

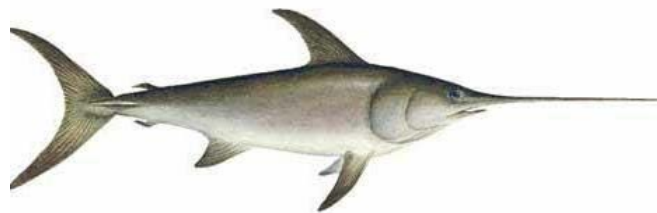


Mexican Progress Report on the Marlin and Swordfish Fishery¹

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Introduction:

Since the first meeting of the Marlin and Swordfish Working Group (MARLIN-SWO-WG) of the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened, Mexico has been participating and reporting directly to this working group and fully cooperating with the other ISC working groups. Each time detailed information on the tuna and tuna-like species, including the billfishes and swordfish had been punctually reported to the ISC joint group, presenting the corresponding fishery statistics, as well as other documentation that provided progress in biological and oceanographic research developed in Mexico with these fish resources. The aim of this contribution is to collate and complement the historical information previously presented, with the most current data on the sport fisheries activities with the marlin species and those of the commercial swordfish fishery in the Mexican Pacific Waters. These included for the total catches and CPUE (Category I and II data) of the different marlin species, and also their size and weights by species and by sexes (Category III data). For the sword fish, only category I data is now available.

Data Sources:

The National Institute of Fisheries of Mexico (Instituto Nacional de Pesca, INP-México), has systematically conducted scientific work and developed fisheries research for its marine resources during more than forty years. The recreational billfish and the commercial swordfish fishing activities are monitored closely by the (INP-México) through out its Regional Fisheries Research Centers, called (Centros Regionales de Investigación Pesquera, (CRIPS-INP). Located in both extremes of the Baja California peninsula, there are two research centres: the (CRIP-ENSENADA) in the northern part and the CRIP-LA PAZ in the south. Also, based in the mainland, across the Gulf of California there are three other centers which are from North to South the CRIP-GUAYMAS, CRIP-MAZATLÁN, and respectively, the CRIP BADEBA. They together are responsables to research, monitor, collect, review and analyse data of the different fisheries in this region of México and specially, to follow the fisheries of the pelagic resources. The data here presented is a combination of all those efforts.

In México, all the sport fishing trips are required by Law (NOM-017-Pesc-1994:D.O.F. 9/05/95), to carry logbooks and specific forms. Besides this, the INP scientists based at the CRIPS, sample regularly the fishing places, collecting direct and complementary information at the piers, boat ramps, weight stations, and marinas. For the swordfish, which is the only billfish subjected to commercial catches in México, logbooks and special forms are also reported after each fishing trip to the local fisheries authorities of the Comisión Nacional de Pesca (CONAPESCA). The commercial data here presented is therefore collected in cooperation with the researchers from the regional CRIPS and the CONAPESCA .

Some of the information presented in this paper was published before in the Carta Nacional Pesquera, 2004 (CNP-INP, 2004) and it was already reported to this group. This is now complemented with new data tabled in the latest version of the (CNP-INP, 2006), which constitutes one of the official national fishery data base produced and reviewed seasonally by the INP-México. Besides the published information, in this report, we further complemented that with the most recent data collected from the Sport Fisheries Monitoring Program, (SFMP-INP-México) sponsored by the (CRIP-LA PAZ) in Baja California Sur. For the first time, as requested by the joint working group, the information presented covers all the other marlin species caught in Mexican waters and ISC category data II and III are submitted.

Billfishes in Mexican Waters:

From the wide-ranging members of the *Istiophoridae* billfish family, six species are recorded commonly in the Mexican Pacific waters. Given their relative abundances, the most important is by large the striped marlin (*Tetrapturus audax*). The other three marlin species present, although in very small numbers are: the blue (*Makaira nigricans*), the black (*M. indica*) and the short bill spearfish (*T. angustirostris*). Besides these, the sail fish (*Istiophorus platypterus*), and the swordfish (*Xiphias gladius*) are the other two billfishes species also distributed. From those billfishes species found in México, only the swordfish is currently subject to commercial catches and all the others are reserved totally for the recreational fisheries.

The sport fisheries activities along the Mexican Pacific coast are developed and concentrated in a specific designated fishing zone, which extends parallel to the Mexican Pacific coast, up to 50 nautical miles (nm) from the shore line. This was officially established in 1983, as a reserve zone only for the recreational fishing, (Diario Oficial, 1983). Later in 1987, for their relative importance, two other specific zones for billfishes were also established in México as an exclusion zone for longliners operations. One is around the coast and tip of the state of Baja California sur and the other, in the south, off the Gulf of Tehuantepec in the South of México. (Fig.1).

In this extensive sport fishing area along the Mexican Pacific coast the marlin catches are concentrated mainly in three places. These sites are located on both sides of the entrance of the Gulf of California. The two more important, in terms of the numbers of fish caught by year 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 88.54% of the total billfishes caught every year. The corresponding 11.46% is from the other location, placed across the Gulf of California, at the mainland Mexico, in the port of Mazatlán, Sinaloa.

As explained before, with the exception of the swordfish, all the other billfishes species present in Mexican waters have been reserved by law only for recreational fisheries operations since 1990. Therefore, the commercial permits for longliners and for drift gillnet fishery, which exclusively were directed in the past to catch billfishes had been prohibited since that year (Ortega-García, Klett-Traulsen and Ponce-Díaz, 2003). Besides these designations and regulations, since 1995, the sport fisheries activities are also ruled in Mexico by a specific norm (NOM-017-Pesc-1994; D.O.F. 9/05/95). Sosa Nishizaki (1998), and our previous Mexican Progress reports presented to ISC, or those directly reported to the MarlinWG, such as: Ulloa, Fleischer, Dreyfus y Vaca (2004); Dreyfus, Fleischer, Robles y Ulloa (2005); Fleischer (2005) and Fleischer, Dreyfus, Robles y Ulloa, (2006) complemented the history of the billfishes management and regulations in Mexico.

Besides the national regulations for the recreational fishery, the marlin species are also in some degree subject to incidental catches, mainly in the Mexican longline fishery and by the drift gillnets operations directed to sharks and the swordfish. Recently the Mexican Government issued the NOM-029-Pesc-2007, directed to regulated the shark fishery and therefore, to prevent further the by catch problem with these and other species. Unfortunately at the present, there is still no reliable information on the incidental catches for the marlins derived from these two national commercial fisheries in the Mexican Pacific. However, Macías-Zamora (1992) and Macías-Zamora, Vidaurri-Sotelo and Santana Hernández (1994) provided some information related with the sail fish incidental catch. As well, the swordfish, which is the only commercially targeted billfish, is also taken, although in low numbers, by the recreational fishery directed to the marlin species. Here some data on this low level catches are presented for the first time.

Marlins Total Catch and Catch and Effort (Categories I and II Data):

Reported catch forms the basis for the analysis used in the CRIPSI and SFMP-INP-México 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 dies and is 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. Nowadays, the rate of catch/release in the Mexican recreational fishing zones is of 75%. However, no data is available on the survival rates of the fish released.

Table 1, taken from the CNP-INP, 2004 and CNP-INP, 2006, shows the number of sport fishing trips recorded at the three main sport fishing locations in the Mexican Pacific coast, from 1990 till 2005. The numbers for the 2006 season are still preliminary and are not used in the calculations presented here.

The average number of sport fishing trips in the 16 years series presented in Table 1, was 37,173. From those, 32,917 or (88.55%) were based at the two Baja

California Sur main fishing areas (Los Cabos and Buenavista) and the corresponding 4,255.93 (11.45%) in the mainland area, in Mazatlán.

With this data, a graph is produced in Fig. 2. which shows an steady increase in the associated effort observed in Los Cabos area since 1995 to the present. In comparison, Buenavista and Mazatlán had more stability in their historic number of trips. The total effort associated to this recreational fishery in the region of the mouth of the Gulf of California has increased since 1995 from 25, 307 trips per year to 56, 760 trips in 2005, (CNP-INP, 2004; CNP-INP, 2006 and recent data generated by the (CRIP-LA PAZ).

The data provided in the appendix (excel file) annexed presents the corresponding information for all the marlin species. In this the relative greater importance of the striped marlin is notorious. It is also clear the relative importance of the two Baja California peninsula fishing sites, which together represents 96.97% of all the captures of this species in México. The average catch rate for the entire period from 1990-2005 is 0.90 fish per trip. Similarly, other tables correspond to the number of blue marlin caught at the three main locations at the Mexican Pacific coast and its comparative catch rate. Again the two Baja California Sur sites yielded together 94.75% of the captures of this marlin species. Across the Gulf of California, only 5.24% were caught. The average catch rate of 0.54 fish per trip in the peninsula side.

One of the less abundant billfishes in the Mexican Pacific waters is the black marlin, which for the entire time series only represented an average of 41 fishes. Once more, the comparative importance of the Baja California Sur, even for this less common marlin species, is well reflected with 97.5% of the average captures and a respective catch rate for the entire period of 0.0025 fish per trip. In contrast with the previous, the sail fish, shows more uniformity between the average catches among the three locations for the entire period. This indicated a wider distribution of this species and a similar vulnerability along the distribution range in the Mexican Pacific. It is also an important recreational fish target in the Gulf zone. 52.20 % of the fish caught in the Baja California peninsula, compared with a relative close value of 47.97% of the catches in the mainland site. The average catch rates are respectively for this species of 0.74 and 0.68 at each place.

The swordfish, although in very low numbers, is sometimes also taken in the recreational operations. Its numbers are similar to those from the black marlin presented above with 41 fishes and average catch rate of 0.0046 for the entire area covered with the three main fishing locations.

The compiled information tabled with the estimated captures of all the marlin species is important at the three locations combined.. It is evident in terms of their relative numbers, the clear dominance of the striped marlin with (68%) of the total catches, among the marlin species in the area. It is followed by the sail fish with (24.69%), then the blue marlin with (6.78%) and with lower and curiously identical values the black marlin and the swordfish with (0.16%) each.

Biological Data (Category III 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 as well as in the fishing success relative to seasonal changes. Catch concentrations for the striped marlin in the Mexican Pacific zone are correlated with sea water temperatures. This normally occurs from December to June, when the temperature is 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 the striped marlin 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°C to 31.5°C. The study suggested that females have to stay in warmer waters because of its reproductive activity. Reproduction is also assumed to occur while migrating 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 2,122 (45.68%) females respectively. 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 4 of this Progress Report.

Similarly, the heaviest fish recorded on this data series (Loc. cit.) was reported in the Spring. The Figure 9 (page 487) of their report, 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.

Complementary to the first historic information on size and weights of the striped marlin caught at Mexico, The new information derived from the CRIP-INP work is presented in the appendix with all the respective data.

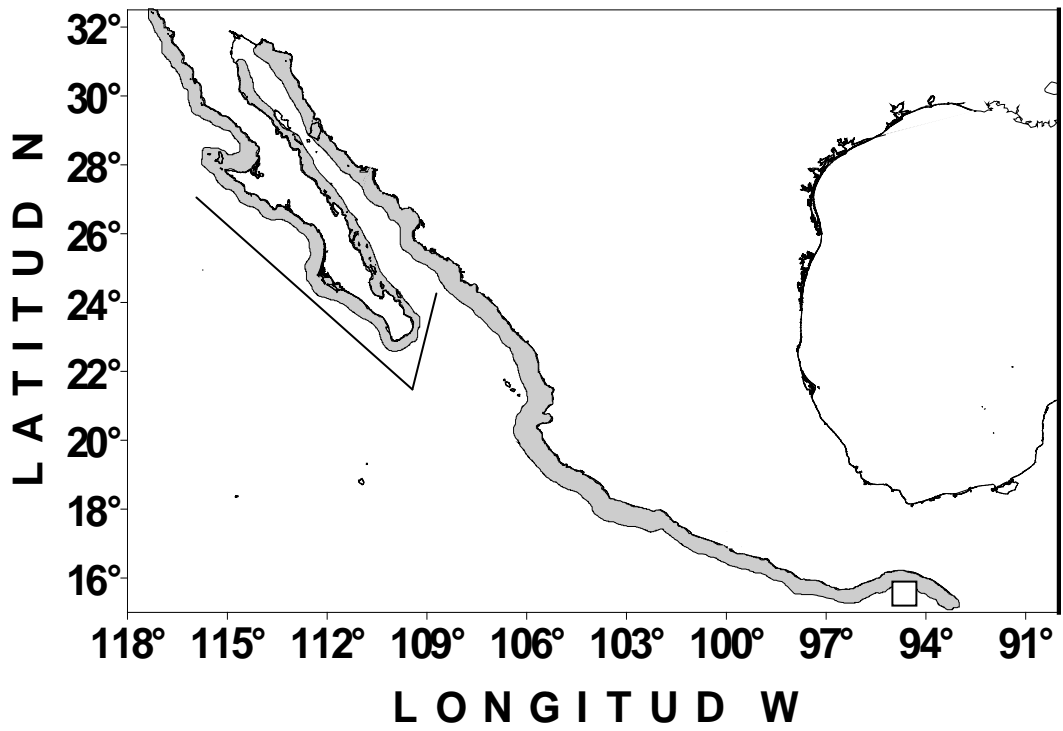


Fig. 1. Exclusive sport fishery zone of 50 nm miles from the coast and location of the two billfish protection zones in the Mexican Pacific

Table1. Number of sport fishing trips at the three main sport fisheries locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1990-2005. (Data taken from the CNP-INP, 2004, 2006 and SFMP-CRIP-LA PAZ).

**Viajes de Pesca Deportiva en Los Cabos, Buenavista y Mazatlán
No. Trips**

YEAR	Effort = (No. Operaciones = No. Trips)				Zonas
	Los Cabos	Buenavista	Mazatlán		Comb.
1990	13589	9276	8649		31514
1991	19462	10157	5715		35334
1992	16576	9127	4320		30023
1993	15385	9313	4545		29243
1994	14845	9961	4421		29227
1995	13472	8619	3216		25307
1996	15315	9365	4368		29048
1997	20611	9694	2318		32623
1998	23501	8106	3321		34928
1999	25783	9948	4313		40044
2000	28211	9555	4074		41840
2001	24939	9300	3793		38032
2002	27618	12909	3828		44355
2003	34651	9361	3622		47634
2004	32780	12522	3554		48856
2005	37434	15288	4038		56760
AVERAGE	22,760.71	10, 156.31	4, 255.93		37,173
(%)	(61.22)	(27.32)	(11.44)		

Número de Operaciones de Pesca Deportiva

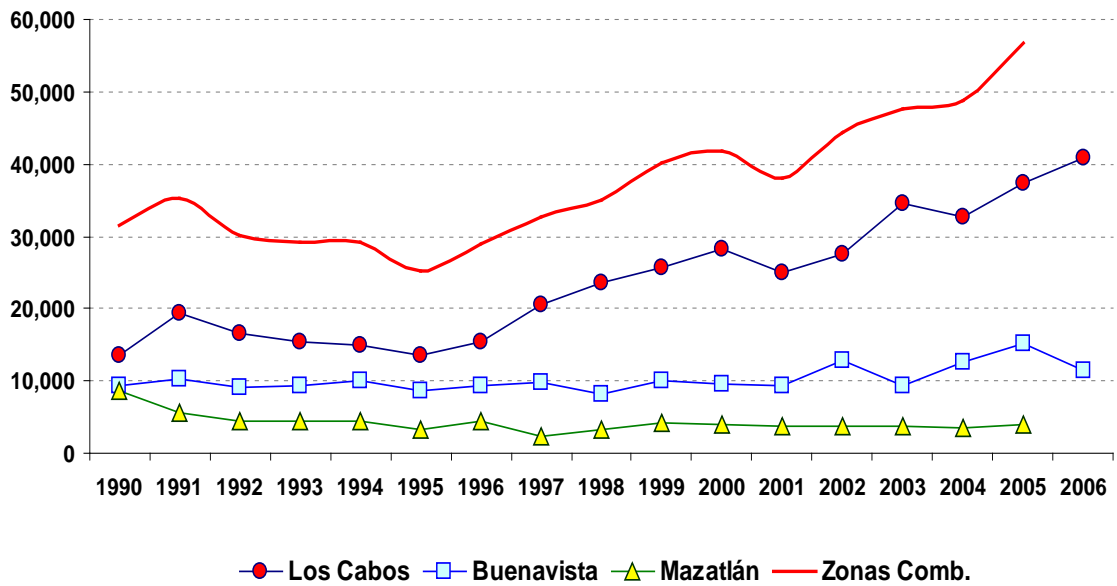


Fig. 2. Number of sport fishing trips at the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1990-2006. (Data from the CNP-INP, 2004, 2006 and SFMP-CRIP LA PAZ).

Table 2 . Estimated Number of all billfishes by species caught at the three main locations (combined) at the Mexican Pacific coast from 1990-2005. (Data taken from the CNP-INP, 2004, 2006 and SFMP-CRIP-LA PAZ).

Estimated Total Catch	All M. Rayado	Combined M. Azul	(LosCabos P. Vela	Buenavista M. Negro	Mazatlán P. Espada
YEAR					
1990	12375	1514	11345	27	98
1991	15120	1535	10079	31	37
1992	9463	3347	6117	46	1
1993	10950	2444	6031	78	5
1994	11083	1709	5101	52	36
1995	11974	1285	4592	34	21
1996	17354	1268	5389	25	18
1997	13302	752	6771	36	99
1998	22458	2083	7257	44	48
1999	16465	2351	6107	45	65
2000	19350	1630	7728	62	77
2001	15468	1561	3775	37	43
2002	19864	1754	3300	14	5
2003	20977	1156	4492	47	18
2004	23546	1214	5577	38	34
2005	33318	1544	5209	36	39
AVERAGE	17067	1697	6179	41	41
SUM					25024
(%)	(68.20%)	(6.18%)	(24.69%)	(0.16%)	(0.16%)

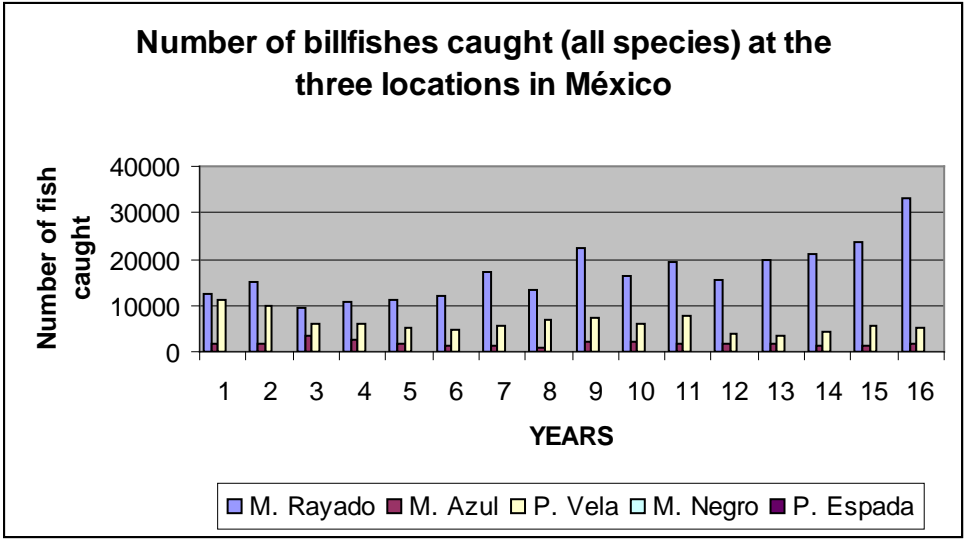


FIG.3a . Number of all billfishes species caught at the three main locations combined in the Mexican Pacific from 1990-2005. (Data taken from the CNP-INP, 2004, 2006 and SFMP-CRIP-LA PAZ).

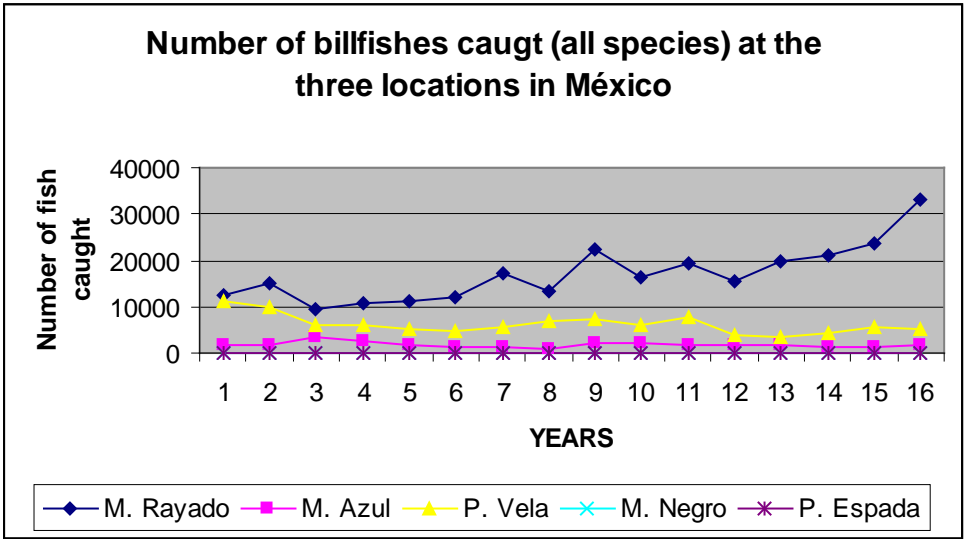


FIG.3b. Number of all billfishes species caught at the three main locations combined in the Mexican Pacific from 1990-2005. (Data taken from the CNP-INP, 2004, 2006 and SFMP-CRIP-LA PAZ).

Table 3. Combined catch rate of the three main locations at the Mexican Pacific coast: Los Cabos, Buenavista, B.C.S. and Mazatlán, Sin. Mexico, from 1990-2006. (Data taken from the CNP-INP, 2004, 2006 and SFMP-CRIP-LA PAZ).

Catch rates all zones combined					
YEAR	M. Rayado	M. Azul	P. Vela	M. Negro	P. Espada
1990	0.3927	0.0480	0.3600	0.0008	0.0031
1991	0.4279	0.0434	0.2852	0.0009	0.0010
1992	0.3152	0.1115	0.2038	0.0015	0.0000
1993	0.3745	0.0836	0.2062	0.0027	0.0002
1994	0.3792	0.0585	0.1745	0.0018	0.0012
1995	0.4732	0.0508	0.1815	0.0013	0.0008
1996	0.5974	0.0437	0.1855	0.0009	0.0006
1997	0.4077	0.0231	0.2076	0.0011	0.0030
1998	0.6430	0.0596	0.2078	0.0013	0.0014
1999	0.4112	0.0587	0.1525	0.0011	0.0016
2000	0.4625	0.0390	0.1847	0.0015	0.0018
2001	0.4067	0.0411	0.0993	0.0010	0.0011
2002	0.4478	0.0395	0.0744	0.0003	0.0001
2003	0.4404	0.0243	0.0943	0.0010	0.0004
2004	0.4819	0.0249	0.1141	0.0008	0.0007
2005	0.5870	0.0272	0.0918	0.0006	0.0007
AVERAGE	0.4530	0.0485	0.1764	0.0012	0.0011

Table 4. 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: Minimum size was reported in 1996 (167 cm).
Maximum length reported in this study was (182 cm)

Swordfish Catches (Category I Data):

In accordance with (FAO, 2000) the total world captures of swordfish are about 90,000 mt. each year. From those, 25,000 mt. are taken from the Pacific Ocean and the Mexican fleet since year 2000 contributes to those with an average of 711t per season. This represents only (2.8%) of the total Pacific ocean captures. In the Eastern Tropical Pacific (ETP), the swordfish shows since 1965 a stable CPUE and it is estimated that it can sustain an annual yield of 2,800t (Bartoo and Coan, 1989; Joseph, 1981). Still there is no model which reflects the condition of the swordfish stock in the entire Pacific ocean. The Japanese data from the longliners indicates that the stock it is subjected to a low catch rate and that there are still possibilities of increasing its harvest. Therefore, the data collection process for this exercise is a mandatory as identified by the SWOWG of ISC and México is contributing for this with the available information.

The development of the swordfish fishery in Mexico has two different historical periods. One started in 1964, using long liners, the second began in 1986, with gillnets. The main ports used by these fishery are: Ensenada, San Carlos, and some times, La Paz, in the Baja California peninsula and Mazatlán, across the Gulf of California, on the mainland Mexico.

The commercial swordfish fishery is regulated by a special Mexican administrative regulation (NOM-017-PESC-1994) which mandates that logbooks should be submitted by the fleet to the fishery agency in Mexico, (CONAPESCA). Besides this, the swordfish fishery was closely monitored from 1998 till 2000 by special trained observers of the Programa Nacional de Aprovechamiento del Atún y Protección a los Delfines, (Mexican Tuna-Dolphin Program-PNAAPD). They worked for those years aboard the longliners and the gillnet ships, which operated outside the 50 miles protected zone for the sport fisheries operations.

In 1992 the swordfish the nominal fleet was integrated by 27 boats. But from those, only 24 were really active fishing boats. In 1995, the fleet was reduced to 22 fishing ships, number which did not change for many years. More recently, in 2006, the number reported is 29 boats. The growth in numbers of the ships is explained because some of them have permits for different species, (multiple fisheries), pending on the availability of the species by season and the presence or not of some species during the year. As a whole 213 fishing trips were performed in 2006 but not all of them caught swordfish (Fig 4.).

The sword fish fleet operates mainly from September-October to February in the Autumn and Winter seasons. The swordfish catches decline after that period and is very scarce in the summer months of July and August. The greater fishing effort is concentrated in two areas in the western coast of the Baja California peninsula, between the latitudes 21° 30'N and 32° 20'N. One is south of Punta Eugenia to the 23°N and the other fishing zone, from the 30° parallel, to the northern limit of the Mexican ZEE (Sosa et. al. 1992; Castro, et. al. 1995) Figure 5.

Also, as it was mentioned before, although in very low numbers, the swordfish is some times caught in the recreational fisheries, with an average number per year of 41 fish.

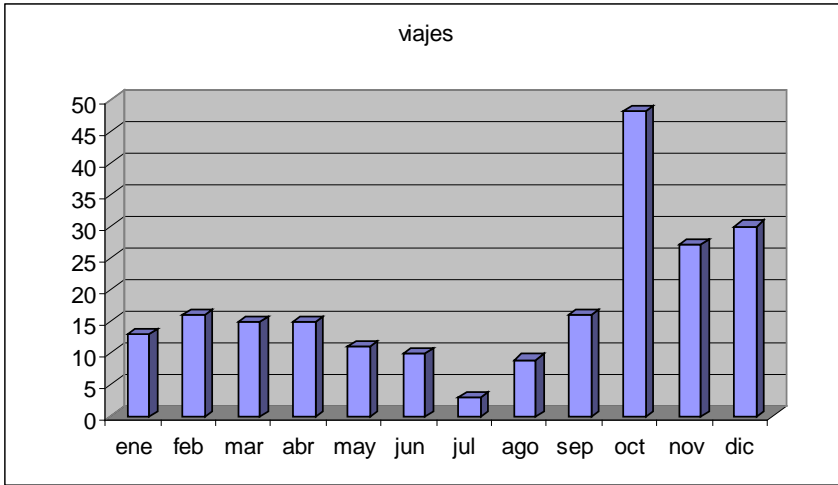


FIG. 4. Monthly number of fishing trips of the swordfish fleet from Ensenada during 2006

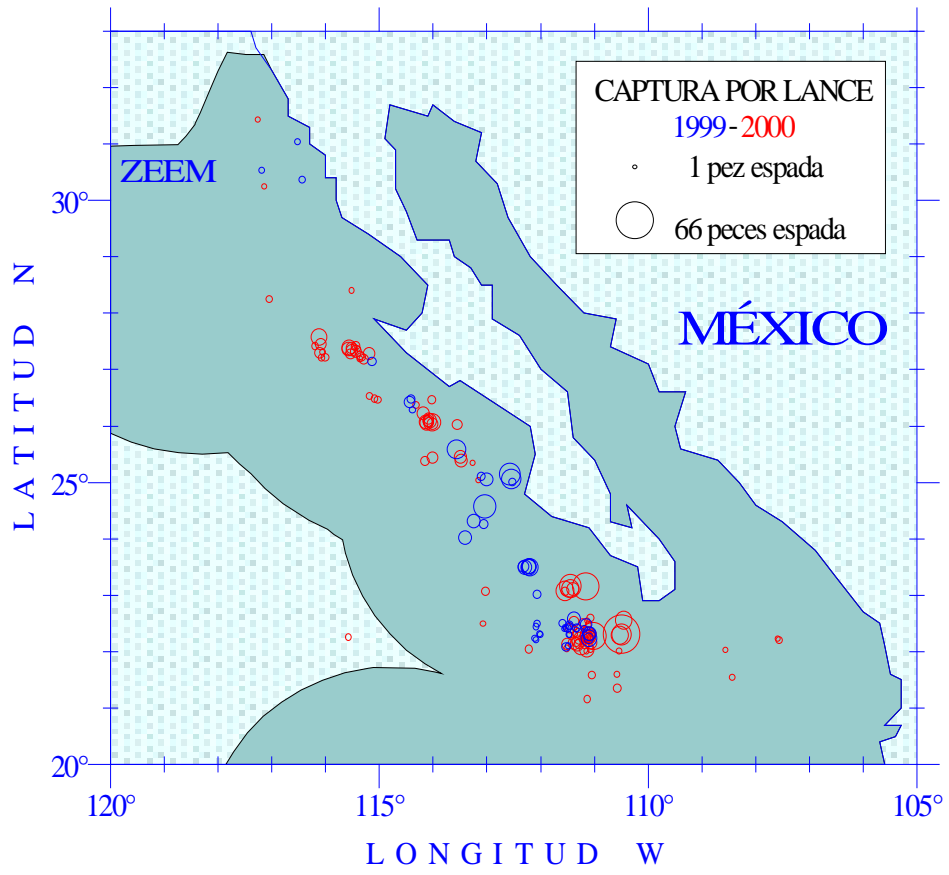
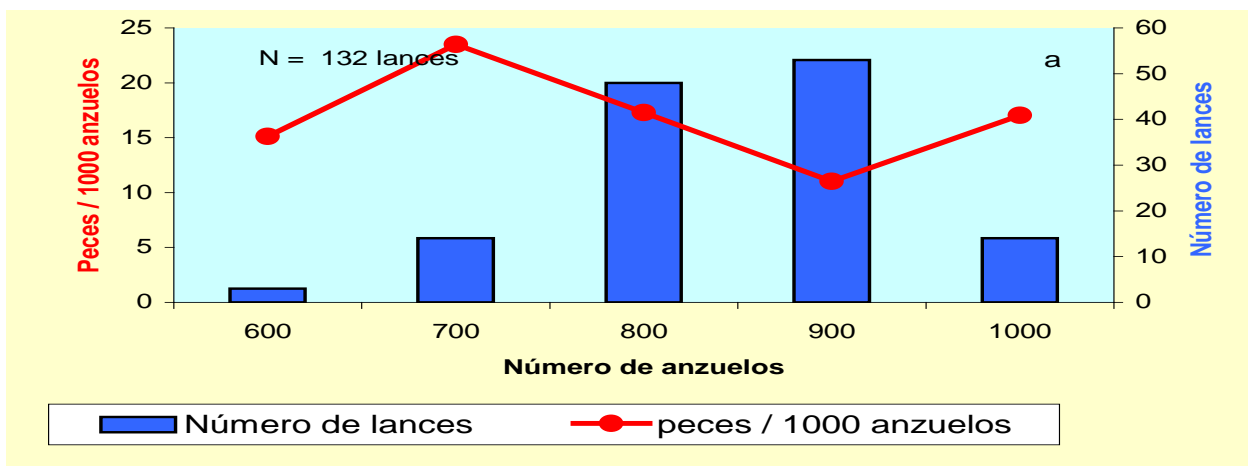


Fig. 5. Swordfish fishing grounds in Mexico and catches by set

Catches (Category I Data):

During the period 1998-2000, time in which the PNAAPD observers program operated aboard the longliner fleet, it was found that the biggest average rate of captures was obtained using 700 hooks by longliner. This number of hooks yielded 24 fishes/1000 hooks. However, the use of 800-900 hooks at that time predominant in the fleet, yielding 17 or 12 fish/1,000 hooks respectively.



Capturas de pez espada 1979-2003 registradas por la FAO y CONAPESCA.

FIG. 6. Rate of captures of swordfish by standardized number of hooks from 1972-2003. Data from the longline fishing ships from México monitored by the PNAAPD-INP

Catch Composition

Sosa et al., 1992 reports preliminary information of the gillnet fishery from México. He mentions that the catches are composed by 88% of sharks species, several other comercial species, like the sun fish and tunas and being the swordfish only the 12 % of the total. The INP reviewed the longline fishery data from the observers from the PNAAD and found that among the shark, the blue shark was the (61%) of the reported captures. The swordfish represented (19%) and the complementary (20%) was formed by other 10 fish species, encompassing the dorado, yellow fin tuna and other sharks species. In both studies, the sharks were undoubtedly, the dominant species caught, followed by the swordfish which has a comparative greater percentage in the long line fishery..

The historic records of the swordfish fishery of the Mexican fleet is presented in the Table. 4 and figure 7.

These indicates three different pick periods. The first in 1981 yielded 1,575t. This catches later declined till 1985. Later an increment was observed reaching 2,650t in 1990. After that an other decline was observed again obtaining 428t. The next pick was in 1998 with 3,603t, which is the historic highest record. The variation observed between the periods is attributed to the changes in the two fishery methods described above. For 2003 a little increment was obtained again with 671t. During 2004 and 2005 the captures have been around 300t for the Ensenada fleet and 347t were reported in 2006, perhaps as a reflection of the increased number of fishing ships.

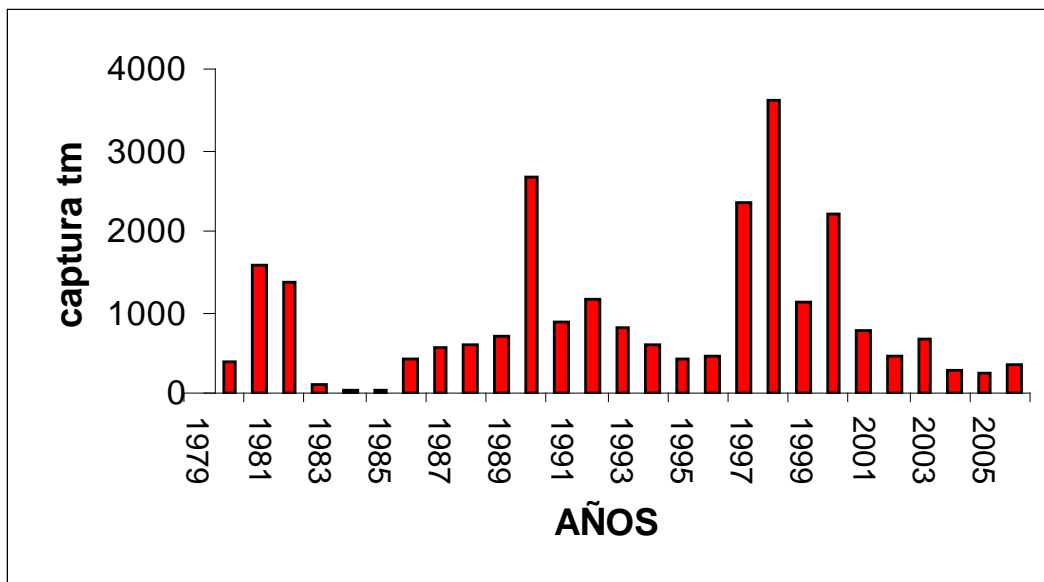


FIG. 7 swordfish catches from 1979-2006.
(FAO, CONAPESCA-Subdelegación de Pesca en Ensenada BC)

Table 4: Historic records of the Mexican swordfish fishery from 1979-2003.
 Data sources from INP-CONAPESCA-México.

YEARS	FAO y CONAPESCA Metric Tones
1979	7
1980	380
1981*	1575
1982	1365
1983	120
1984	47
1985	18
1986	422
1987	550
1988	613
1989	690
1990*	2650
1991	861
1992	1160
1993	812
1994	581
1995	437
1996	439
1997	2365
1998**	3603
1999	1136
2000	2216
2001	780
2002	465
2003	671
2004	270.1
2005	234.5
2006	347.2

Notes:

*High picks

**High Historic record

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Annex: Appendix with the entire data base of Mexico (tabled in Excel).