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A HISTORY OF THE RECREATIONAL BILLFISHING SURVEY IN THE NORTHERN GULF OF MEXICO, 1971-1991: PURPOSE, METHODS, AND SUMMARY

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SUMMARY

The National Marine Fisheries Service initiated a recreational billfishing survey in 1971 for the northern Gulf of Mexico in response to the discovery of significant stock of billfishes in the mid-1950's. An overview of the methods and purpose of that survey, and a brief summary of the data for the period 1971-1991, are presented.

RESUME

Le "National Marine Fisheries Service" a mis en route en 1971 dans le golfe du Mexique une prospection de la pêche sportive d'istiophoridés, en réponse à la découverte d'un stock significatif d'istiophoridés au milieu des années cinquante. Le présent document fournit une vue de synthèse des méthodes et objectifs de cette prospection, ainsi qu'un bref résumé des données pour la période 1971-91.

RESUMEN

El "National Marine Fisheries Service" inició en 1971 una prospección de la pesca de recreo de marlines en la parte norte del Golfo de México, en respuesta al descubrimiento de un importante stock de marlines a mediados de los años 50. Se presenta un panorama general de los métodos y objetivos de dicha encuesta y un breve resumen de los datos del período 1971-1991.

1. INTRODUCTION

While conducting exploratory longline fishing for tunas, *Thunnus spp.*, off the Louisiana coast in the mid-1950's, the U.S. Fish and Wildlife Service made significant catches of marlin and sailfish (family Istiophoridae). Although there had been some intermittent fishing for these fishes prior to and during this period, this discovery generated an intense interest in big game fishing. In response to this new recreational fishery, the National Marine Fisheries Service (NMFS) began a study of this resource in 1971 with the cooperation of the New Orleans Big Game Fishing Club. The objectives of this study were to learn about: 1) the abundance and distribution of the resource, 2) the morphology of these species, and 3) the occurrence of these fishes in relation to environmental factors, such as weather and sea conditions. Ultimately, analyses of these data would provide scientific support to NMFS in the development of the U. S. Atlantic Billfish Fishery Management Plan (FMP), as well as support to other regulatory agencies such as the International Commission for the Conservation of Atlantic Tunas (ICCAT).

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2. METHODS

On-site interviews with recreational fishermen at tournament and non-tournament sites were chosen to meet study objectives. This method provided information on the resource and documentation of pressure the recreational fishery exerted on that resource. The survey data include information about weather and sea conditions, fishing time, number of hours trolled (effort), baits and techniques used, number of each species encountered and result of each encounter (i.e., raise, hooked, lost, tagged and released, or boated), biological data of boated fish (i.e., length, weight and sex), and areas fished. A detailed description of all the data collected is presented as Appendix 1. This report will summarize the data obtained from this survey over a twenty-year period.

3. BILLFISH SURVEY HISTORY

Catch records from 1966 to 1970 of the New Orleans Big Game Fishing Club were examined by National Marine Fisheries Service (NMFS) in 1971 for information pertaining to billfish (i.e., blue marlin, *Makaira nigricans*; white marlin, *Tetrapturus albidus*; and sailfish, *Istiophorous platypterus*). Information on hours fished, species of catches, and stomach contents was compiled from these records (E.L Nakamura, pers. comm.). Because of the availability of information, NMFS solicited information from Big Game Fishing Clubs in Mobile (Alabama), New Orleans (Louisiana), and Pensacola (Florida). Big game fishing clubs are recreational fishmen competeing for points; billfish are the targeted species. Destin (Florida), and Panama City (Florida) Charter Boat Associations also assisted by providing information. NMFS port samplers collected specific information on hours fished, areas fished, times of catches, species, and water color and conditions (i.e., rips, weeds or open water). In addition, they examined the catches to obtain biological data such as lengths, weights, girths, tail spread, and sex. Information on types of bait was added to the survey in 1982 and subjective information on water color and rips deleted after Beardsley and Conser (1981) presented a detailed analysis of the survey. The fishing community continues to cooperate with the survey effort and benefit from survey results through an annual newsletter on fishing activity.

Sampling Strategy

Port samplers are hired for the summer when most of the billfishing occurs. The number of samplers has varied from 4 to 10, at least 7 are involved in the survey except 1981 and 1983 when there were 10 and 8 samplers, respectively, and in 1973 when there were 4. The samplers are stationed at major billfishing ports in the northern Gulf of Mexico from Texas to Florida. Initially sampling ports corresponded with the location of the fishing clubs that responded to the original survey request: Port Aransas (Texas), South Pass (Louisiana), Pensacola, Destin, and Panama City, (Florida). Subsequently South Padre Isle (Texas), Grand Isle (Louisiana) were added (Figure 1). During the interviews the samplers fill out a logsheet with 20 fields of information which are subsequently entered on the computer (Appendix 2).

This survey interviews recreational anglers at tournaments or docks. Tournaments are organized events held within a specified period (usually 2 to 4 days), regulated by a board of directors who establish rules of conduct. Dock sampling is non-tournament recreation fishing where duration of effort and time of year are not regulated. The samplers randomly sample at dock sites, tournaments, and big game fishing clubs. Tournament sampled effort expanded every year reaching its peak in 1983, whereas dock sampled effort declined slightly over the 21-year study (Figure 2A). Total fishing effort sampled expanded from 8,334 trolling hours in 1973 to 31,604 trolling hours in 1978 (Figure 2B), with peak years 1981 (34,840 trolling hours) and 1983 (34,602 trolling hours) (Table 1). Data from surveys conducted by the Fish and Wildlife Service and the Bureau of Census indicate a substantial increase has occurred in overall recreational fishing effort. Biggame fishing effort has undoubtedly increased during the survey; however, this survey was not designed to estimate total effort or total catch. (Prince et al. 1990)

Our primary index of fishing success is hooked-per-unit-effort (HPUE), expressed as the number of billfish hooked divided by the number of hours trolling by each vessel. A hooked billfish is one that is boated, released, tagged and released, or lost. Beardsley and Conser (1981) justify using HPUE as a valid measure of fishing success, and Farber (1991) used HPUE in modeling the recreational billfish fishery. Both support the use of this statistic as an index of relative abundance for billfish in the Gulf of Mexico.

4. RESULTS

4.1 Relative Abundance

A linear regression (r^2) of annual average HPUE indicates a general decline in catch rates for white marlin, and sailfish (Figure 3B and 3C, respectively). The blue marlin HPUE in the northern Gulf of Mexico has remained most constant of the three species with a range of 0.012 fish/hour trolling from a maximum of 0.033 in 1979 and 1981 to a minimum of 0.021 in 1978, 1990 and 1991 (Figure 3A). The r^2 coincides exactly with the 21-year average of 0.026 fish/hour trolling (Figure 3A line separation in the graph is for visual emphasis).

Blue marlin is the target species in tournament fishing therefore a gear bias has to be considered. There has been significant changes in bait and technique since the late 1970's; the predominate fishing technique changed from natural bait and slower trolling speeds to artificial bait and faster trolling speeds. This change would bias sailfish HPUE most since they are caught more in-shore at slower trolling speed with smaller lures than the larger marlins (Figure 3C). White marlin HPUE would be less affected by the changes in gear because they feed in the same environment as the blue marlin.

Other factors besides changes in recreational fishing methods that influence the survey results such as: 1) fluxuation in sampling coverage; 2) environmental changes e.g., water temperature, current patterns, hurricanes; 3) abundance and distribution of food; and 4) commercial longline activity, are not addressed in this study. This list of factors affecting the statistical outcome is representative but not exhaustive.

Spearfish are rarely caught by the billfish fishery in the northern Gulf of Mexico, therefore the numbers are so low they are not included in the discussion. Table 1 gives the actual number of trolling hours and number of fish sampled.

4.2 Boated vs. Released; Weight Composition; Sex Information

Overall boated (killed) billfish has decreased from 90% in the late 70's to under 30% in 1991 (Figure 4). Blue marlin are released (74% in 1991) more often than white marlin (67% in 1991) or sailfish (52% in 1991).

Weights are recorded in pounds and converted to kilograms, length is measured in centimeters. Weight by sex for each of the three species are summarized in Figure 5. The changes in fishermen's attitudes concerning catch and release, and changes in tournament and federal regulations on minimum capture size, have affected the results of the survey on weights of landed fish (Prince et al 1990).

Blue Marlin

The largest male blue marlin in the 21-year survey weighed 256.3 kg and was landed in 1972. The largest female blue marlin in the 21-year survey weighed 462.0 kg and was landed in 1977. There have been two years that the smallest blue marlin of the year was a female (1971 and 1985) but never a year that the female average was not at least 24.4 kg larger than male average, with a yearly maximum average of 69.0 kg larger than male's (Table 2).

In 1988 when size regulations were enacted in the U.S. under the U.S. Fishery Management Plan for Atlantic Billfishes (Federal Register, 1988) the sex ratio was 1:8.66 in 1991 it was 1:17.0 favoring females (Table 2). The sex ratio in the northern Gulf of Mexico historically favors females but since enactment of minimum size regulations the ratio of female blue marlin boated has greatly increased. Before size regulation, the sampled sex ratio for blue marlin had varied from a low of 1:1.48 (M:F) in 1972, to a high of 1:4.82 in 1982 (Table 2).

White Marlin

The largest male white marlin in the 21-year survey weighed 40.8 kg landed in 1977. The largest female white marlin in the 21-year survey weighed 51.4 kg landed in 1978. The only year the male yearly average exceeded the female average (by 1.1 kg) was 1990 when there were only 8 males weighed the largest being 36.1 kg and the smallest 25.8 kg. Prior to 1988 regulations female averages ranged from a maximum of 4.5 kg (in 1978) to a minimum of 2.7 kg (in 1987) above male averages. Since the billfish FMP weight regulation in 1988 the female average has never exceeded 0.6 kg over the male average. (Table 3)

White marlin and sailfish sex ratios have not significantly changed since 1988. However, catch levels were low in those years and the size difference between thr sexes is not as great as in the blue marlin. White marlin M:F sex ratio range from a low of 1:1.5 in 1979 to a high of 1:3.6 in 1986 (Table 3).

Sailfish

The largest male sailfish in the 21-year survey weighed 38.1 kg landed in 1978. The largest female sailfish in the 21-year survey weighed 43.1 kg landed 1972. In 1985, the male average exceeded the female average by 3.1 kg. The largest male was not of exceptional size at 29.0 kg (with only 4 weighed), with the smallest 21.1 kg. In 1973 and 1974 (both low catch years) the male average exceeded the female weight average by 0.3 kg and 1.2 kg, respectively (Table 4). Catches (both boated and released) of sailfish have been at an all time low since 1986.

Sailfish M:F sex ratio range from a low of 1:0.92 (favors males) in 1982 to a high of 1:10 in 1985 with 4 males recorded (Table 4).

5. CONCLUSION

Consistent methodology and relatively consistent sampling effort has produced a 21-year database of reliable recreational billfishing catch/effort. The general trend in HPUE analyzed by species indicates downward trends in white marlin and sailfish. The changes in baits and fishing techniques and the targeting of blue marlin may contribute to the appearant downward trends of relative abundance in white marlin and sailfish however, these issues do not totally account for the decline. The affect of the billfish FMP size regulation on the M:F sex ratio significantly changed to favor the female catch (17:1 in 1991) in blue marlin. In basing management strategy on size effectively targets the larger blue marlin females. White marlin and sailfish sex ratios did not significantly change since the size regulations. Blue marlin male yearly weight averages have been increasing since 1987. However, both male and female catch rates have gone down significantly since the 1988 size regulations. Sailfish catches, down since 1986, show no weight or sex ratio trend. In 1990, the highest release year for sailfish, only 51% of sailfish catches were released compared to 75% of the white marlin and 70% of the blue marlin in the same year making the sailfish the least released billfish.

6. LITERATURE CITED

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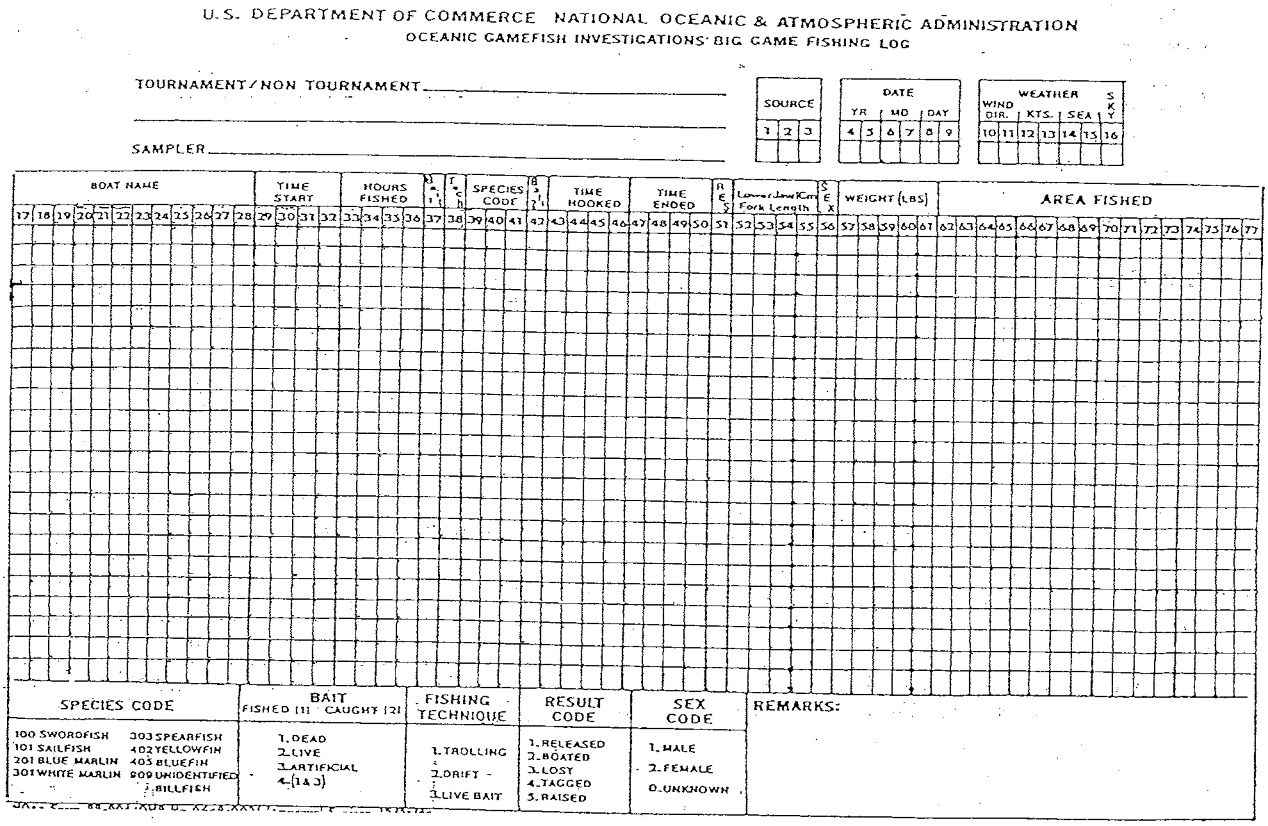
APPENDIX 1

DATA SHEET DESCRIPTION: data fields in order of appearance are:

1. Source 3-digit code which distinguishes location sampling was done and if it was a tournament;
2. Date 6-digit YY/MM/DD;
3. Weather and sea conditions 7-digits (2-wind direction, 2-wind speed, 2-height of seas, 1-per cent of cloud cover);
4. Boat name 20-character;
5. Start time 4-digit HH:MM;
6. Number of hours fished 4-digit HH:MM;
7. Bait1 used 1-digit code 1=dead, 2=live, 3=artificial 4=combination 1 and 3;
8. Technique 1-digit code 1=troll, 2=driftfish, 3=livebait;
9. Species of billfish 3-digit code, 101=sailfish, 201=blue marlin, 301=white marlin, 100=swordfish, 303=spearfish, 402=yellowfin tuna, (if none encountered go to the areas fished);
10. Bait2 used 1-digit code: same as bait1 in case of combination usage it identifies the bait that was taken;
11. Time of hook-up 4-digit HH:MM;
12. Time of conclusion of hook-up 4-digit HH:MM: fight time is deducted from the effort for net fishing hours;
13. Result of encounter 1-digit: 1=lost, 2=boated, 3=hooked and lost, 4=tagged and released, 5=raised not hooked, (if none boated go to areas fished);
14. Length in centimeters 4-digit with 1-decimal place;
15. Sex 1-digit: 1=M, 2=F;
16. Weight in pounds 5-digit with 1-decimal place (converted to kg for this paper);
17. 18. 19. 20. areas fished 4-digits each. A grid is drawn on a chart at 10' intervals, each square has a numeric code extracted from degrees and minutes latitude and longitude.

APPENDIX 2. Example of logsheet onto which information provided by fishermen is recorded.



U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION
OCEANIC GAMEFISH INVESTIGATIONS' BIG GAME FISHING LOG

TOURNAMENT/NON TOURNAMENT ____________

SAMPLER ____________

SOURCE			DATE						WEATHER						
			YR		MO		DAY		WIND DIR.		KTS.		SEA		SKY
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

BOAT NAME	TIME START	HOURS FISHED	Bait 1	Tech	SPECIES CODE	Bait 2	TIME HOOKED	TIME ENDED	RES	Lower Jaw/Cm Fork Length	SEX	WEIGHT (LBS)	AREA FISHED
17 18 19 20 21 22 23 24 25 26 27 28	29 30 31 32	33 34 35 36	37	38	39 40 41	42	43 44 45 46	47 48 49 50	51	52 53 54 55	56	57 58 59 60 61	62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77

SPECIES CODE	BAIT FISHED (1) CAUGHT (2)	FISHING TECHNIQUE	RESULT CODE	SEX CODE	REMARKS:
100 SWORDFISH 101 SAILFISH 201 BLUE MARLIN 301 WHITE MARLIN 303 SPEARFISH 402 YELLOWFIN 403 BLUEFIN 909 UNIDENTIFIED BILLFISH	1. DEAD 2. LIVE 3. ARTIFICIAL 4. (1 & 3)	1. TROLLING 2. DRIFT 3. LIVE BAIT	1. RELEASED 2. BOATED 3. LOST 4. TAGGED 5. RAISED	1. MALE 2. FEMALE 0. UNKNOWN	

Table 1. Trolling effort and numbers of billfishes reported as boated (Boat) or released (Rel.) in the northern Gulf of Mexico, 1971-1991.

Year	Hours trolling	Blue marlin		White marlin		Sailfish		Spearfish		All species	
		Boat	Rel.	Boat	Rel.	Boat	Rel.	Boat	Rel.	Boat	Rel.
71	11,259	92	7	229	76	244	88	0	0	565	171
72	14,787	127	2	267	130	327	97	0	0	721	229
73	8,334	106	3	175	55	89	26	1	0	371	84
74	10,545	152	10	273	66	119	44	1	0	545	120
75	14,675	128	5	399	187	277	154	2	0	806	346
76	17,760	160	19	353	150	311	246	1	0	825	415
77	25,273	205	17	414	71	415	47	3	0	1,037	135
78	31,604	255	16	416	84	173	14	6	2	850	116
79	23,967	286	19	485	99	120	14	2	1	893	133
80	27,058	261	30	873	176	186	16	0	0	1,320	222
81	34,840	440	77	558	234	326	47	4	0	1,328	358
82	30,692	300	67	592	364	156	34	1	0	1,049	465
83	34,602	308	93	552	424	249	57	0	0	1,109	574
84	30,575	347	81	538	325	188	58	2	0	1,075	464
85	29,110	341	87	302	155	119	27	1	0	763	269
86	24,905	271	111	252	168	104	36	1	0	628	315
87	25,951	213	170	231	214	63	10	0	0	507	394
88	25,675	176	187	167	195	104	70	2	2	449	454
89	21,113	104	183	33	86	43	12	1	0	181	281
90	24,603	92	174	48	148	29	34	3	0	172	356
91	23,798	68	195	45	97	37	41	1	3	151	336

Table 2. Weight in kg by sex and number of blue marlin sampled in Gulf of Mexico, 1971-1991. LG=largest, SM=smallest, AV=average. Unsexed are boated fish with no biological data. Ratio is how many females were caught to one male.

Blue Marlin

YEAR	MALES				FEMALES				RATIO	UN-SEXED
	#FISH	LG	SM	AV	#FISH	LG	SM	AV	M:F	#FISH
71	18	174.4	28.1	78.2	61	246.3	20.9	117.6	1:3.4	13
72	35	256.3	34.0	95.8	52	246.3	47.6	126.6	1:1.5	40
73	27	122.2	24.0	71.9	58	252.7	25.4	132.1	1:2.1	21
74	21	118.0	37.2	64.4	48	259.5	44.0	126.1	1:2.3	83
75	22	130.2	54.0	84.8	78	254.5	64.1	132.7	1:3.5	28
79	33	134.3	21.5	80.3	83	277.6	35.7	133.8	1:2.5	44
77	28	178.0	27.2	88.2	120	462.0	26.1	136.0	1:4.3	57
78	32	183.8	27.1	72.5	143	317.1	27.1	132.2	1:4.5	80
79	39	173.0	20.4	77.2	179	302.0	25.9	137.6	1:4.6	68
80	38	124.6	30.4	73.5	130	334.8	50.4	143.3	1:3.4	93
81	47	147.2	27.7	72.7	198	308.0	29.7	131.6	1:4.2	197
82	28	125.0	26.8	76.5	135	327.5	34.0	127.0	1:4.8	138
83	54	131.5	26.3	74.8	163	300.7	26.4	132.9	1:3.0	91
84	41	142.0	23.6	65.0	173	334.2	24.9	134.0	1:4.2	133
85	44	152.0	34.2	70.4	196	444.8	29.9	124.6	1:4.5	101
86	42	192.6	31.1	74.0	120	328.9	34.4	130.1	1:2.9	109
87	26	144.9	31.8	82.1	107	309.4	37.0	148.9	1:4.1	82
88	12	128.5	37.2	86.2	104	331.5	41.8	130.5	1:8.7	62
89	8	212.8	74.2	110.5	60	353.5	73.7	149.6	1:7.5	38
90	7	155.6	63.9	113.4	59	270.3	92.1	151.5	1:8.4	26
91	3	93.2	78.7	87.6	51	280.3	84.8	112.0	1:17.0	17

Table 3. Weight in kg by sex and number of white marlin sampled in Gulf of Mexico, 1971-1991. LG=largest, SM=smallest, AV=average. Unsexed are boated fish with no biological data. Ratio is how many females were caught to one male.

White Marlin

YEAR	MALES				FEMALES				RATIO	UN-SEXED
	#FISH	LG	SM	AV	#FISH	LG	SM	AV	M:F	#FISH
71	38	31.3	14.1	21.0	136	38.2	18.1	25.1	1:3.6	55
72	62	32.9	14.1	21.6	93	39.9	15.0	24.8	1:1.5	93
73	27	38.6	17.7	23.2	55	46.9	14.7	27.2	1:2.0	93
74	28	31.5	17.7	22.9	74	39.9	16.1	26.9	1:2.6	171
75	74	32.9	16.8	21.7	152	39.9	18.3	25.9	1:2.1	173
76	74	31.1	15.4	21.1	153	48.1	15.1	25.2	1:2.1	126
77	119	40.8	14.1	21.8	186	46.4	16.3	25.0	1:1.6	109
78	75	34.4	16.7	22.3	140	51.4	12.4	26.8	1:1.9	201
79	121	33.1	15.6	22.4	182	43.1	15.2	24.6	1:1.5	183
80	129	33.9	9.4	21.1	251	40.6	14.5	24.9	1:1.9	493
81	77	35.9	15.5	21.4	212	37.4	14.3	23.6	1:2.8	270
82	63	30.1	15.0	21.0	202	39.3	15.5	23.9	1:3.2	327
83	108	35.8	14.2	21.4	229	42.3	12.2	24.6	1:2.1	215
84	101	32.7	14.1	20.7	214	49.8	12.7	24.1	1:2.1	223
85	54	35.6	16.8	22.5	164	45.8	15.1	25.0	1:3.0	84
86	30	26.5	17.8	21.9	108	36.7	13.8	24.2	1:3.6	114
87	32	30.1	15.6	22.2	69	45.4	17.4	24.9	1:2.2	130
88	23	27.2	18.7	22.3	68	40.4	16.8	24.2	1:3.0	77
89	10	26.0	20.8	23.8	17	31.8	19.1	24.4	1:1.7	6
90	8	36.1	19.5	25.8	25	30.1	21.3	24.7	1:3.1	15
91	11	30.4	19.0	23.6	21	40.9	18.0	24.2	1:1.9	13

Table 4. Weight in kg by sex and number of sailfish sampled in Gulf of Mexico, 1971-1991. LG=largest, SM=smallest, AV=average. Unsexed are boated fish with no biological data. Ratio is how many females were caught to one male.

Sailfish

YEAR	MALES				FEMALES				RATIO	UN-SEXED
	#FISH	LG	SM	AV	#FISH	LG	SM	AV	M:F	#FISH
71	64	24.5	2.5	15.6	156	30.4	2.7	18.2	1:2.4	24
72	77	26.8	7.9	17.9	115	43.1	11.3	21.2	1:1.5	135
73	11	24.7	2.3	15.2	28	32.1	.9	14.9	1:2.5	50
74	7	23.1	15.4	21.1	18	24.5	14.5	19.9	1:2.6	94
75	60	27.2	12.8	19.1	87	38.2	12.7	21.5	1:1.5	130
76	80	29.2	3.6	18.5	91	38.0	11.6	20.7	1:1.1	140
77	106	30.1	2.5	17.5	177	38.3	12.7	19.9	1:1.7	132
78	27	38.1	3.4	18.4	71	34.0	7.5	22.3	1:2.6	75
79	24	28.1	12.2	18.6	60	32.4	13.4	21.9	1:2.5	37
80	50	31.0	12.2	18.8	48	36.3	10.0	20.6	1:1.0	88
81	70	28.6	9.3	18.1	81	33.1	3.2	19.7	1:1.2	188
82	39	25.2	12.7	19.0	36	33.6	14.5	21.9	1:0.9	81
83	48	23.4	10.0	17.4	59	32.7	11.1	20.7	1:1.2	143
84	45	23.3	12.0	17.2	43	34.2	14.0	20.5	1:1.0	101
85	4	29.0	21.1	24.4	40	33.5	15.0	21.3	1:10.0	75
86	3	23.6	16.6	20.0	20	35.2	14.3	20.5	1:6.7	81
87	8	24.9	12.5	19.1	15	34.5	11.3	21.2	1:1.9	40
88	11	23.4	10.7	17.3	31	34.7	12.2	19.5	1:2.8	64
89	3	17.5	10.9	14.2	3	24.9	14.9	21.3	1:1.0	37
90	5	18.1	17.1	17.6	11	27.2	14.9	20.1	1:2.2	13
91	13	23.6	14.4	18.5	14	27.0	15.8	21.2	1:1.1	10

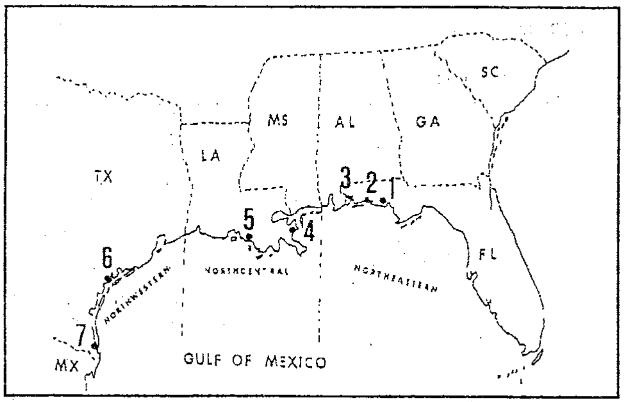


Fig. 1. Primary sampling ports of the Recreational Billfishing Survey in the northern Gulf of Mexico.

1. Panama City, FL 2. Destin, FL 3. Pensacola, FL
4. South Pass, LA 5. Grand Isle, LA
6. Port Aransas, TX 7. Padre Island, TX

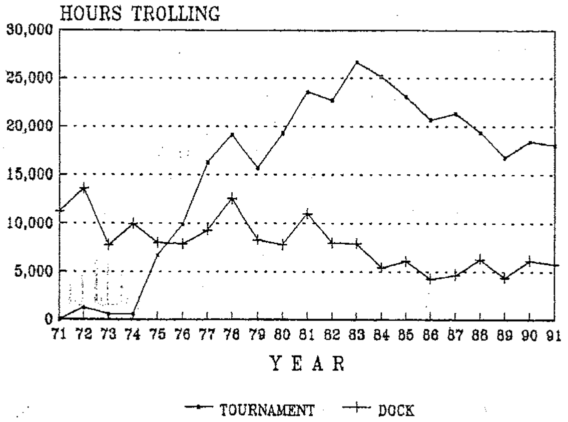


Fig. 2A. Comparison of dock sampled vs. tournament sampled trolling effort in northern Gulf of Mexico, 1971-1991.

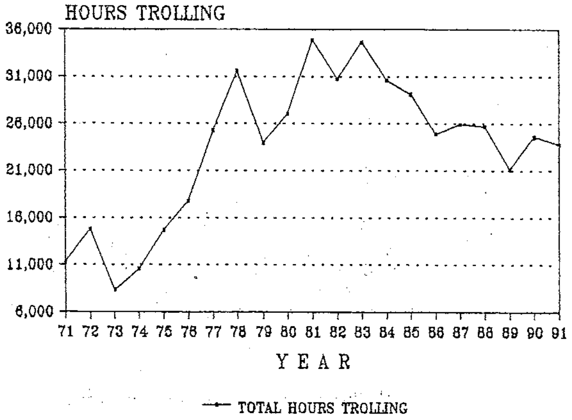


Fig. 2B. Number of hours trolling for billfishes recorded in the northern Gulf of Mexico, 1971-1991.

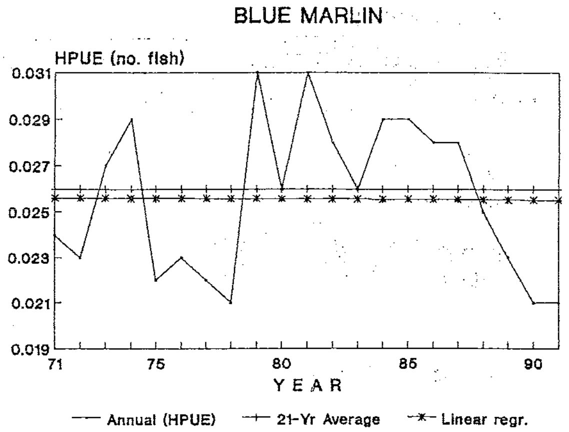


Fig. 3A. Blue marlin HPUE (number of fish hooked-per-hour-trolling), 21-year average 0.026 (hatched line) and r^2 (starred line separation visual only).

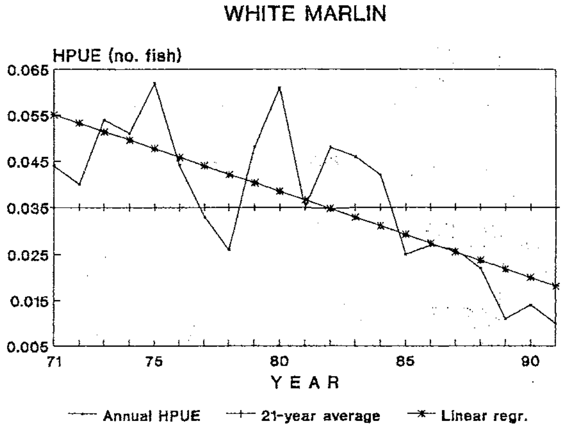


Fig. 3B. White marlin HPUE (number of fish hooked-per-hour-trolling), 21-year average 0.035 (hatched line) and r^2 (starred line).

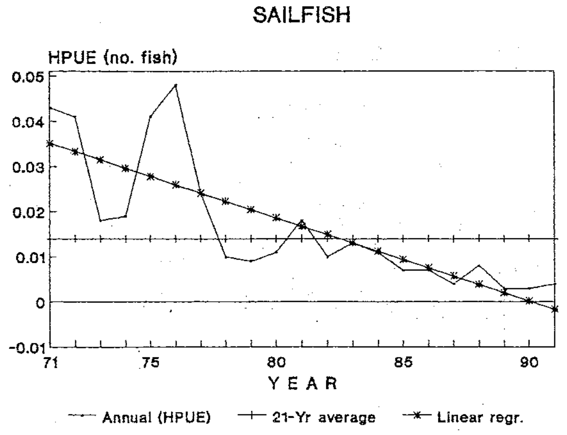


Fig. 3C. Sailfish HPUE (number of fish hooked-per-hour-trolling), 21-year average 0.014 (hatched line) and r^2 (starred line).

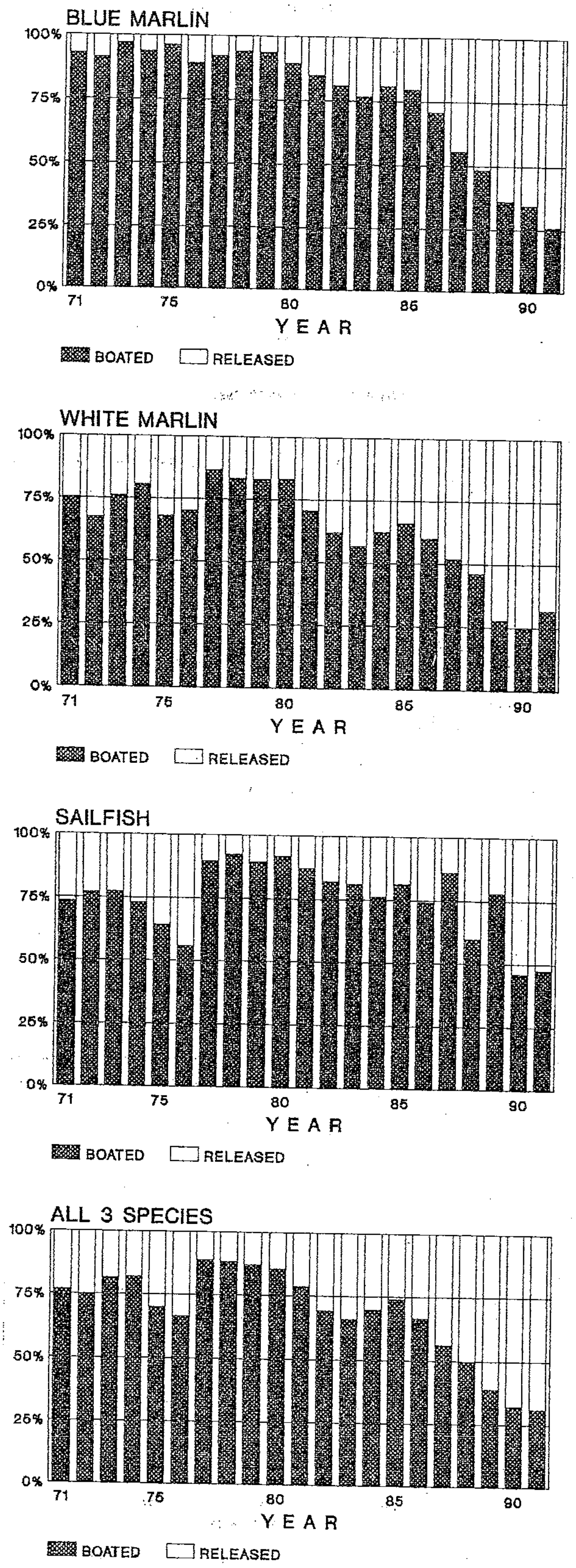


Fig. 4. Percent of billfishes boated vs. released by species and 3 species combined, in the northern Gulf of Mexico, 1971-1991.

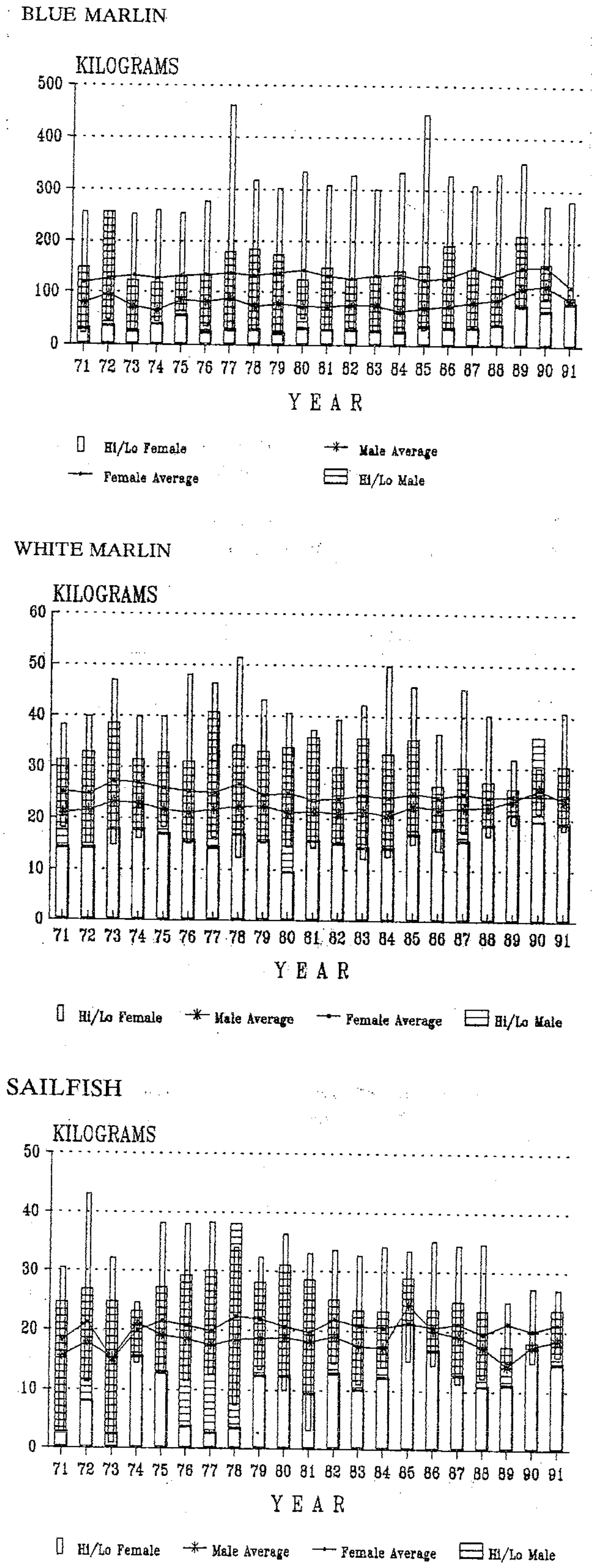


Fig. 5. Yearly average in kilograms (horizontal lines) by sex, high/low range (vertical boxes, female plain), in northern Gulf of Mexico, 1971-1991.