

DESCRIPTIVE ANALYSIS OF THE ARTISANAL FISHERY OF BILLFISH IN THE CENTRAL COAST OF VENEZUELA

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ABSTRACT

Billfish are captured in Venezuela as target species by artisanal and sport fishermen, and as a by-catch during operations of industrial tuna and shark long liners. The targeting of billfish by artisanal fishermen is a recent activity. The artisanal fishery is mainly conducted by two communities, one located in Playa Verde, in the central venezuelan coast, and another located in Juan Griego, northern Margarita Island. The artisanal fleet at Playa Verde has 28 wood vessels, 8 m long operating with two outboard engines 48 to 75 HP. Approximately, 12 daily campaigns are made every month, from 15:00-16:00 to 06:00 to 08:00. The boats are operated by three fishermen. The fishing gear are gillnets, 500 to 1500 m long and 11 to 21 m in depth, made with polyamide net with mesh size 7.5 - 12,5 cm, stretched. The fishing ground during the last 4 years has been the Placer of La Guaira, located 14 - 18 Km North of La Guaira. Billfish resources are exploited during the whole year, with greater landings between april and november. Other species captured are: tunas (yellow fin, big eye, albacore), sharks, mackerel, swordfish, wahoo and dolfin fish. Billfish captures had varied from 38 to 179 t/year between 1988-92. Until 1988, the most abundant group in the landings were sharks; since then, billfish, tuna and mackerel became the most important groups in the landings. The change in composition is probably related to the different fishing ground exploited in later years, from the oceanic islands in the southern Caribbean Sea to the Placer of La Guaira, near shore. A comparison of the billfish captured by artisanal, sport and industrial long line vessels, indicated that sailfish did not differ significantly in size among these three fisheries. Blue marlin from artisanal and sport fisheries were similar in size, and larger than those capture by long line vessels. White marlin differed significantly among all three fisheries, being larger those from the sport vessels, and smaller the ones from the long line vessels. Sailfish is more abundant in the venezuelan coast around March-April and from June to November. Blue marlin is found in greater abundance during the first semester of the year, while white marlin occurs mainly during the second semester. Swordfish has a more irregular abundance pattern, with a greater catch during the first semester. Changes in governmental regulations have induced great fluctuations in the artisanal effort in the area.

RESUME

Les istiophoridés sont capturés au Venezuela en tant qu'espèce cible par les pêcheurs artisanaux et sportifs, et en tant que prise accessoire au cours d'opérations de palangiers industriels pêchant les thonidés et les requins. La pêche artisanale est surtout le fait de deux communautés, l'une située à Playa Verde, dans la partie centrale de la côte vénézuélienne, et l'autre à Juan Griego, au nord de l'île Margarita. La flottille artisanale de Playa Verde dispose de 28 bateaux en bois, de huit m de longueur, qui fonctionnent avec deux moteurs hors-bord de 48 à 75 HP. Douze sorties quotiennes environ sont effectuées chaque mois, de 15h-16h à 6h-8h. Les bateaux sont manoeuvrés par trois pêcheurs. Les engins se composent de filets maillants de polyamide, de 500 à 1.500 m de long et de 11 à 21 m de profondeur, avec une maille de 7,5 à 12,5 cm (étirée). Depuis quatre ans, la zone de pêche est Placer de La Guaira, situé à 14-18 km au nord de La Guaira. Les ressources en

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istiophoridés sont exploitées toute l'année, les plus forts débarquements étant effectués d'avril à novembre. Les autres espèces capturées sont: thonidés (albacore, thon obèse, germon), requins, *Scomberomonus spp.*, espadon, thazard bâtard et coryphènes. Les prises d'istiophoridés ont varié de 38 TM à 179 TM/an de 1988 à 1992. Jusqu'en 1988, les requins constituaient le groupe le plus abondant dans les débarquements; depuis lors, les istiophoridés, thonidés et *Scomberomonus spp.* sont devenus les groupes prédominants. Le changement de composition est probablement lié aux différents lieux de pêche exploités ces dernières années, des îles océaniques au sud de la mer des Antilles à Placer de La Guaira sur la côte. Une comparaison des istiophoridés capturés par les palangriers artisanaux, sportifs et industriels indique que la taille du voilier ne diffère pas sensiblement entre ces trois pêcheries. Le makaire bleu des pêcheries artisanales et sportives montrait une taille similaire, qui dépassait celle des poissons pris par les palangriers. Le makaire blanc différait sensiblement entre les trois pêcheries, les plus grands étant capturés par la pêche sportive, et les plus petits par les palangriers. Le voilier est plus abondant le long des côtes vénézuéliennes en mars-avril et de juin à novembre. Le makaire bleu est plus abondant pendant le premier semestre, alors que le makaire blanc est surtout présent pendant le deuxième semestre. Le mode d'abondance de l'espadon est plus irrégulier, les prises les plus fortes étant effectuées pendant le premier semestre. Les modifications des réglementations gouvernementales ont entraîné de fortes fluctuations de l'effort artisanal dans cette région.

RESUMEN

En Venezuela, el marlín es especie-objetivo para las pesquerías artesanales y deportivas y captura fortuita en las operaciones de los palangreros industriales de pesca de túnidos y tiburones. La búsqueda de marlines por parte de las pesquerías artesanales es reciente. Esta pesquería artesanal la desarrollan principalmente dos comunidades, una localizada en Playa Verde, en la costa central de Venezuela y otra en Juan Griego, al norte de Isla Margarita. La flota artesanal de Playa Verde cuenta con 28 embarcaciones de madera de 8 m de largo, que operan con dos motores fuera-borda de 48 a 75 HP. Cada mes se realizan aproximadamente 12 campañas diarias, de 15:00-16:00 a 06:00 a 08:00. La tripulación de cada barco está compuesta por tres pescadores. El arte empleado es la red de enmalle, entre 500 y 1500 m de longitud, y de 11 a 21 m de profundidad, de poliamida, con una malla entre 7.5 y 12.5 cm, una vez estirada. El caladero de los últimos cuatro años ha sido el Placer de La Guaira, situado a 14-18 km al norte de La Guaira. El marlin se pesca durante todo el año, y los desembarques mas importantes tienen lugar entre abril y noviembre. Otras especies capturadas son: túnidos (rabil patudo, atún blanco) tiburones, caritas, pez espada, peto y dorado. La captura de marlín ha variado entre 38 y 179 t/año en el período 1988-92. Hasta el año 1988, el grupo mas abundante en los desembarques eran los tiburones; a partir de entonces, los marlines, túnidos y caritas cobraron mayor importancia en los desembarques. El cambio en la composición está probablemente relacionado con los diferentes caladeros explotados en años posteriores, desde las islas oceánicas en el Caribe sur hasta el Placer de La Guaira, cerca de la costa. Comparando los marlines capturados por los palangreros artesanales, deportivos e industriales, se observó que el pez vela no difería mucho en tamaño en estas tres pesquerías. La aguja azul de las pesquerías artesanal y deportiva era similar en tamaño, y mayor que la capturada por los palangreros. La aguja blanca eran muy diferente en las tres pesquerías, siendo mayor en el caso de los barcos deportivos y mas pequeña en el caso de los palangreros. El pez vela es mas abundante en la costa de Venezuela alrededor de marzo-abril y de junio a noviembre. La aguja azul abunda mas durante el primer semestre del año, mientras que la aguja blanca aparece sobre todo en el segundo semestre. El pez espada presenta una abundancia mas irregular, con mayor captura en el curso del primer semestre. Los cambios en las regulaciones gubernamentales han inducido mayores fluctuaciones en el esfuerzo artesanal en la zona.

1. INTRODUCTION

In Venezuela the capture of billfish started with sport fisheries. This is one of the oldest organized fishery in the country, in which most fishermen and vessels are associated in different clubs and marinas (Machado & Jaen, 1982). This fishery targets species of the families Istiophoridae and Xiphiidae. The latter family includes only the sword fish, *Xiphias gladius*, while the Istiophoridae includes four species, the sailfish, *Istiophorus albicans*, the white marlin, *Tetrapturus albidus*, the spear fish, *T. pflugery*, and the blue marlin, *Makaira nigricans* (Cervigón, 1966).

Until recently (approx. 1987), there was not a commercial fishery in Venezuela targeting Istiophoridae, since the landings were incidental by-catch from the operation of tuna or shark and king mackerel gillnetter vessels, and, more recently, swordfish long-line boats. The increase in the price of billfish meat induced the orientation of the effort towards Istiophoridae species (Mihara, 1971; Ramos, 1976; Novoa & Ramos, 1976; Eslava de G., 1990; González & Gaertner, 1992). This new orientation of the effort was achieved through a change in the fishing grounds in several artisanal fishery communities in the country (Playa Verde, Punto Fijo and Juan Griego), where the original target species had been sharks and king mackerel.

The billfish artisanal fishery in Playa Verde (Catia La Mar, in the central venezuelan coast), is one of the most important in the country. In its short period of time since it originated, the billfish landings have undergone severe changes. One of the major reasons for the latter has been the prohibition established in 1990 by the government to landings of any billfish in an area 50 miles around La Guaira (Venezuela-MAC, 1990). The goal of this measure was to protect the billfish resources used by the sport fishermen near the Placer of La Guaira. Clandestine fishing took place, any way, but landings were very much reduced. Since October 1991, a new resolution from the Ministry of Agriculture (Venezuela-MAC, 1991) allowed again the fishing of billfish with gillnets, operated from boats not longer than 14 m. The control of the landings has been improved since this time, with the permanent monitoring enhanced billfish program in the beaches of Playa Verde.

This report describes the characteristics of the artisanal fishery of billfish in Playa Verde, including the fishermen community, the gear used and the resources exploited in the area.

2. MATERIALS AND METHODS

2.1 Source of data.

The data on catch (Kg) and effort (N° trips) were obtained from the following sources:

- a) Monthly reports of landings by species, vessels in operation and number of trips, provided by the fishermen to the Fisheries Office of the Min. Agriculture in La Guaira (mainly through the community leader).
- b) Yearly reports about the number of boats in the artisanal fleet, their structural characteristics and type of fishing gear, made by the Fisheries Office in La Guaira.
- c) Daily samplings of the catch and effort, made at the beach according to an intensive monitoring plan started for this ICCAT program in October 1991 by MAC and FONAIAP samplers.

2.2 Biological data:

The data related to weight (whole or dressed) and length (LJFL, PAL, PFL) of the fish, were obtained daily by the project samplers in the beach.

2.3 Processing of the data.

The composition of the catch was made based on all information available on the fishery, from January 1988 to June 1992. Until 1990 all three species of billfish were lumped together in the field

reports. The analysis on composition of Istiophoridae in the catch was based on data from January 1991 to June 1992, as well as the seasonality and apparent abundance of the three species of Istiophoridae. Data on size structure for all species were analyzed based on the lower jaw - fork length of the animals. Conversion equations for other length parameters are provided in Appendix 1. Type II regressions were used in all cases (Sokal & Rohlf, 1981).

The seasonality of the apparent abundance of billfish in the area was based on the analysis of the c.p.u.e. for each species, standardizing the monthly data by subtracting the mean and dividing by the standard deviation. Size structure of the species was compared using the Kolmogorov-Smirnov two sample test (Sokal & Rohlf, 1981).

2.4 Operation of the fleet.

The information about the operation of the fleet, fishing ground, gear use, and handling of the catch, was based on surveys made by the project personnel in the community. Information on commercialization of the catch was provided by the community leader who is in charge of the sales.

3. RESULTS AND DISCUSSION

3.1 Fishing grounds.

The community of Playa Verde is located in the central coast of Venezuela, at North of Catia La Mar, Federal District, near Caracas (Fig. 1). During the years earlier than 1989, the fishing was performed near oceanic islands in the southern Caribbean Sea (Las Aves archipelago). Since then, the fishing has taken place near Placer of La Guaira, located about 20 Km North of the harbor of La Guaira. This area is known for the great abundance of billfish during the entire year.

3.2 Fleet and fishing gear.

By the end of 1991, there were 28 vessels in the artisanal fleet of Playa Verde. The boats are made with wood, 8 m in length, propelled by two outboard engines (3 boat had engines of 48 HP; 6 had 60-65 HP, and 19 had 75 HP). There are three operators on board of each vessel.

The fishing gear is a gillnet, 200 - 1500 m in length, 7-14 m in height, made with polyamide mesh of 15 - 25 cm (6 - 10 in), stretched. Between November and February, the fishermen use a different gillnet, with smaller mesh (4-6 in), targeting small scombrid fish which are abundant during this time of the year.

The trips have a duration of 16 - 18 h, starting at 15:00- 16:00 and ending about 07:00 - 09:00 of the following day. Nets are set in the surface and are allowed to drift over night, being retrieved starting at 06:00. The fish are landed dressed, and fresh. No conservation means are available on board.

Each vessel makes 8 - 12 trips per month, any day except during the full moon. Capture decreases during this lunar phase due probably to the fact that excess light allows the fish to see the gear, avoiding it.

3.3 Effort, catch and C.P.U.E.

The number of trips in this fishery has changed widely, between 695 trips per year to 2142 (an increase of 200 %; Table 1). This variation is probably related to irregular situations confronted in the fishery. Before 1989, fishermen made campaigns in different fishing grounds, targeting resources other than billfish. In 1989, when the greatest effort was applied upon the billfish resources, the fleet operated during the entire year in Placer of La Guaira. In 1990, the prohibition to land billfish in the central region of Venezuela, induced a reduction of the effort applied upon billfish, but the resources were still illegally captured. From October 1991 the prohibition ceased, being the fishermen allowed to land billfish, which explains the observed increment in the effort. For 1992, the number of trips will surely be larger than the one observed in the previous two years (Fig. 3)

In the period 1988-91, the total catch fluctuated between 104 and 281 t (Table 1); it is possible that for 1992 the catch reaches 300 t. The catch was integrated by 7 group of species, of which the most important groups were billfish, sharks, tuna and mackerel.

It is observed that during 1988 the most important group in the catch was sharks (46%); followed by billfish (37%) and tunas (12%). From 1989 until now, the composition changed, since the billfish became the most important group in the landings; falling sharks to a low representation in the catch (Fig. 2). This alteration in the composition was probably due to changes in the fishing grounds, by a concentration of the effort in areas closer to shore (Placer of La Guaira). Sharks are more abundant in the vicinity of oceanic islands, where the fleet operated before 1989.

In the period when the composition of the billfish catch could be independently evaluated (Jan. 91 - Jun. 92), sailfish was the most important species (52.4%), followed by the blue marlin (37.3%), the white marlin (6.5%) and the sword fish (3.8%; Fig. 4).

Monthly catch showed values between 0.3 and 6.2 t for the blue marlin; 0.14 to 1.2 t for white marlin; 0.25 to 9.2 t for sailfish, and 0.05 to 0.7 t for sword fish (Table 2). Considering the individual mean weigh for the four species of billfish in the zone (SAI 20 ± 5 Kg; WHM 22.4 ± 7.4 Kg; BUM 66.7 ± 36.4 and SWO 18.3 ± 18), these capture values would represent a monthly catch of up to 93 blue marlins, 54 white marlins, 459 sailfish and 38 sword fish. The low catch of sword fish in this fishery indicates that it is incidentally captured, since this species inhabits deeper waters while the gear used for billfish drifts in the surface.

The annual yield (c.p.u.e.) for the three billfish species combined varied between 85 and 43 Kg/trip, with the best yields during 1989 when the fleet started to concentrate operations in the Placer of La Guaira (Table 3, Fig. 5). In spite of a reduction in the effort after that year (as a consequence of the prohibition in the landings), the yield maintained the decreasing trend. It seems that there is still not a direct relationship between the effort applied upon the billfish resources and the yields, as described by Kesteven (1973) for a fishery in its early stages.

The seasonality of the billfish resources indicated that blue marlin has a greater abundance during the first semester of the year, particularly between April and May (Fig. 6). For white marlin, this period is on the second semester, with occasional moments of greater abundance between February and March (Fig. 7). The sailfish shows a longer period of abundance, in comparison with marlins; greater abundance was observed during some months at the beginning of the year (March to May), and a second period (the most important for this species) from June to November (Fig. 8). Swordfish shows an irregular abundance pattern for different years, with greater captures during the first semester (Fig. 9).

The results on seasonality support the analysis made by Gaertner *et al.* (1989) on the monthly distribution of the billfish resources in the area, using data from the sport fishery in the central venezuelan coast. Blue marlin occurs in the region, alternating with white marlin.

3.4 Size structure.

The analysis of size structure for the billfish captured in Playa Verde indicates that mean size for sailfish was 166 ± 13 cm (mean \pm SD, LJFL). The comparison of this result with the values reported for other fisheries in the zone (the sport fishery, Gaertner *et al.*, 1988; and the long line fishery, unpublished results) revealed that there is not a significant difference in the size structure of this species among them. It can be considered that the three fisheries are exploiting the same sailfish population (Table 4).

The mean size of white marlin differed significantly among the three fisheries, being the largest animals captured by the sport fishery in the area, and the smallest those capture with long lines. Mean size for blue marlin did not differ among the animals captured by the sport fishery and by the artisanal fishery. However, the blue marlin captured by the long line industrial fishery were significantly smaller than the animals captured with the other two types of gear. Swordfish did not differ in size between the artisanal and the long line fishery (Table 4).

The results on the marlins exploited with the three types of fishing gear suggests that these resources stratified according to age and depth, younger animals being located at deeper water.

The large number of sailfish available from the artisanal fishery (N= 922) allowed the comparison of the size variation in this species captured at different times of the year. The bimonthly analysis indicated that the animals captured between Sept. - Oct. are significantly smaller than those captured from Nov. to June (Table 5). This result, and the fact that this is the only species spawning in the zone (García de los Salmones *et al.*, 1989), would indicate that recruitment of sailfish occurs in a restricted time of the year, between Sept. - Oct.

4. CONCLUSIONS

The artisanal fishery of billfish in Playa Verde is one of the two commercial fishery targeting billfish in Venezuela. It is still in an early stage of development. The fishing effort has varied widely due to changes in the official regulations.

Drifting gillnets are used in this fishery, operated from wood boats with outboard engines. The fishing takes place during the entire year, concentrating the fishing effort in the Placer of La Guaira.

Billfish represented more than 35% of the landings between 1988-92. Sailfish accounted for 54.4% of the billfish landings between 1991-middle 92; blue marlin represented 38.9% and white marlin 6.7%.

Sailfish is most abundant in the venezuelan coast around March and between June to November. Blue marlin is found in greater abundance during the first semester of the year, while white marlin occurs mainly during the second semester.

Mean sizes (LJFL) were SAI 166 ± 13 cm; BUM 204 ± 28 cm; WHM 162 ± 14 and SWO 139 ± 34 cm. Size structure of the sailfish captured with lines, gillnets and long lines were similar, while blue and white marlin captured with long lines were smaller than those captured with the other types of gear. The smaller mean size in the population of sailfish between Sept.-Oct. in comparison with other times of the year, would indicate that recruitment concentrates around this period.

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Table 1. Catch composition and effort by year, for the artisanal fisheries of billfish in Playa Verde.

Species Group	1988		1989		1990		1991		1992*	
	MT	%	MT	%	MT	%	MT	%	MT	%
CATCH										
Billfish	38.1	36.5	178.9	63.7	79.1	49.8	65.2	40.2	38.1	38.2
Swordfish	0.0	0.0	2.3	0.8	1.1	0.7	2.0	1.2	1.9	1.9
Tuna	12.6	12.1	42.0	15.0	24.2	15.2	17.2	10.6	6.9	6.9
Mackerel	2.4	2.3	13.6	4.8	26.1	16.1	62.9	38.8	39.3	39.3
Sharks	47.9	45.9	37.7	13.4	22.7	14.3	12.2	7.5	10.9	10.9
Dolphin fish	2.6	2.5	5.9	2.1	5.8	3.6	2.1	1.3	2.5	2.5
Wahoo	0.8	0.8	0.4	0.1	0.5	0.3	0.4	0.2	0.1	0.1
Total	104.4	100.0	280.8	100.0	159.5	100.0	162.0	100.0	99.7	100.0
EFFORT										
No. boats	105		232		176		193		118	
No. trips	695		2142		1219		1339		808	
Fishing time (h)	10425		32130		18285		20085		12120	
Effect. time (h)	8340		25704		14628		16068		9696	

* Jan. - June

Table 2. Monthly catch (t) and effort (No. trips) for the artisanal fishery of billfish in Playa Verde, 1991-92.

Species	1991												1992						Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
CATCH																			
Blue marlin	2.04	0.43	0.30	6.20	3.00	0.50	0.80	0.50	0.30	2.20	0.90	2.00	0.60	0.20	0.80	0.20	0.02	0.10	21.09
White marlin	2.04	0.70	0.40	6.50	3.20	0.70	1.40	1.00	0.60	3.40	1.60	2.20	1.60	1.80	7.20	6.00	2.00	1.20	43.54
Sail fish	0.00	2.30	2.70	0.00	0.20	3.90	5.00	4.20	2.50	9.00	8.70	0.20	1.70	0.60	2.20	7.10	2.30	2.00	54.60
Swordfish	0.10	0.80	0.00	0.60	0.20	0.30	0.80	0.40	0.10	0.20	0.10	0.40	0.40	0.20	0.30	0.60	0.20	0.20	59.00
TOTAL	4.18	4.23	3.40	13.30	6.60	5.40	8.00	6.10	3.50	14.80	11.30	4.80	4.30	2.80	10.50	13.90	4.52	3.50	125.13
EFFORT																			
	124	78	82	116	84	0	102	109	75	189	186	214	225	93	157	151	75	104	2253

Table 3. C.P.U.E. (Kg/trip) for the artisanal fishery of billfish in Playa Verde, 1991-92.

Species	1991												1992					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Blue marlin	16.4	5.5	3.7	53.5	34.0	5.8	8.6	4.8	3.9	11.7	4.9	10.0	7.5	19.7	46.1	29.2	27.1	12.3
White marlin	0.0	4.4	1.7	3.0	3.0	3.0	5.0	4.4	5.9	6.4	4.0	0.3	2.7	2.4	5.4	1.7	0.2	1.1
Sail fish	0.0	3.0	33.0	0.0	3.0	43.8	49.5	38.7	34.0	48.6	47.0	1.2	7.5	7.4	14.0	47.0	31.6	19.3
Swordfish	1.0	1.0	0.0	6.0	1.7	0.3	0.8	0.4	1.5	1.3	0.7	1.7	1.8	2.3	2.1	3.8	2.3	2.3
Total	17.4	13.9	38.4	62.5	41.7	52.9	63.9	48.3	45.3	68.0	56.6	13.2	19.5	31.8	67.6	91.7	61.2	35.0

Table 4. Comparison of the population structure of billfish captured by artisanal, sport and longline fisheries in central Venezuela. Data on sport fisheries after Gaertner et al., 1989. Data on LL fishery are unpublished results from the authors.

Species	Fisheries	Mean	SD	N	LJFL (cm)		
					Mode	Min.	Max.
SAI	Sport	170	9	108	170	150	190
	Artis.	166	13	921	170	120	238
	LL	165	13	125	165	119	195
WHM	Sport	163	9	84	165	139	183
	Artis.	162	14	188	165	131	206
	LL	160	22	81	165	125	230
BUM	Sport	202	23	35	202	171	302
	Artis.	204	28	238	195	137	315
	LL	178	26	71	170	132	270
SWO	Artis.	139	34	84	110 *	82	274
	LL	134	33	422	110 **	52	285

* a second mode at 145 cm was also observed
 ** a second mode at 140 cm was also observed

Table 5. Comparison of the population structure of sailfish (Mean \pm SD) captured by the artisanal fleet of Playa Verde at different times of the year. Non significantly different periods are jointly marked with X's.

LJFL (cm)	PERIOD				
	SEPT. - OCT.	NOV. - DEC.	JAN. - FEB.	MAR. - APR.	MAY - JUNE
	163 \pm 14	167 \pm 10	168 \pm 13	171 \pm 11	168 \pm 11
	XXXXXXXXXXXXX	XX			

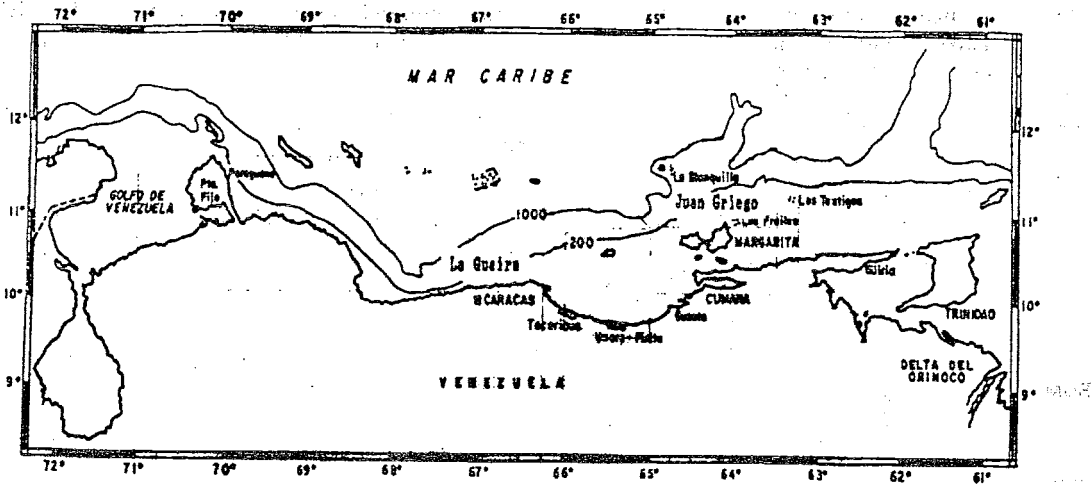


Fig. 1 Marine coasts of Venezuela, showing places where artisanal billfish fishing take place, Placer de la Guaira and Juan Griego.

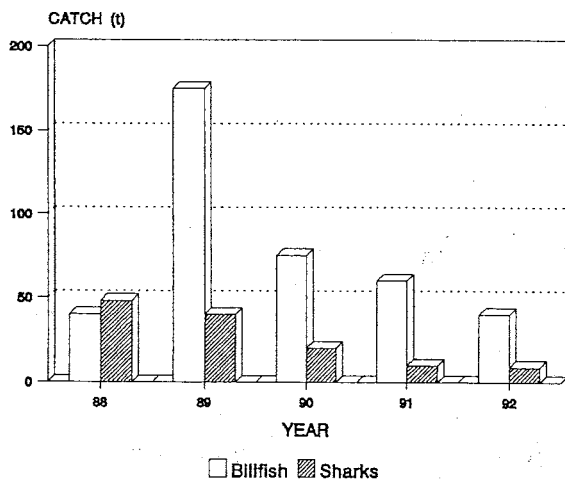


Fig. 2 Total landings of billfishes and sharks by the artisanal fishery off the central coast of Venezuela.

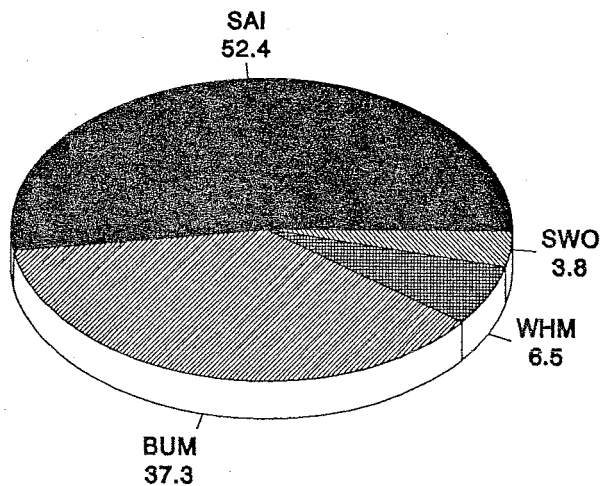


Fig. 4 Species composition of billfishes caught during January, 1991 through June, 1992.

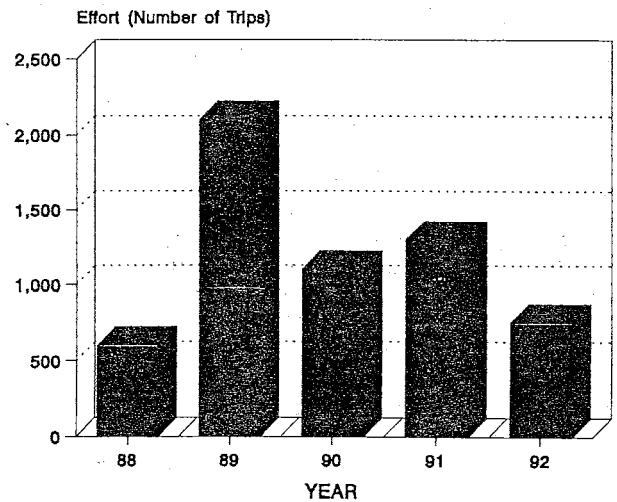


Fig. 3 Number of trips made annually by the artisanal fishery.

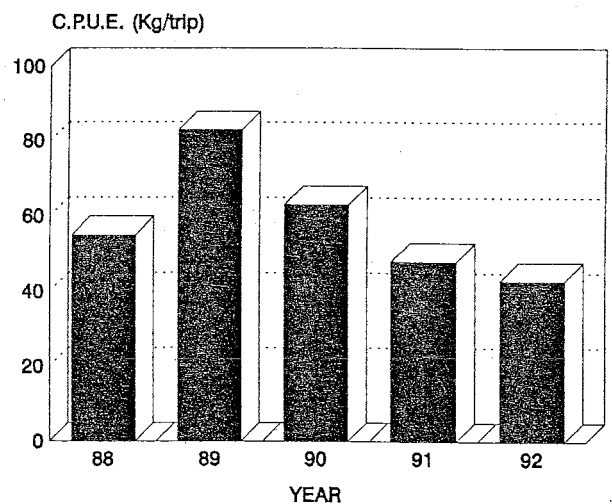


Fig. 5 Annual nominal CPUE (weight/trip) for artisanal fishery.

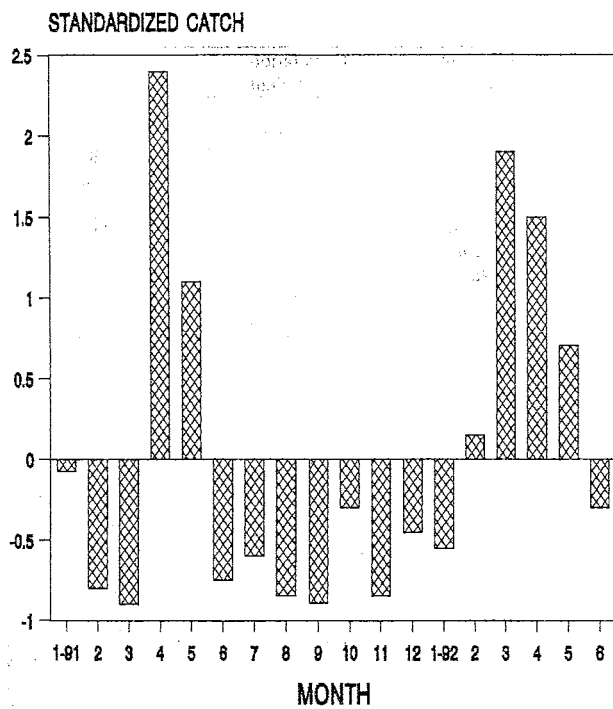


Fig. 6 Standardized monthly catches of blue marlin by the artisanal fishery off the central coast of Venezuela.

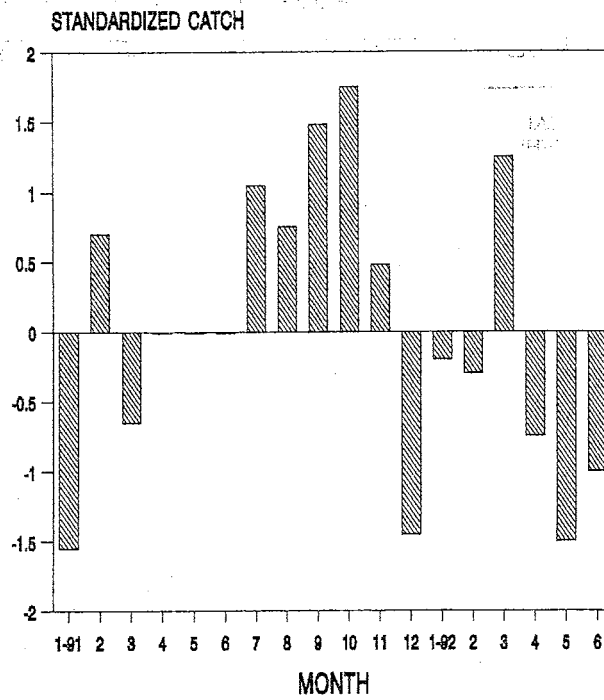


Fig. 7 Standardized monthly catches of white marlin by the artisanal fishery off the central coast of Venezuela.

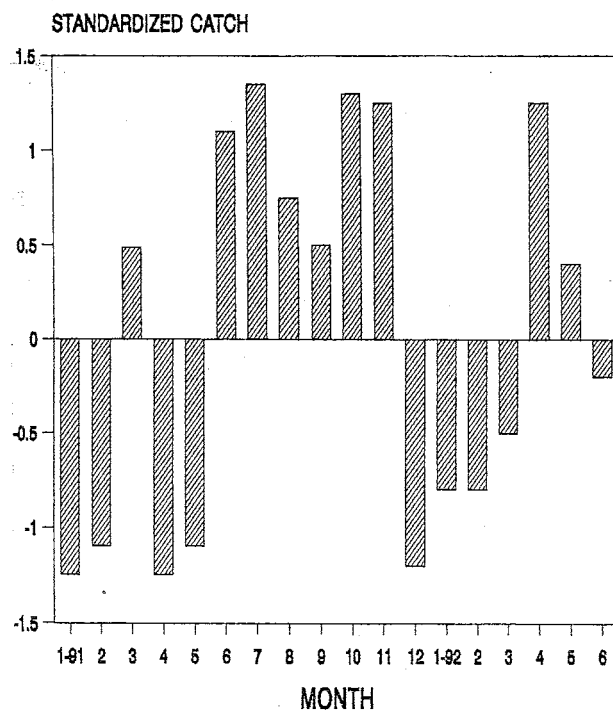


Fig. 8 Standardized monthly catches of sailfish by the artisanal fishery off the central coast of Venezuela.

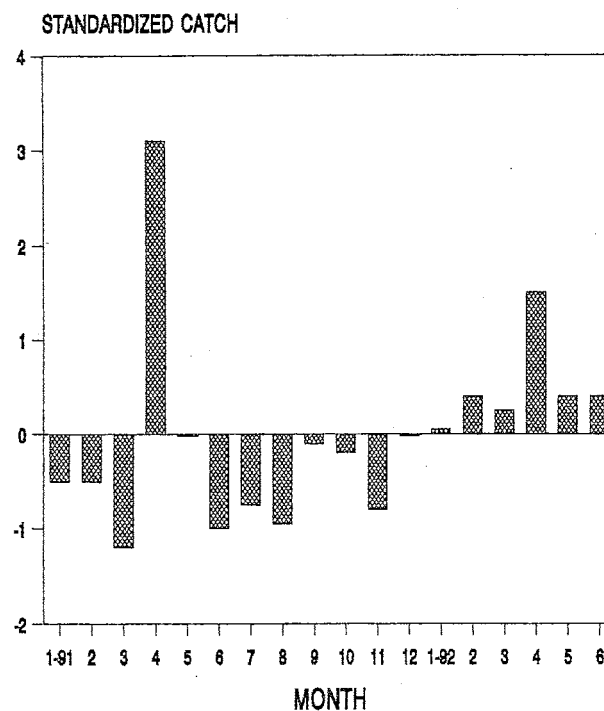


Fig. 9 Standardized monthly catches of swordfish by the artisanal fishery off the central coast of Venezuela.

APPENDIX Length conversions for linear equations (type II regressions) from billfish in the southern Caribbean Sea. All measurements are in cm.

Species	Dependent variables	Independent variables	Slope	Constant	Correlation coefficient	N
SAI	LJFL	PFL	1.264	6.516	0.95	128
WHM			1.308	5.909	0.92	85
BUM			1.201	19.126	0.97	34
SAI	LJFL	PAL	1.645	65.461	0.61	115
WHM			1.939	3.813	0.61	63
BUM			2.409	48.219	0.96	24
SWO	LJFL	CK	1.655	9.678	0.96	420