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MEXICAN PROGRESS REPORT ON THE STRIPED MARLIN SPORT FISHERY

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SUMMARY

They are reported six different species of billfishes in Mexican waters, four of them are marlins, being the most abundant the striped marlin. Since 1990, all these species in Mexico, with the exception of the sward fish, have been reserved only to sport fisheries operations. Therefore they have not been subject to any direct commercial catches. Also in 1987, all the commercial fishing permits for this species were canceled and special protection zones were designated for these species. The Sport Fishing Monitoring Program of the INP-México (SFMP-INP) provides information for the conservation and management of the billfishes resources used as target species for the recreational fishery. This research program includes the sport fishery monitoring, stock assessment and biological research. In consequence, the aim of this paper is to document the Mexican striped marlin sport fishery data collected between 1985 and 2003 by the SFMP-INP in Mexico.

Because of its relative major abundance the striped marlin is the dominant species among all the billfishes species caught in the recreational operations. Its importance is highly contrasted when compared with the small proportion of the other billfishes fished. The importance of the recreational fisheries activities in the Mexican Pacific region is reflected by the number the fishing trips per year which is above the 35, 000. From those, (87.74%) of the associated effort was performed at the Baja California Sur (B.C.S.) region and the corresponding (12.26%) in the Mazatlán area. The average total yearly catch from 1990-2003 was 14, 690 striped marlins caught. From this total 75% were reported to be released alive. The total catch is divided by regions, 14, 262 representing the (97.08%) were caught at B.C.S. and only (2.91%) in the Mazatlán region.

Besides these, the striped marlin is also subject to some incidental catches, mainly in the high sea long line and in the gillnets operations directed to sharks and the sward fish, which is the only billfish subject to commercial fisheries in Mexico. Unfortunately, there is at the present no reliable information to report here on the incidentally of the striped marlin in the EEZ of Mexico.

The data here presented are based on the Carta Nacional Pesquera, 2004 (CNP-INP) which constitutes a national fishery official data base, produced and reviewed by the INP yearly. Also, it is based on the reports and the continuous and systematic monitoring work of the sport fishery performed by the SFMP-INP.

INTRODUCTION:

Six species of billfishes are recorded In the Mexican Pacific waters. Given their relative abundances, the most important is the striped marlin (Tetrapturus audax). Other three marlin species present, are the blue (Makaira mazara) and although in very small numbers, the black (M. indica) and the short bill spearfish (t. angustirostris). Besides these, the sail fish (Istiophorus platypterus), and the sward fish (Xiphias gladius) are the other billfishes species commonly present in the Mexican Pacific waters.

From these highly migratory billfishes species reported in the Pacific Mexican waters, only the sward fish is currently subject to a small scale commercial catch in Mexico. Data from this direct fishery have been reported regularly to the regional fisheries bodies in the Pacific area. Therefore, the aim of this paper is to collate and present current and historic information on the sport fisheries activities of the striped marlin, data which is collected systematically by the Sport Fisheries Monitoring Program, sponsored by the Instituto Nacional de la Pesca (SFMP-INP). This produces the essential information pertaining to the recreational Mexican billfish fishery. The data here presented has been recently published in the Carta Nacional Pesquera, 2004 (CNP-INP) which constitutes an official national fishery data base produced and reviewed seasonally by the INP.

All the sport fisheries activities along the Mexican Pacific coast have been concentrated in a specific designated fishing zone. This extends parallel to the Pacific coast, up to 50 nautical miles (nm) from the shore line. This special area was established in 1983, as a reserve zone for all the sport fishing activities (Diario Oficial, 1983). In 1987, two other specific protection zones for billfishes were also established. One is off the tip of the Baja California peninsula and the other, in the south, off the Gulf of Tehuantepec. (Fig.1). With the exception of the sward fish, all the other billfishes species have been by law reserved only to sport fisheries operations since 1990. All the permits for longliners and for drift gillnet fishery which exclusively were directed to billfishes had been since prohibited (Ortega-García, Klett-Traulsen and Ponce-Díaz, 2003). Sosa Nishizaki (1998), also complemented in good detail the complete history of the billfishes management and regulations in Mexico.

In this extensive sport fishing area in the Mexican Pacific, called in some literature as the "core area", the stripped marlin catches are concentrated mainly in three places. These are tourist sites located on both sides of the entrance of the Gulf of California. The two more important, in terms of the numbers of fish caught are: Cabo San Lucas and Buenavista, in the state of Baja California Sur (B.C.S), which is located at the tip of the Baja California peninsula. Undoubtedly, they constitute the prime sport fishing locations for billfishes on the whole Pacific coast of Mexico, accounting for 91.95% of the total billfishes caught every year. The corresponding

8.05% is from the other location, placed across the Gulf of California, in the mainland Mexico, in the port of Mazatlán, Sinaloa. (Fig. 1).

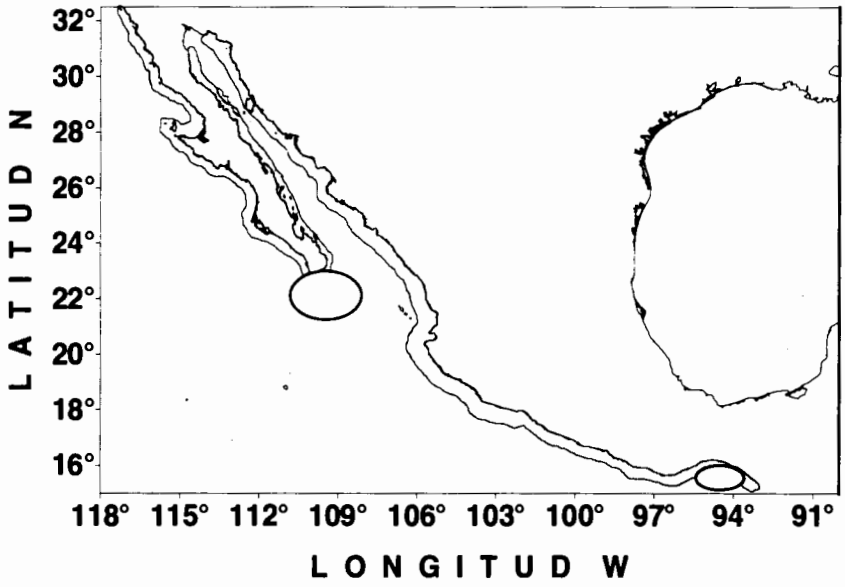

Fig. 1. Exclusive sport fishery zone of 50 nm miles from the coast and location of the two billfish protection zones in the Mexican Pacific

Besides the national regulations for the sport or recreational fishery, the striped marlin is also in some degree subject to incidental catches, mainly in the Mexican longline fishery and by the drift gillnets operations directed mainly to sharks and the sward fish. These is performed outside the "core area" in the EZZ waters of Mexico. Macías-Zamora (1992) and Macías-Zamora, Vidaurri-Sotelo and Santana Hernández (1994) provided some information related with the sail fish incidental catch. Unfortunately at the present, there is no reliable information on the incidental catches for the striped marlin derived from these two national commercial fisheries.

Biological Data:

Like in other recreational billfishes around the world, the influence of environmental variables is reflected in the species composition of the catches at each location and in the fishing success relative to seasonal changes. Pick concentrations for the stripped marlin in the Mexican Pacific zone are correlated with sea water temperatures. This normally occurs from December to June, when the temperature is of 22° C to 25°C (Howard and Ueyanagi, 1965). Also, Ortega-García et al. (2003), reported more recent, a similar range of temperatures from 22°C to 24°C. Other works like Squire (1974, 1985 and 1987), have discussed the catch

distribution of the striped marlin and its relationship with surface isotherm temperatures.

At the present there is some evidence of reproduction of this species in the Baja California waters. González-Armas, Sosa-Nishizaki, Funes–Rodríguez and Levy-Pérez (1999) confirmed the presence of striped marlin larvae in the entrance of the Gulf of California, from June to November. This finding was associated with warmer temperatures ranging from 27-8^{0}C to 31.5^{0}C. The study suggested that females have to stay in warmer waters because of its reproductive activity. Reproduction it is also assumed to occurs during the migration to the Pacific southern latitudes, during the months from July to October, (CNP-INP, 2004).

Ortega-García et al. (2003), reported the average lengths of striped marlin from Los Cabos area (B.C.S.). They sampled a data set with a total of 4,646 fishes caught from 1990-1999. From these, 2,524 (54.32%) were males and respectively, 2,122 (45.68%) females. The average eye-fork length derived from this important regional study was 175 cm. The minimum size was recorded by them in 1996, with 167 cm and the maximum length reported in this study was 182 cm. Significant length and weights differences were also found by these authors for males and females. This data is summarized in Table 1 of this progress report.

Similarly, the heaviest fish recorded on this data series was reported in the Spring. Their Figure 9 (page 487), noted a lower number of fishes during the summer, but heavier females during this period were found. The sex ratio obtained in this study which encompasses ten years of data was 1: 1.19, with more males landed, but they again noted that females were more frequent during the summer months.

TABLE 1. Average mean lengths (eye-fork) and weights of striped marlins caught at Los Cabos, B.C.S. from 1990-1999. (Modified from Ortega-García et al. 2003)

Sex	Mean Length (cm)	Mean Weight (Kg)
MALES	**171.4**	**51.0**
FEMALES	**174.4**	**54.7**

Notes: Minimun size was reported in 1996 (167 cm)
Maximum length reported in this study was (182 cm)

DATA SOURCES:

The sport fisheries activities are regulated in Mexico by a specific norm (NOM-017-Pesc-1994; D.O.F. 9/05/95). These fishing activities are monitored closely by the INP, through out two of its Regional Fisheries Research Centers, (Centros Regionales de Investigación Pesquera, CRIPS). One is located in Baja California Sur (CRIP-La PAZ) and it is responsible for the monitoring of the catches at the two prime sites for striped marlin recreational fishing in Mexico. The other (CRIP-

Mazatlán),is located at the mainland site described before which complements the studies.

All sport fishing trips are required by the NOM to carry logbooks and specific forms which are submitted to the two CRIPS-INP regional centers each month. Besides this, the CRIPS scientists visit regularly the three main tourist fishing places described for sampling and collection of direct and complementary information obtained at the boat ramps, weigh stations, and marinas.

Catch and Effort

Reported catch forms then the basis for the analysis used in the SFMP-INP research work. Catch is defined as the number of fish caught. This includes the fish which is hooked and released, as well as, the fish which are retained. The effort is defined as the number of fishing trips. CPUE is therefore, the number of fish reported per boat per day for the major billfishes species. The average catch rate here reported (monthly or annual) is the number of fish caught by the number of trips.

Table 2, taken from the CNP-INP, 2004 shows the number of sport fishing trips recorded at the three main sport fishing locations in the Mexican Pacific coast, from 1990 till 2003. The average number of sport fishing trips in the 14 years series analyzed was 35, 264. From those, 30, 942 (87.74%) were based at the Baja California Sur region and the corresponding 4, 321 (12.26%) in the Mazatlán area. This is also shown in Fig. 2.

From this data an steady increase in the associated effort is observed in los Cabos area from 1995 to the present. In comparison, Buenavista and Mazatlán had more stability in their historic number of trips. The effort associated to this recreational fishery in the region of the mouth of the Gulf of California has increased to 47, 000 trips per year, (CNP-INP, 2004)

Table and Fig. 3. present the number of striped marlin caught at the three main locations from 1990 till 2003. The average total catch was for that period was 14, 690 striped marlins. From those 75% were reported to be released alive.

It is also notorious the high contrast observed between and within the catches from the two B.C.S. locations, compared with those from the mainland site. An average of 14, 262 representing the (97.08%) were caught at B.C.S. and only 428.5 or (2.91%) in the Mazatlán region. The importance of the Baja California Sur recreational fishing areas is confirmed by these numbers. The Los Cabos area has the major component of this fishery and constitutes an important part of the local economy (Squire and Au, 1990). The striped marlin is the dominant species in the sport fishery, representing about 80% of the billfishes caught in los Cabos, 51% in Buenavista and 12% Mazatlán. The other billfishes in contrast only contributed together with a 0.5% (CNP-INP, 2004).

TABLE 2. Number of sport fishing trips at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1990-2003. (Data taken from the CNP-INP, 2004)

YEAR	LOS CABOS	BUENAVISTA	MAZATLÁN
1990	13, 589	9, 296	8, 649
1991	19 417	10, 157	5, 715
1992	16, 845	9, 127	4, 320
1993	15, 517	8, 505	4, 545
1994	14, 845	9, 941	4, 421
1995	13, 472	8, 618	3, 216
1996	15, 315	9, 365	4, 368
1997	20, 613	9, 694	2, 318
1998	23, 501	8, 106	3, 321
1999	25, 781	9, 947	4, 313
2000	28, 211	9, 555	4, 075
2001	29, 941	9, 301	3, 793
2002	27, 618	12, 909	3, 828
2003	34, 651	9, 361	3, 622
AVERAGE	21,379.7	9,563.0	4, 321.71

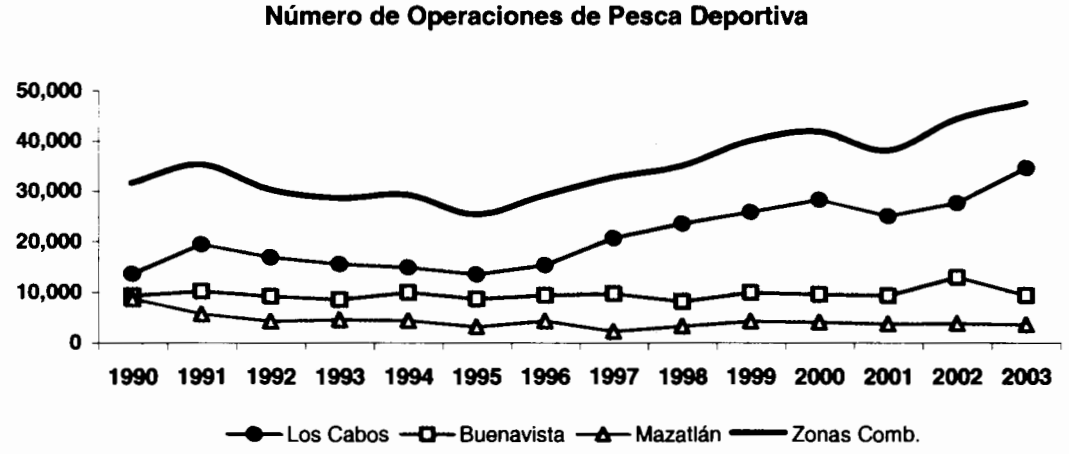

FIG 2. Number of sport fishing trips at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico from 1990-2003. (Data from the CNP-INP, 2004)

TABLE 3. Number of striped marlin caught at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1990-2003. (Data taken from the CNP-INP, 2004)

YEAR	LOS CABOS	BUENAVISTA	MAZATLÁN
1990	8, 910	3, 003	461
1991	1, 159	3, 100	428
1992	7, 129	2, 193	140
1993	9, 054	1, 764	132
1994	8, 382	2, 480	220
1995	8, 452	3, 160	360
1996	9, 980	6, 086	1287
1997	9, 105	3, 374	822
1998	19, 644	2, 633	98
1999	12, 362	3, 595	506
2000	15, 578	3, 331	440
2001	12, 921	2, 074	473
2002	13, 796	5, 794	273
2003	18, 190	2, 427	359
AVERAGE	**11, 047.28**	**3,215.2**	**428.5**

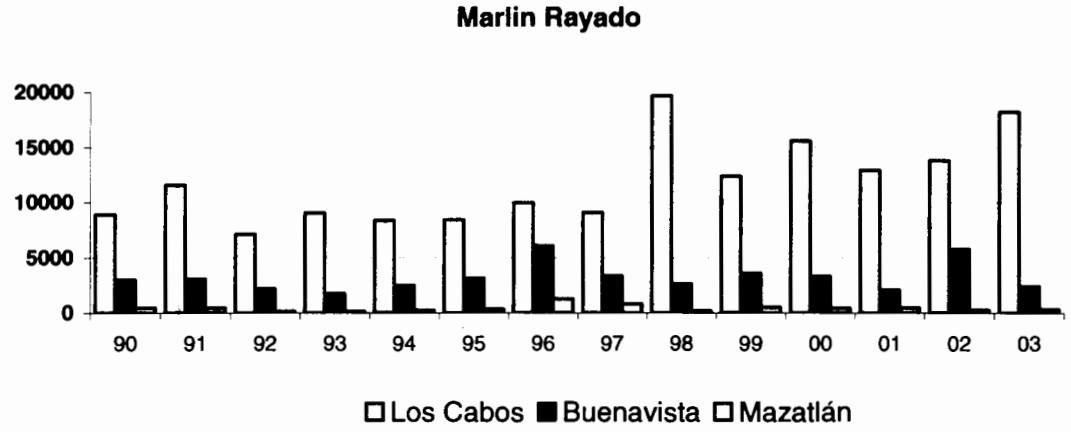

FIG 3. Number of striped marlin caught at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico from 1990-2003. (Data from the CNP-INP, 2004)

The average catch rate estimated during the entire period from 1990-2003 for the three zones together is 1.01 fish per trip. For los Cabos area alone the value derived is 0.548, which is comparative higher from the other two. The calculated value is at the same time, a little less than the 0.6 fish per trip, value reported by Ortega-García, et al. (2003), and it is a little higher than the 0.5 fish per trip value, reported by Squire and Au (1990). Considering their similarity and also the dates of the different reports cited, some stability in the abundance of the exploited population is assumed. From this data is possible to observe that the highest annual catch rate observed in the time series was obtained in 1998 with (0.812) in the Cabos area. Complementary, the lowest was in Mazatlán with (0.029) fish per day in year 1993. Standardization of the catch rate is needed. Table and Fig. 4 presents the calculated rates of captures of the striped marlin at the three main locations in the Mexican Pacific.

TABLE 4. Rates of captures of striped marlin catch at the three main locations in the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1985-2003. (Data taken from the CNP-INP, 2004)

YEAR	LOS CABOS	BUENAVISTA	MAZATLÁN
1985	0.574	0.157	0.253
1986	0.592	0.34	0.256
1987	0.539	0.526	0.222
1988	0.492	0.335	0.169
1989	0.48	0.227	0.030
1900	0.533	0.319	0.053
1991	0.605	0.305	0.074
1992	0.429	0.24	0.032
1993	0.593	0.174	0.029**
1994	0.535	0.247	0.049
1995	0.628	0.367	0.111
1996	0.687	0.65	0.294
1997	0.465	0.385	0.354
1998	0.812*	0.368	0.054
1999	0.467	0.386	0.117
2000	0.519	0.359	0.108
2001	0.476	0.239	0.124
2002	0.495	0.450	0.071
2003	0.506	0.251	0.099
AVERAGE	**0.548**	**0.332**	**0.131**

Notes: * Highest value
** Lowest value

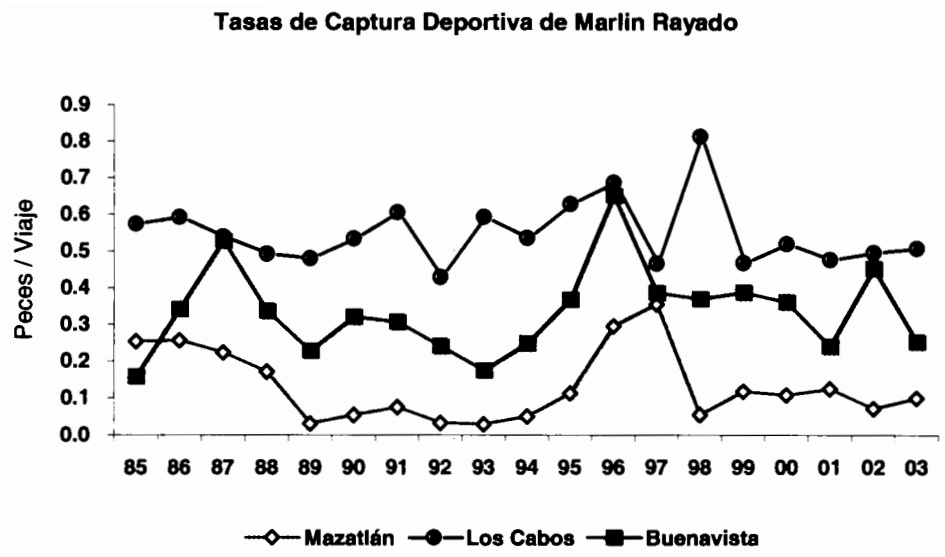

FIG 4. Rates of captures of striped marlin catch at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico from 1985-2003. (Data from the CNP-INP, 2004).

Size limits of these catches are presented in Fig. and Table 5. The medium size series is below for 4.0 cm of the average historic trend. This also shows a down trend since 1992. On the average, the length frequencies reported in here showed larger fish than the previously studied by Squire and Au (1990) and Ortega-García et al. 2003).

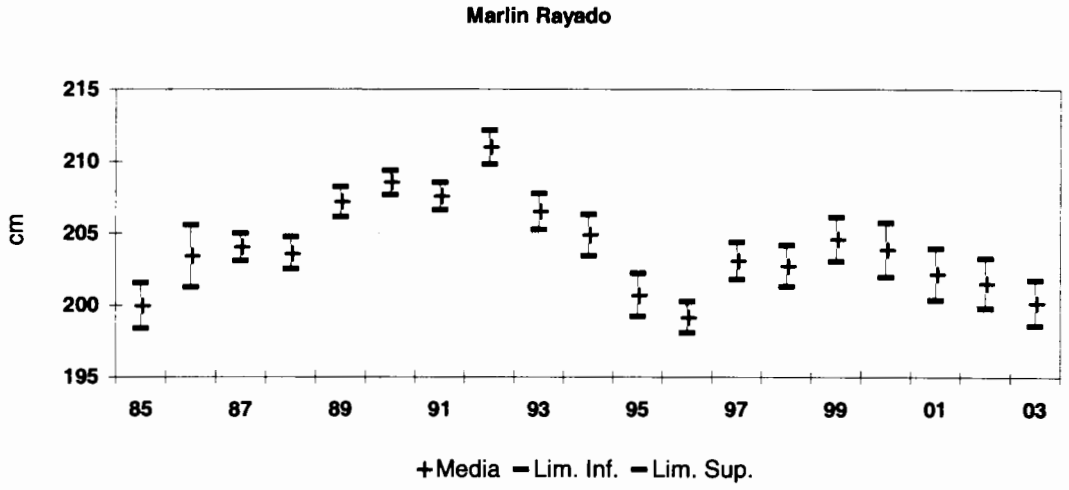

Fig 5. Average size of the catch of striped marlin from 1985-2003. (Data in cm reported from the CNP-INP, 2004).

TABLE 5. Average size of the catch of striped marlin from 1985-2003. (Data in cm reported from the CNP-INP, 2004).

YEAR	Lower Limit	Media	Upper Limit
1985	198.37	199.94	201.51
1986	201.23	203.41	205.59
1987	203.08	204.231	204.95
1988	202.49	203.61	204.73
1989	206.13	207.17	208.21
1990	207.66	208.51	209.36
1991	206.60	207.55	208.51
1992	209.79	210.97	212.15
1993	205.23	206.49	207.74
1994	203.41	204.85	206.29
1995	199.15	200.68	202.20
1996	198.09	199.16	200.23
1997	201.77	203.06	204.36
1998	201.28	202.72	204.17
1999	203.03	204.57	206.11
2000	201.95	203.85	205.74
2001	200.35	202.15	203.95
2002	199.76	201.51	203.25
2003	198.58	200.15	201.71

CONCLUTIONS:

The striped marlin data collected by the SFMP-INP provides useful indexes of fishing success of this fishery. The Mexican government has established several management and conservation measures ensuring the proper development of the commercial and recreational fisheries, which represents a high value input of local economies. The striped marlin is by large the main component of this activities. The B.C.S. area is the most important of the entire Mexican Pacific zone in terms of numbers of trips and specially by the number of fish caught yearly. The catch rates trends indicated a non apparent change in the abundance of the exploited population of striped marlin in Mexican waters. However, standardizing the catch rates is needed, since there is a significant increasing trend in the number of fishing trips in the Los Cabos area. Other important finding is the length frequencies, which showed larger fish than in previous studies. Finally, the incidental catches of this species in other fisheries, mainly for commercial sward fish or sharks outside the "core area" needs to be monitored and incorporated in future analysis of this sport fishery.

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