.

Swordfish Ageing Project

A review of recently published studies on ageing swordfish revealed some difficulties in our abilities to age this species. For example, none of these studies presented conclusive data on age validation, nor were researchers able to age the entire size range. It appears that otoliths may be the best structure for ageing swordfish less than 1 year old and older than about age 8, whereas anal spines seem to be a good structure for ageing intermediate age classes. However, these details need to be resolved before we can expect to make significant advances in assessing the status of swordfish populations. Therefore, a ageing project is currently being planned to address these critical issues. The start of our project is uncertain at this time, but initial collections of samples could begin as early as the summer 1985.

Sailfish Ageing Project

Recent analysis of skeletal structures from one tagged recaptured sailfish, at-large for almost 11 years, has revealed some new insights into the life history of this species, as well as potential problems with past ageing studies using dorsal spines (see summary article in this section). It is apparent from these new data that sailfish much larger than about 50 pounds (estimated age 5 or older) should probably be aged with otoliths. Dorsal spines, which had previously been relied on as a source of age and growth information, are not reliable structures for ageing older/larger sailfish. A new sailfish ageing project, using both otoliths and dorsal spines, appears to be appropriate based on these findings. Because of the urgency of the other two new ageing projects, initiation of this study may be delayed somewhat. However, we will probably start making a passive effort to collect samples in the summer and fall of 1985.

Longevity and Age Validation of Atlantic Sailfish *Istiophorus platypterus*, Using Dorsal Spines and Otoliths[1]

The Atlantic sailfish is one of the most popular recreational fishes in the Atlantic Ocean and adjacent seas. The biological information presently used in stock assessments of sailfish relies on age and growth data derived from dorsal spine analysis. However, uncertainties remain in the sailfish age structure, maximum longevity, choice of skeletal structure for ageing, and rate of growth because of inconsistencies in the literature. We present an analysis of dorsal spines and otoliths obtained from one tag-recaptured sailfish, where age was known from tagging records, to help resolve problems associated with ageing this species.

Tag-Recapture

A 54 pound tagged female sailfish was caught on January 14, 1984, off Boynton Beach, Florida. The fish was originally tagged and released off the Florida Keys on March 5, 1973, at an estimated weight of 40 pounds. Based on the tagging records, this fish was at-large for 10 years and 10 months or 4,025 days. The entire fish was made available to us, courtesy of Reese Taxidermists, Inc., and we were able to sample dorsal spines (3-6) and otoliths for age and growth analysis.

Using a slow speed saw, thin cross sections were taken near the base of spines 3-6 and counts of the internal zonations were made to estimate age. The otoliths were cleaned and prepared for scanning electron microscopy and counts of external growth zones (ridges) on the otolith surface were used for age estimation.

Longevity

Maximum age of the Atlantic sailfish has been speculated to range from 3-4 years based on length frequency analysis to 8 years (or possibly 9-10 years) based on dorsal spine analysis (Fig. 1). Our tagging records indicate that this sailfish is the longest time-at-large specimen recorded by the CGFTP. This fish was released at an estimated 40 pounds, which we feel was a reliable weight based on the judgment of a very experienced charterboat captain. The estimated age of a 40 pound sailfish could range from 2-4 years based on the previously published studies. Therefore, the age of this sailfish based on tagging information was 13-15 years old, which was a conservative estimate, and we feel it is very unlikely that this fish could be younger than 13 years.

Skeletal Structure Analysis

Each section from dorsal spines 3-6 had a vascularized core in the central portion of the structure (Fig. 2), which tends to increase in size as the fish gets larger (older). The vascularized core obscures zonations

---

[1]Charles A. Wilson, Louisiana State University, Baton Rouge, LA, and John M. Dean, University of South Carolina, Columbia, SC, assisted in this research.

associated with the early growth history and thus prevents their enumeration for estimating age. Counts of the growth zonations in the solid bone area of the sections ranged from 2 to 8 (Fig. 2), which substantially underestimated age of this sailfish known from our tagging records. We conclude from these data that dorsal spine sections are probably only useful in ageing young sailfish, and individuals aged with spines larger than about 50 pounds will likely result in a considerable underestimate of true age.

The otoliths from the tagged sailfish had external and internal features which were characteristic of sailfish. Because of the multi-directional growth pattern of the otolith, two methods were utilized to count the growth zonations. Growth zonations 1 and 2 (hidden from view; Fig. 3, bottom) were not clearly defined on the external surface of the otolith. A thin polished section of the otolith was made to better observe these initial zonations. Growth zonations (ridges) 3 through 10 were easily counted on the external surface (Fig. 3, bottom), while zones 11 through 13 (Fig. 3, top) were observed using higher magnification. Therefore, otolith age of the tagged sailfish was 13 years but could have been as high as 15 years depending on our interpretation of the growth zonations at the beginning and the end of the counting path. Although we acknowledge potential error in our counts, we feel errors at these locations of the counting path would have increased the count and thus, otolith age should be presented conservatively as ranging from 13 to 15 years.

In conclusion, tagging records indicate that estimates of maximum age for Atlantic sailfish should be revised upwards to at least 13-15 yr and that sailfish of this age grow at a very slow rate. Dorsal spines do not appear to be an accurate source of age and growth information for sailfish greater than about 50 pounds, while otoliths do provide accurate estimates of age for these older age groups. Current stock assessments of Atlantic sailfish rely exclusively on dorsal spine ageing data which offer little insight into the mature segments of the population. Future assessments should be revised using otolith ageing methods, to clarify that portion of the age structure that cannot be reliably appraised using dorsal spines.

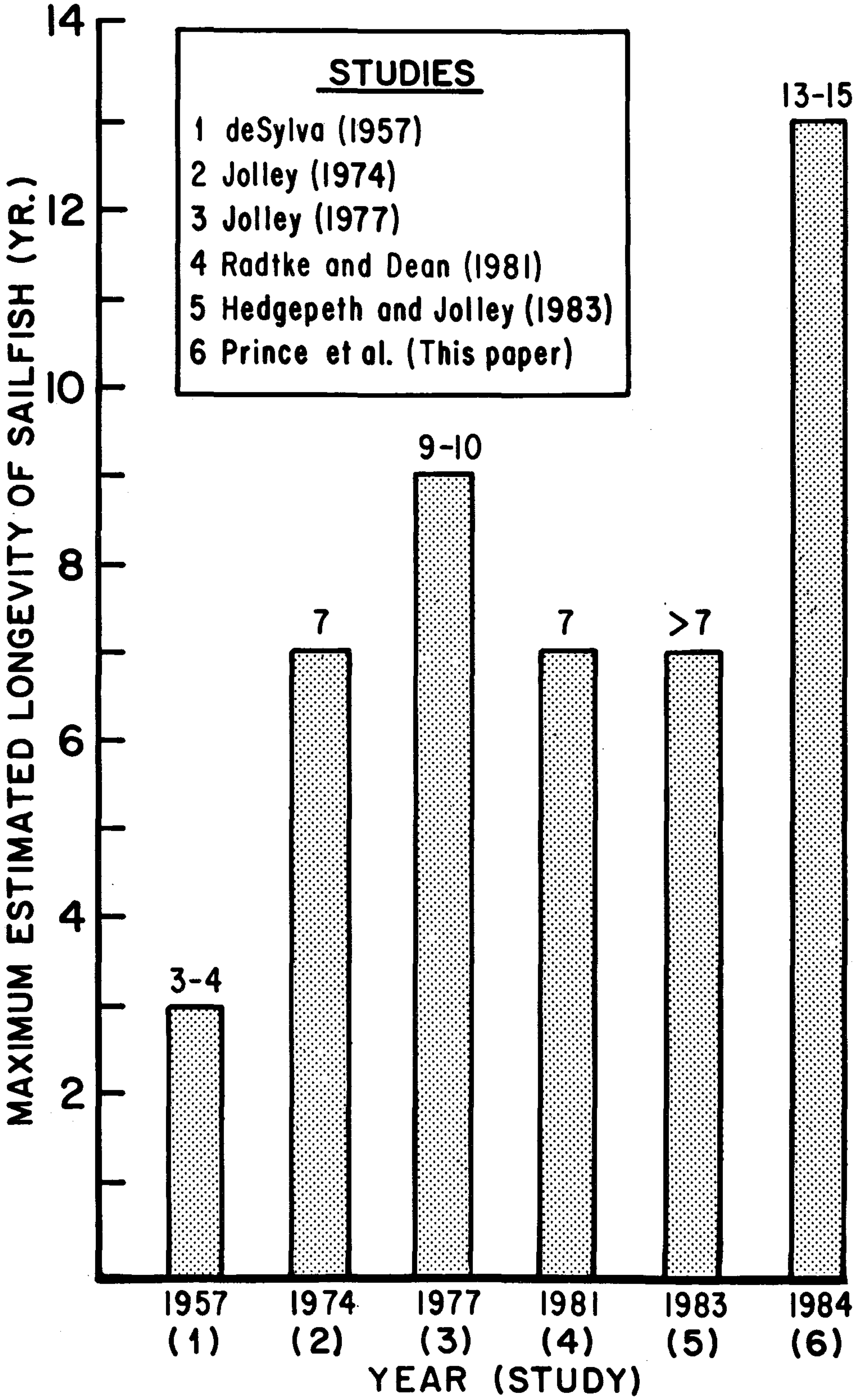


Figure 1- Estimates of maximum longevity (yr) for Atlantic sailfish from six different studies, 1957-1984.

References

1. de Sylva, D.P.
1957. Studies on the age and growth of the Atlantic sailfish, Istiophorus americanus (Cuvier), using length-frequency curves. Bull. Mar. Sci. Gulf Carib. 7:1-20.

2. Jolley, J.W., Jr.
1974. On the biology of the Florida east coast Atlantic sailfish (Istiophorus platypterus). In R.S. Shomura and F. Williams (editors), Proceedings of the international billfish symposium Kailua-Kona, Hawaii, 9-12 Aug. 1972, par 2. Review and contributed papers, p. 81-87. U.S. Dep. Commer., NOAA Tech. Rep. NMFS-SSRF-675.

3. Jolley, J.W., Jr.
1977. The biology and fishery of Atlantic sailfish, Istiophorus platypterus, from southeast Florida. Fla. Mgr. Res. Lab. 28:31 p.

4. Radtke, R.L., and J.M. Dean.
1981. Morphological features of the otoliths of the sailfish, Istiophorus platypterus, useful in age determination. Fish. Bull. 179:360-367.

5. Hedgepeth, M.Y., and J.W. Jolley, Jr.
1983. Age and growth of sailfish, Istiophorus platypterus, using cross sections from the fourth dorsal fin spine. In E.D. Prince and L.M. Pulos (editors), Proceedings of the international workshop on age determination of oceanic pelagic fishes: tunas, billfishes, and sharks, p. 131-135. U.S. Dep. Commer., NOAA Tech. Rep. NMFS8.

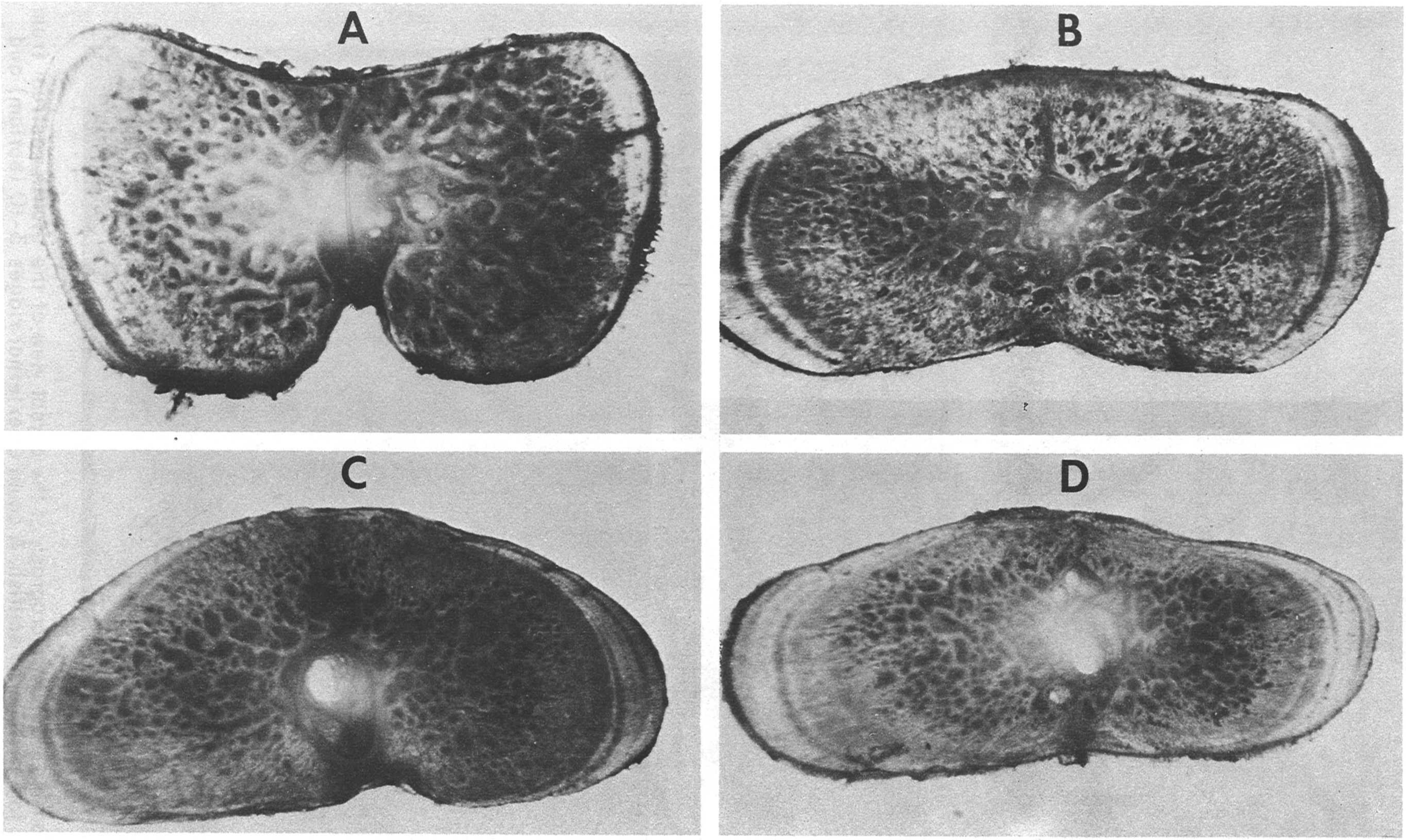


Figure 2- Sections of dorsal spines 3(A), 4(B), 5(C), and 6(D) from a tag-recaptured Atlantic sailfish at-large for 10 yr, 10 mo. Age based on tagging records was 13-15 yr.

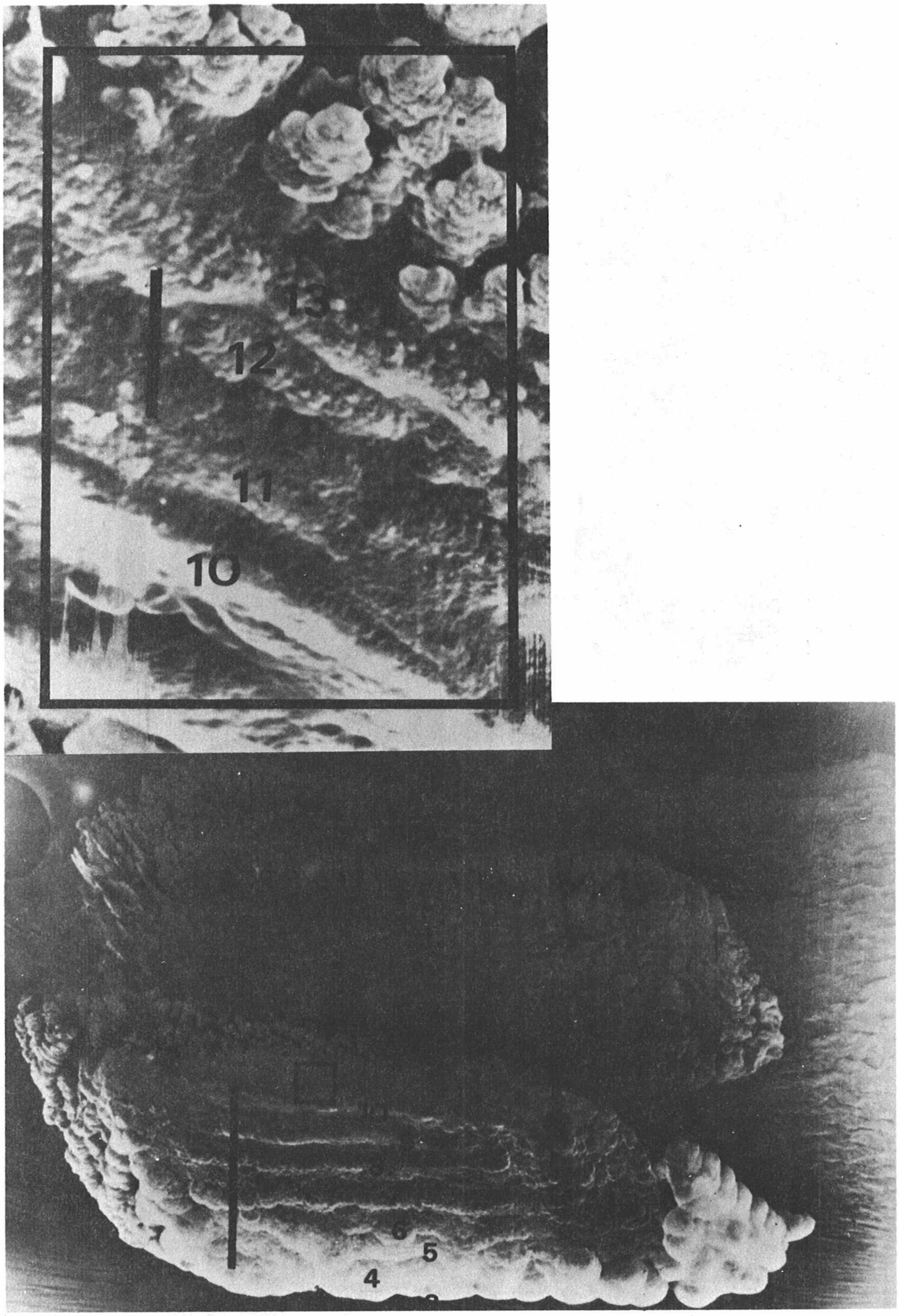


Figure 3- Scanning electron micrograph of the dorsal view of the otolith rostrum from the tag-recaptured sailfish. A count of external ridges 3-10 (bottom) and 10-13 (top) were used to assign a numeric otolith age of 13 yr. Bar on bottom = 1.0 mm, bar on top = 0.1 mm.

Appendix I. Tournaments and docks sampled by oceanic gamefish personnel or by personnel from cooperating agencies 1984.

Tournaments/Docks	Location	Dates	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Masters Invitational Sailfish	Palm Beach, FL	Jan 10-Jan 14	870.33	0	0	206	0	0	0
Annual Silver Derby Sailfish	Palm Beach, FL	Jan 14-Feb 3	16:30	0	0	1	0	0	0
	Livebait		364:55	0	0	148	0	0	0
Invitational Gold Cup	Palm Beach, FL	Jan 18-Jan 21	1379:00	0	0	43	0	0	0
International Womens Fishing Association	Palm Beach, FL	Jan 25-Jan 27	253:00	0	1	18	0	0	0
Buccaneer Invitational	Palm Beach, FL	Jan 27-Jan 29	35:00	0	0	0	0	0	0
	Livebait		664:30	0	0	215	0	0	0
Annual Bimini Benefit (formerly Frankie Brown)	Bimini, Bahamas	Mar 5-Mar 9	672:48	27	21	1	0	0	0
Annual Bacardi Billfish	Bimini, Bahamas	Mar 20-Mar 24	1195:50	26	15	1	0	0	0
Showdown	Walkers Cay, Bahamas	Mar 30-Mar 31	589:30	35	5	0	0	0	0
Annual His and Hers Billfish	Chub Cay, Bahamas	Apr 2-Apr 6	560:00	17	17	13	0	0	0
Walkers First	Walkers Cay, Bahamas	Apr 9-Apr 13	1694:05	60	11	2	0	0	0
Members Only Billfish	Chub Cay, Bahamas	Apr 9-Apr 13	643:39	27	13	7	0	0	0
Club Nautico de Cozumel	Cozumel, Mexico	Apr 11-Apr 13	171:20	6	15	24	0	0	0
Ernest Hemingway Billfish	Bimini, Bahamas	Apr 17-Apr 20	1816:39	29	15	2	0	0	1
South Texas BGFC First	Port Isabel, TX	Apr 28-Apr 28	104:00	3	2	0	0	0	1
Walkers Cay Annual Billfish	Walkers Cay, Bahamas	Apr 30-May 4	2685:30	97	5	3	0	0	0
Hilton Head Island	Sea Pines, SC	May 3-May 5	352:45	6	0	0	0	0	0
Bertram-Hatteras Billfish	Bimini, Bahamas	May 10-May 12	1311:30	66	5	2	0	0	0
Bohicket-Seabrook Billfish	Charleston, SC	May 11-May 12	595:10	16	0	0	0	0	0
New Orleans Big Game Fishing Club First	South Pass, LA	May 11-May 13	452:55	20	3	0	0	0	7
Angler's Invitational (formerly Jerry Isan)	Chub Cay, Bahamas	May 14-May 18	956:00	42	5	9	0	0	0
Georgetown Blue Marlin	Georgetown, SC	May 25-May 26	538:41	15	3	9	0	0	0
Mobile Big Game Fishing Club Memorial Day	Orange Beach, AL	May 26-May 27	185:30	5	1	0	0	0	4
	Drifting		57:26	0	0	0	0	0	0
South Pass Memorial Day	South Pass, LA	May 26-May 28	683:40	19	6	0	0	0	18
South Texas BGFC Second	Port Isabel, TX	May 26-May 27	232:00	1	2	2	0	4	2
Cayman Million Dollar Month	Cayman Island	Jun 3-Jun 30	6218:43	317	14	4	0	0	0
Cat Cay Blue Marlin	Cat Cay, Bahamas	Jun 6-Jun 9	1237:30	15	7	4	0	0	0
Liollio's Warmup Tournament	Destin, FL	Jun 8-Jun 9	248:00	4	4	0	0	0	1
Golden Meadow Big Game Fishing Club Invitational	Grand Isle, LA	Jun 8-Jun 9	462:02	11	9	1	0	0	76
New Orleans Big Game Fishing Club Tag & Release	South Pass, LA	Jun 9-Jun 10	118:01	4	5	0	0	0	18
Hatteras Blue Marlin	Hatteras, NC	Jun 11-Jun 16	1324:18	29	49	1	0	0	7
Baton Rouge Big Game Fishing Club Invitational	South Pass, LA	Jun 14-Jun 16	430:40	12	12	1	0	0	13
Destin Summer Open Billfish	Destin, FL	Jun 15-Jun 16	1180:15	27	34	1	0	0	21
	Drifting		15:35	0	0	0	0	0	0

Appendix I. Cont'd

Tournaments/Docks	Location	Dates	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Port Aransas Masters Billfish	Port Aransas, TX	Jun 16 Jun 17	565:00	35	5	4	0	0	38
South Texas BGFC Third	Port Isabel, TX	Jun 18-Jun 18	124:00	0	0	2	0	0	2
Bimini Blue Marlin	Bimini, Bahamas	Jun 20-Jun 23	1152:00	17	4	6	0	0	0
New Orleans Big Game Fishing Club Invitational	South Pass, LA	Jun 21-Jun 23	2233:12	33	30	0	0	0	100
La Pesca Fishing	Port O'Connor, TX	Jun 22-Jun 23	99:30	4	1	2	0	0	5
Panama City Big Game Fishing Club First	Panama City, FL	Jun 23-Jun 23	159:00	5	10	0	0	0	4
Hatteras Invitational	South Pass, LA	Jun 29-Jun 30	370:45	4	2	0	0	0	8
Ocean City White Marlin & Tuna	Ocean City, MD	Jun 30-Jul 1	114:25	0	1	0	0	0	16
	Drifting		6:00	0	0	0	0	0	0
Texas Championship Billfish	Port Aransas, TX	Jun 30-Jul 1	662:05	17	4	8	0	0	39
South Texas BGFC Fourth	Port Isabel, TX	Jun 30-Jul 1	269:00	4	0	5	0	0	3
Capt. Fanny Blue Marlin	Beaufort, NC	Jul 2-Jul 6	1213:55	11	2	1	0	0	0
Harms July 4 Open	St. Thomas, VI	Jul 6-Jul 8	542:34	34	1	0	0	0	1
Pensacola International Billfish	Destin, FL	Jul 6-Jul 7	250:45	4	9	0	1	0	0
Pensacola International Billfish	Pensacola, FL	Jul 6-Jul 7	1174:45	40	70	4	0	0	21
	Drifting		8:59	0	0	0	0	0	0
Golden Meadow Tarpon Rodeo	Grand Isle, LA	Jul 6-Jul 7	29:00	1	4	0	0	0	0
General Ray Huff Billfish	South Pass, LA	Jul 6-Jul 8	306:50	4	5	0	0	0	10
	Drifting		9:00	0	0	0	0	0	0
Chub Cay Blue Marlin	Chub Cay, Bahamas	Jul 9-Jul 13	1013:03	37	1	4	0	0	0
Deep Sea Roundup	Port Aransas, TX	Jul 10-Jul 12	369:45	27	8	13	0	0	17
Bay Point Invitational	Panama City, FL	Jul 13-Jul 14	828:05	29	72	11	0	0	8
New Orleans Big Game Fishing Club Ladies Day	South Pass, LA	Jul 13-Jul 14	500:45	12	16	0	0	0	17
Eastern Shore Marlin	Wachapreague, VA	Jul 14-Jul 15	224:00	1	11	0	0	0	21
Hemingway Tournament	Key West, FL	Jul 19-Jul 22	504:00	6	6	1	0	0	0
Port Mansfield Fishing	Port Mansfield, TX	Jul 19-Jul 21	393:05	7	7	19	0	0	11
Mid-Atlantic White Marlin Handicap	Ocean City, MD	Jul 20-Jul 22	90:00	0	17	0	0	0	4
Dauphin Island Deep Sea Rodeo	Dauphin Island, AL	Jul 20-Jul 22	468:15	3	22	1	0	0	6
	Drifting		38:56	0	0	0	0	0	0
Poco Bueno	Port O'Connor, TX	Jul 20-Jul 21	687:56	40	73	23	0	0	30
Mako Outboard	Port Aransas, TX	Jul 20-Jul 21	28:30	0	2	0	0	0	0
Annual Small Boat Marlin	Virginia Beach, VA	Jul 21-Jul 21	174:00	0	11	0	0	0	30
Panama City Big Game Fishing Club Second	Panama City, FL	Jul 21-Jul 21	60:15	1	5	0	0	0	1

Appendix I. Cont'd

Tournaments/Docks	Location	Dates	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Bimini Summer Billfish Tournament	Bimini, Bahamas	Jul 24-Jul 28	486:00	5	2	3	0	0	0
Grand Isle Tarpon Rodeo	South Pass, LA	Jul 26-Jul 28	797:55	16	33	0	0	0	4
Shinnecock Invitational Tuna & Marlin	Shinnecock, NY	Jul 27-Jul 29	234:00	0	11	0	0	0	5
Ocean Yachts' Tournament	Ocean City, MD	Jul 27-Jul 28	245:00	1	54	0	0	0	7
South Padre Island Invitational	Port Isabel, TX	Jul 27-Jul 28	638:39	24	14	16	0	0	7
	Drifting		42:55	0	0	0	5	0	0
Babylon Invitational Marlin	Babylon, NY	Jul 28-Jul 29	149:30	1	1	0	0	0	33
Montauk Yacht Club Cup	Long Island, NY	Jul 29-Jul 29	44:00	0	2	0	0	0	4
Texas International Fishing	Port Isabel, TX	Aug 2-Aug 4	1156:45	42	29	53	0	0	14
Rudee Inlet Marlin Release	Virginia Beach, VA	Aug 3-Aug 4	183:30	1	20	0	0	0	2
Annual Fort Walton-Destin Billfish	Destin, FL	Aug 4-Aug 4	464:50	4	37	3	0	0	4
Gulf Breeze Optimists Rodeo	Pensacola, FL	Aug 4-Aug 5	24:00	1	1	0	0	0	0
Mobile Big Game Fishing Club Ladies	Orange Beach, AL	Aug 4-Aug 5	619:15	3	38	0	0	0	14
	Drifting		137:44	0	0	0	0	0	0
BVI International Billfish	St. Thomas, VI	Aug 10-Aug 12	288:13	48	0	0	0	0	0
Panama City Captains Day Billfish	Panama City, FL	Aug 10-Aug 11	706:00	19	88	1	0	0	15
	Drifting		9:59	0	0	0	1	0	0
Betram	South Pass, LA	Aug 10-Aug 11	414:15	12	9	0	0	0	8
Pensacola Ladies	Pensacola, FL	Aug 11-Aug 12	270:00	3	19	2	0	0	2
$25,000 White Marlin Open	Ocean City, MD	Aug 13-Aug 17	1710:00	22	222	1	0	0	6
Empire-South Pass Fishing Rodeo	South Pass, LA	Aug 16-Aug 18	422:49	5	1	1	0	0	15
	Drifting		3:00	0	0	0	0	0	0
Gulf Coast Masters	Dauphin Island, AL	Aug 17-Aug 18	677:01	22	73	10	0	0	12
Pirate Cove Blue Marlin	Grant Isle, LA	Aug 17-Aug 18	45:00	5	4	0	0	0	0
Dean Hawn Memorial Billfish	Port Aransas, TX	Aug 17-Aug 18	813:30	14	18	25	0	0	3
Monkey Boat Billfish Tournament	Pensacola, FL	Aug 18-Aug 18	248:20	2	13	2	0	0	8
Panama City Big Game Fishing Club Third	Panama City, FL	Aug 25-Aug 25	78:45	2	9	0	0	0	0
Port Aransas Rod & Reel	Port Aransas, TX	Aug 25-Aug 26	35:00	0	0	7	0	0	0
Virginia Beach Blue Marlin	Virginia Beach, VA	Aug 31-Sep 3	645:00	3	221	0	0	0	11
Alabama International	Orange Beach, AL	Aug 31-Sep 1	1406:15	35	82	2	0	0	7
	Drifting		150:13	0	0	0	5	0	0
Baton Rouge Big Game Fishing Club Second	South Pass, LA	Aug 31-Aug 31	29:30	1	1	0	0	0	0
Ocean City Annual White Marlin Open	Ocean City, MD	Sep 1-Sep 3	246:00	0	46	0	0	0	6
New Orleans Big Game Fishing Club Labor Day	South Pass, LA	Sep 1-Sep 3	361:10	3	5	1	0	0	14
	Drifting		9:30	0	0	0	0	0	0

Appendix I. Cont'd

Tournaments/Docks	Location	Dates	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Teal Harbor Ladies Billfish	Port Aransas, TX	Sep 1-Sep 1	268:05	4	2	20	0	0	0
South Texas BGFC Fifth	Port Isabel, TX	Sep 1-Sep 1	168:00	2	2	1	0	0	0
San Juan International Billfish	San Juan, PR	Sep 5-Sep 9	2454:22	109	1	0	0	0	2
Annual Destin Billfish	Destin, FL	Sep 14-Sep 15	765:42	22	32	2	0	0	3
New Orleans Big Game Fishing Club Last	South Pass, LA	Sep 14-Sep 15	240:05	9	4	1	0	0	4
	Drifting		6:29	0	0	0	0	0	0
South Texas BGFC Sixth	Port Isabel, TX	Sep 15-Sep 15	80:00	1	2	1	0	0	0
Oregon Inlet Fishing	Oregon Inlet, NC	Sep 19-Sep 21	420:00	7	65	1	0	0	103
IBL Orange Beach Grand Prix	Orange Beach, AL	Oct 4-Oct 6	309:30	5	22	0	0	0	0
Orange Beach Invitational	Orange Beach, AL	Oct 12-Oct 13	705:13	21	47	2	0	0	2
Key West Blue Marlin	Key West, FL	Oct 16-Oct 20	2555:43	49	7	2	0	0	0
	Livebait		3:00	0	0	0	0	0	0
Marlin International Open	Destin, FL	Oct 19-Oct 20	424:40	19	68	0	0	0	1
	Drifting		7:45	0	0	0	0	0	0
IBL Key West	Key West, FL	Oct 23-Oct 25	575:08	33	1	1	0	0	0
Tripod-Marathon	Marathon, FL	Nov 7-Nov 10	742:00	0	0	37	0	0	0
	Drifting		56:00	0	0	11	0	0	0
Bill King One Day Billfish	Key Colony, FL	Nov 12-Nov 12	136:00	0	0	17	0	0	0
Key Colony Beach Sailfish	Key Colony Bch, FL	Nov 14-Nov 18	579:00	0	0	42	0	0	0
Islamorada Sailfish (live bait)	Islamorada, FL	Nov 28-Dec 2	1160:00	0	0	65	0	0	0
Stuart Annual Light Tackle Sailfish	Stuart, FL	Dec 5-Dec 9	1410:30	0	0	229	0	0	0
Dock Sampling									
South Pass Docks	Trolling	Apr 5-Oct 14	831:07	15	11	0	0	1	25
	Drifting		11:30	0	0	0	1	0	0
Port Aransas Docks	Trolling	Apr 11-Nov 4	1220:30	85	24	46	0	0	110
	Drifting		7:59	0	0	0	1	0	0
Mobile Docks	Trolling	May 11-Oct 20	160:40	10	9	0	0	0	1
	Drifting		6:00	0	0	1	0	0	0
Pensacola Docks	Trolling	May 14-Sep 15	162:15	3	6	0	0	0	2
Padre Island Docks	Trolling	May 19-Aug 18	390:25	23	10	12	0	1	2
Panama City Docks	Trolling	May 22-Oct 20	375:30	9	17	4	0	0	0

Appendix I. Cont'd

Tournaments/Docks	Location	Dates	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Destin Docks	Trolling	May 25-Oct 31	2127:14	46	131	20	3	0	24
	Drifting		11:25	0	0	0	0	0	0
Grand Isle Docks	Trolling	May 26-Sep 15	141:30	7	5	0	0	0	4
Galveston Docks	Trolling	May 26-Sep 1	186:30	4	8	0	0	0	1
Virginia Docks	Trolling	May 27-Sep 23	2505:34	22	402	6	1	0	1902
Ocean City Docks	Trolling	Jun 18-Sep 22	2563:15	12	523	1	0	0	101
New York Docks	Long Island, NY	Jun 22-Oct 6	3097:52	7	84	0	1	0	452
	Drifting		278:28	0	9	0	0	0	24
New Jersey Docks	Trolling	Jun 23-Oct 28	1397:46	4	37	0	2	0	446
	Drifting		112:25	1	0	0	3	0	8
New England Docks	Trolling	Jul 16-Sep 3	143:00	0	16	0	0	0	73
	Drifting		17:00	0	0	0	0	0	4

☆ U.S. Government Printing Office: 1985—567-099