

# Estimations of the Shortfin Mako Shark (*Isurus oxyrinchus*) catches by Mexican Pacific fisheries, An update (1976-2016)

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## Abstract

This document presents an update of the estimates for the shortfin mako shark catches landed at four states from northwestern Mexico, for the period of 1976 to 2016. Mexican shark catch statistics by species were not available until recently, so past shortfin mako shark catches were estimated using the different sources of information, assuming different proportions of the species in total catches that have been published in the scientific literature or estimated using more detailed local statistics. In Mexico, shortfin mako sharks are caught mainly by the artisanal and middle size long-line fisheries that target pelagic sharks or swordfish. Catches that were landed in the past by the large size vessel long-line fisheries and the drift gill net fisheries were taken into consideration to construct the historical series. Shortfin mako shark was not an important species in the catch until the 1980s when the catches increased from a level of around 60 metric tons to around 250 t. With the development of the longline fishery in Mazatlan, Sinaloa, during the second half of the 1990s today catches have reach a level of around 1,000 t. Estimates indicate that shortfin mako sharks are caught mainly in the western coast of the Peninsula of Baja California, and waters off the mouth of the Gulf of California.

## Introduction

Pelagic sharks have been targeted within the exclusive economic zone off Mexico's Pacific Coast by the artisanal fishery, the pelagic long-line fishery, and the former drift gillnet fishery (Holts et al. 1998; Sosa-Nishizaki et al. 2008). In the catch compositions of these fisheries, shortfin mako shark has become an important species, and since the middle of the 1980s it has been an species for exportation to the USA, mainly from the port of Ensenada, in Baja California (Holts et al. 1998). Until recently, shark landings in Mexico were not reported by species, but were divided into two groups based on the length. Sharks larger than 150 cm total length (TL) were reported as "Tiburón", while shark less than 150 cm TL were reported as "Cazón". Since 2006, reports with the species composition of the landings started to be published by the official Mexican fisheries agency, the National Commission for Fisheries and Aquaculture (CONAPESCA; [http://www.conapesca.sagarpa.gob.mx/wb/cona/consulta\\_especifica\\_por\\_produccion](http://www.conapesca.sagarpa.gob.mx/wb/cona/consulta_especifica_por_produccion)). Unfortunately, in these reports, landings categorized as "Species not specified" still are listed, and in many state shortfin mako is included in this category.

The objective of this document is to report an update for the estimations of the Mexican shortfin mako shark landings from 1976-2016 following Sosa-Nishizaki et al. (2014) approach.

## Material and Methods

### Catch data

Aggregated shark catches from Mexico's Pacific waters were provided by the Mexican National Institute of Fisheries and Aquaculture (INAPESCA, based in its name in Spanish) for each state in the Mexican Pacific, from 1976-2013. Because shortfin mako shark is manly landed at the Baja California, Baja

California Sur, Sinaloa, Nayarit and Colima states, the estimation is based on their reported total shark catches. For the period of 2008 to 2013 shortfin mako shark catches for each state are here reported as they have been reported by CONAPESCA in its web page (see above). The estimated catches for each of the states followed different assumptions for the proportion that shortfin mako sharks represented in the total shark catch reported, following Sosa-Nishizaki (2013) and Sosa-Nishizaki et al. (2014) approach. For the period 2014 to 2016 catches were submitted by CONAPESCA directly to one of the coauthors (JLCG).

#### Baja California

In Baja California sharks are target by the artisanal fishery that catch mainly sharks (Holts et al. 1998). Since 1986 middle sizes vessels (10-17 m size) drift gillnet fishery started targeting sharks and swordfish, where shortfin mako was an important target species because its value and the demand in USA. This fishery was forbidden by federal regulations in 2010. Some of the drift gill net fishing vessels started to switch fishing gear to long-lines in the middle of the 1990s, and kept targeting swordfish, but also pelagic sharks, mainly blue shark and short fin mako shark (Holts et al. 1998; Sosa-Nishizaki et al. 2008).

Shark landings statistics were obtained from the Mexican fisheries agency office at the port of Ensenada. Because Baja California state has two coasts, one facing the Pacific Ocean and the other the Gulf of California, for some periods in the statistics for each coasta had to be estimated. Reported shark landings are classified by coast for the period of 1992 to 2010, and since 2002 shortfin mako shark landings, in weight, are specified for some of the years. Shortfin mako shark is only landed in the Pacific side, so first we estimated the proportion of the total shark landings that come from the Pacific coast and obtained the Pacific shark catch for each year. Based in the information reported in Sosa-Nishizaki et al. (2002), Sosa-Nishizaki et al. 2008, and Cartamil et al. (2011), the proportion of shortfin mako shark caught by the artisanal fishery was estimated to be 2% of the total yearly catch of sharks caught in the Pacific side. During the 1976 to 1989 period the total shortfin mako shark catches were assumed to be land by the artisanal fishery only, and yearly shark catches were estimated using this proportion.

By 1990 the number of artisanal boats targeting blue and shortfin mako shark increased, and the middle size boats started to land shortfin mako shark, instead of finning them at sea. For the period of 1990 to 1992, in order to reflect this increment, we assumed a proportion of 12% of the shark catches were represented by shortfin mako shark catch. Since 1993, most of the middle size vessels started to land blue shark and shortfin mako, and local landing statistics started to be classified, including both species catches. However, there was a high increment in the blue shark catches representing 55% of the total shark catches in the Pacific for the period of 1993 to 2007, and a decrease of the proportion of the shortfin mako was seen, so we assumed a proportion of 10% during the period of the middle of 1980s to middle 2000s. For the period of 2008 to 2016, based on observations at port, shortfin mako shark landings have decreased to represent only the 7% of the state catches.

#### Baja California Sur

In this state, most of the shortfin mako shark catches come from the artisanal long-line fishery at both Pacific side and Gulf of California coasts (Bizzarro et al. 2009b; Ramirez-Amano 2011). Nevertheless, at Puerto San Carlos in Magdalena Bay of the Pacific coast, a middle size fleet of small number of vessels (4-8 depending the year), have been fishing with drift gillnet and long-line since the middle of 1990s (Ramirez-Gonzales 2002), and switch to long-lines after 2010. During 2015 and 2016 landings at this port increased substantially to 957 t in 2016, to decrease in the following year to around 300 t level.

The proportion of shortfin mako shark catches in the total shark catches of the state were estimated for different periods. From 1976 to 1984, 2 % was considered to be the proportion in the state catches, based on the information reported by Bizzarro et al. (2009b), and considering that fishing in the Pacific coast was less developed. From 1985 to 1989, 4% was used considering the development of the artisanal

fishery in the Pacific coast and the continuation of the fishery in the Gulf of California (Bizzarro et al. 2009b; Ramirez-Amano 2011). For the period of 1990 to 2000, the proportion was raised to 6 % to include the participation of the middle side vessels based in Puerto San Carlos. And for the period 2001 to 2006 the proportion was raised to 8 % to reflect a continuity of the increment of the pelagic shark catches in recent years, suggested by Ramirez-Amano (2011).

#### Sinaloa

Bizzarro et al. (2009a) described the artisanal catches of elasmobranch in the state of Sinaloa, and found very few shortfin sharks among 2,390 sharks analyzed during 1998-1999. Today in the port of Mazatlan pelagic sharks are usually landed by the middle size vessel long-line fishery that is based there. This fishery is one of the less known shark fisheries in the country; however see Castillo-Géniz et al. 2014. The shortfin mako shark catches estimations for this state were done, first, considering the proportion of the total sharks landed in Mazatlan. For the period of 1976 to 1993, because of the lack of information, we assumed that 50% of the sharks landed in Sinaloa were landed in Mazatlan. For the period of 1994 to 2011 we have access to data reporting the proportion of sharks landed in Mazatlan in yearly bases, with values varying from 47% to 94%. These values were used to estimate shark catches landed at Mazatlan. Knowing the total shark catches landed in Mazatlan, for the period of 1976 to 1992 a 1% value was used as the proportion of shortfin mako sharks caught by the local fishery, taking into consideration local artisanal catches observations (Corro-Espinosa unpublished data). To estimate the following years catches, we used a 5.5 % value based on observer on board reports (Castillo-Géniz et al. 2014) and landing reports.

#### Nayarit

Since 2003 the Nayarit state has almost double its “tiburón” and “cazón” landings from a level of 843 t to 1,594 t in 2011 (CONAPESCA 2011). In this state, sharks are landed only by the artisanal fishery. Pérez4 Jiménez et al. (2005) and Mondragon-Sanchez (2011) estimated that blue shark represented 1% of the catches in the most important fishing areas of Nayarit. We used this proportion to estimate the blue shark catches for this state during the period of 1976 to 2013, because the fishery has not changed significantly during the whole period (Mondragon-Sanchez, 2011).

#### Colima

Shortfin mako shark catches in the state of Colima are landed mainly in the port of Manzanillo, where a large size vessel long-line fishery operated during the period of 1986 to 2002 (Mendizabal y Oriza et al., 2002). Before that period most of the fishing was carried out by the artisanal fishery, and we assumed a 0.1% of shortfin mako for this fishery. Since 2003, a long line fishery using middle size vessels (10-14 m long), started to operate targeting sharks in costal pelagic waters (Vögler et al., 2012). Yearly blue shark catches for the state were estimated, for the period of 1976 to 1986, assuming artisanal operations only, with a proportion of 1% similar to Nayarit. Then for the period of 1986 to 2002, I used the yearly proportions of blue shark reported by Mendizabal y Oriza et al., (2002). Then a proportion of 1% was used to reflect the catches of shortfin mako shark by the coastal middle size vessels (Santana-Hernández personal communication), for the 2003 to 2006 period. Finally, we used shortfin mako shark catches reported for the state by CONAPESCA.

### Results and Discussion

#### Catch data

Estimates indicate that shortfin mako sharks are caught mainly in the western coast of the Peninsula of Baja California, and waters off the mouth of the Gulf of California. Today Baja California seems to be the most important landing place for the species, followed by Sinaloa and Baja California Sur (Table 1). Shortfin mako shark was not an important species in the catch until the 1980s when the catches increased from a level of around 60 metric tons to around 250 t. With the development of the longline fishery in Mazatlan, Sinaloa, during the second half of the 1990s up to 2013 catches increased to a level around 700 t. However, in 2014 double and reached a level of around 1,400 t, to pick in 2015 with a value of 1,600 t

in 2015. In 2016 catches decreased once again around a level around 700 t (Table 1). The reasons for this increase in 2014 and 2015 might be related with the oceanographically conditions or other factors that have not been analyzed.

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Table 1. Mexican shortfin mako shark landings estimations in metric tones (live weight) by state. BC= Baja California state, BCS= Baja California Sur, SIN= Sinaloa, NAY= Nayarit, and COL=

Colima

<b>Year</b>	<b>BC</b>	<b>BCS</b>	<b>SIN</b>	<b>NAY</b>	<b>COL</b>	<b>TOTAL</b>
1976	13	53	6	1	0	73
1977	7	57	6	2	0	72
1978	7	85	6	5	0	103
1979	8	35	8	13	0	65
1980	16	35	1	12	1	66
1981	22	16	5	13	1	56
1982	36	25	5	9	1	75
1983	32	26	4	5	1	67
1984	21	19	4	4	2	49
1985	7	28	3	3	1	43
1986	16	41	3	6	20	84
1987	128	49	3	3	13	197
1988	151	80	2	2	12	248
1989	83	31	2	4	14	135
1990	170	87	3	4	23	288
1991	120	78	3	4	23	228
1992	221	129	3	4	19	376
1993	205	149	65	3	21	442
1994	180	94	34	3	24	336
1995	125	151	22	4	32	333
1996	180	157	44	3	29	413
1997	202	126	55	2	16	401
1998	226	106	38	4	14	386
1999	144	209	68	4	13	439
2000	255	176	88	10	10	539
2001	293	129	53	7	10	491
2002	282	110	78	6	12	488
2003	263	85	111	5	8	471
2004	412	118	318	7	9	865
2005	258	130	208	4	8	609
2006	268	112	252	3	5	641
2007	207	137	335	3	7	689
2008	244	156	197	5	7	609
2009	284	154	201	7	6	653
2010	257	293	199	8	4	760
2011	211	309	219	8	11	758
2012	243	245	205	14	7	715
2013	258	220	211	17	6	711
2014	531	394	466	75	1	1467
2015	296	957	375	25	0	1653
2016	117	284	255	4	0	660