ISC/25/PLENARY/08

PLENARY 08

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International Scientific Committee for Tuna
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NATIONAL REPORT OF MEXICO: MEXICAN TUNA AND TUNA-LIKE FISHERIES IN THE NORTH PACIFIC OCEAN IN 2024 [1]

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and FIDEMAR

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INTRODUCTION

This national report describes the recent trends of the Mexican tuna fishery for the tuna and tuna-like species in the ISC area.

In Mexico, the Mexican Institute of Sustainable Fisheries and Aquaculture Research (Instituto Mexicano de Investigación en Pesca y Acuacultura Sustentables, IMIPAS, formerly INAPESCA and INP), was created more than sixty years ago to systematically conduct scientific work and fisheries research with the marine resources of Mexico. The IMIPAS is responsible of providing the scientific bases for the management advice to the fisheries authorities in México and has stablished along its coastal states, in both, Pacific and Gulf of Mexico, 14 regional aquaculture and fisheries centers (CRIAPs) which are the centers and laboratories in charge of data collecting, sampling, monitoring and assessment of the main fisheries and aquaculture activities on a regional scale. Since 1992, the IMIPAS incorporated to this effort, the work of the National Tuna-Dolphin Program (Programa Nacional de Aprovechamiento del Atún y Protección del Delfín, PNAAPD of FIDEMAR), which closely monitors and study the tuna fishery of its purse seine and longline national fleets. The data here reported is based on the combined efforts from these different and unified groups.

1. SHARKS

Mexico participated in a 5-day hybrid meeting held in Yokohama, Japan from January 27 – 30 and February 3, 2025 with virtual participation of the Mexican delegation though Microsoft Teams. In the workshop participate delegates from Chinese Taipei (TWN), Japan (JPN), Mexico, the United States of America (USA), the Inter-American Tropical Tuna Commission (IATTC), and The International Commission for the Conservation of Atlantic Tunas (ICCAT).

The primary goal of the workshop was to conduct an indicator analysis of the North Pacific blue shark and to recommend whether a benchmark assessment should occur prior to the scheduled benchmark stock assessment in 2027.

Seven working papers and four presentations were submitted. The WG agreed to post all working papers on the ISC website and make them publicly available following the close of the meeting.

Twenty working and information papers about a broad range of topics were provided and some presented during the workshop, all approved for posting on the ISC website (http://isc.fra.go.jp/). Mexico presented the working paper "Update on standardized catch rates for blue shark (Prionace glauca) in the 2006-2022 Mexican Pacific longline fisheries based upon a shark scientific observer program", (ISC/25/SHARKWG-1/1), by José Ignacio Fernández-Méndez, Luis Vicente González-Ania, Georgina Ramírez-Soberón, José Leonardo Castillo-Géniz, and Horacio Haro- Ávalos.

In this working paper Abundance indices for blue shark (*Prionace glauca*) in the northwest Mexican Pacific for the period 2006-2022 were estimated using data obtained through a pelagic longline observer program, for two partially overlapping fisheries. Individual longline set catch per unit effort data, collected by scientific observers, were analyzed to assess effects of environmental factors (such as sea surface temperature, mean-SST anomalies), time-area factors (Year, quarter, distance to the nearest point on the coast including islands), and fishing strategy (nocturnal vs diurnal fishing sets).

Standardized catch rates were estimated by applying generalized linear models (GLMs) to data from two fleets (Ensenada and Mazatlán). Sea surface temperature, mean SST anomalies, distance to the coast, latitude, year, quarter and catch of swordfish in the fishing set were all significant factors included in the model.

The results of this analysis show a relatively stable trend in the standardized abundance index in the period considered for the Ensenada fleet (operating mainly above 25° N) and a descending trend in the last years of the time series for the Mazatlán fleet (operating mostly below 25° N).

These trends could be explained in terms of the different fishing strategies of the fleets involved as can be seen in the following figures, which show the positive sets for blue shark (in green) and the negative ones (in red) for the period between 2006 and 2022 for both fleets. In the case of the Mazatlán fleet the cluster of negative sets seen at the mouth of the Gulf of California, is the result of fishing operations taking place after 2012 (figure 1).

It was discussed whether the target shifting (from blue shark to swordfish) was seasonal and, if so, whether it would be reasonable to use year-season as a random effect. The authors indicated that this shift was not seasonal. It was also suggested that, given this, it might be better to separate the CPUE time series into before and after 2014/2015 when the targeting changed.

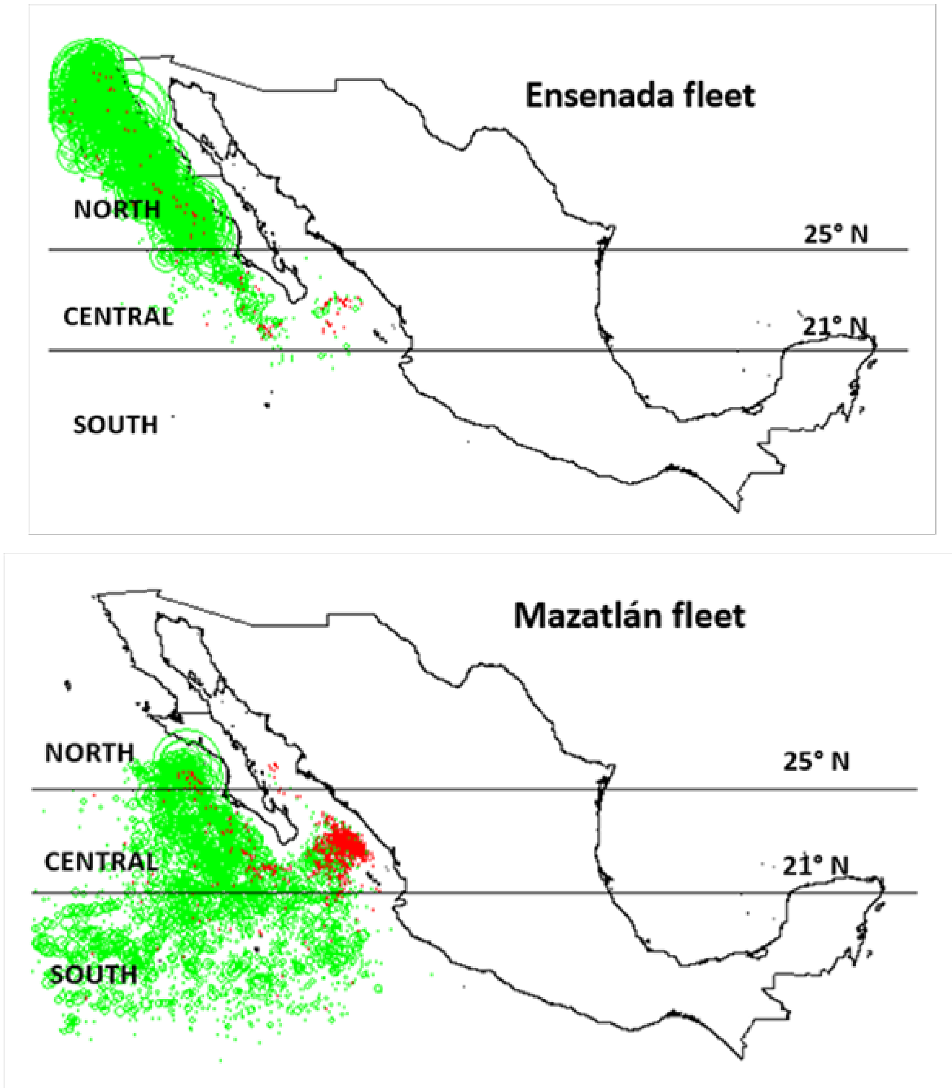

Figure 1. Distribution of positive (green) and negative (red) fishing sets for blue shark for the Ensenada and Mazatlán fleets (see text).

The Mexican National Aquaculture and Fisheries Commission (CONAPESCA 2023) reported an average catch of blue shark of 2,862t for the period 2001-2023 for the Mexican Pacific. In 2023, Baja California Sur(BCS) accounted for 23.8% of the total catch, followed by Sinaloa (23.6%) and Chiapas (16.9%). According to those official figures, the total annual catch of blue sharks in the Mexican Pacific has shown a consistent growth (figure 2).

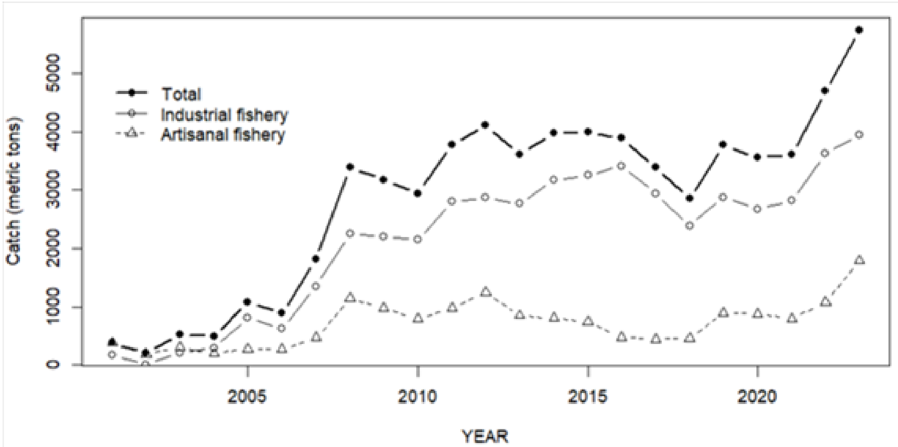

Figure 2. Total, industrial and artisanal catch of blue shark from the Mexican Pacific, 2001-2023. Source: CONAPESCA 2023.

The WG also asked about this increasing trend in blue shark catches in the Mexican Pacific longline fisheries, and whether that trend could be attributed to a corresponding increase in fishing effort. The author responded that this was not the case, as far as he knows, but it is something they will check, as it may be an issue with the way the Mexican fishing administrative authorities are processing the shark landing data.

The WG expressed some concerns with the Mazatlan fleet, they suggested focusing effort on Ensenada data only, and removing Mazatlan data from the model. As that meeting was not meant to focus on improving CPUE methodologies but rather to update the group on current CPUE trends for use in an indicator analysis the group paused this discussion. The authors indicated that they look forward to further collaborations to improve Mexico's CPUE indices.

In the session concerning the environmental effects on the blue shark fishery José Ignacio Fernández-Méndez made a presentation on the paper Marine-climate interactions with the blue shark (Prionace glauca) catches in the western coast of Baja California Peninsula, Mexico, by Godínez-Padilla, et al., In that paper it was reported Fishery and size data from 28,110 blue sharks (Prionace glauca), collected during 2,162 longline sets on 204 industrial fishing trips from Ensenada, Mexico (2006–2016), were used to perform a spatial-temporal analysis of catch-per-unit-effort (CPUE) and its relationship with climate indices along the western Baja California Peninsula.

The catch mainly consisted of juvenile females (58–199 cm TL) and males (60–179 cm TL). Seasonal CPUE patterns were associated with sea surface temperature (SST) and Chlorophyll-a (Chl), indicating that aggregations occurred in areas with specific oceanographic processes.

The SanDiAs local climate index showed the strongest correlation with annual CPUE variation (figure 3). A generalized additive model (GAM) with 13 predictor variables explained 50.5% of overall CPUE variation and 65.5% for juvenile females.

Key factors influencing CPUE included SST, NPGO, year, latitude with distance to coast and seasonal interactions, and number of hooks set. Delayed effects (over one year) from NEI and SanDiAs indices also impacted CPUE trends. The study suggests that local and regional climate indices are effective tools for predicting blue shark catches in the Northwestern Mexican Pacific.

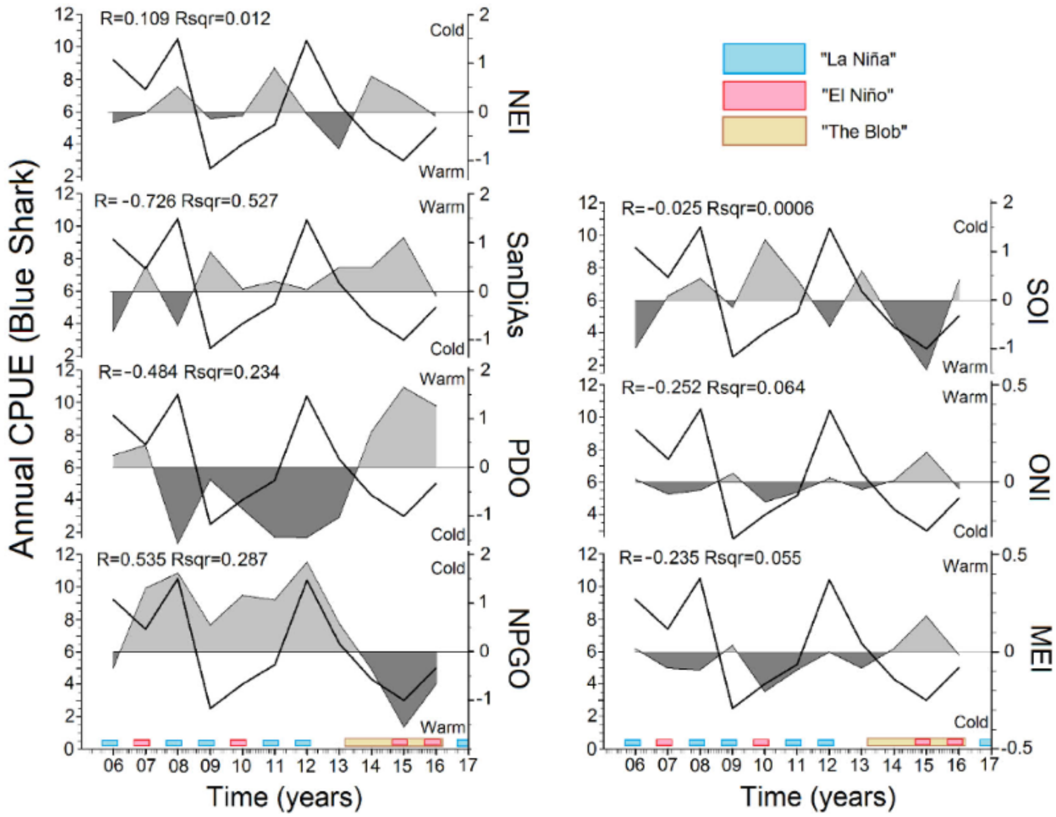

Figure 3. Exploratory analysis of annual means values of the climate indices, where it is shown that SanDiAs had the best correlation with blue shark CPUE.

The WG expressed their interest in seeing this type of analysis being continued. It was noted that the aim and results of this study closely match the discussion on climate change and its effect on ISC species. The possibility of including this effect in future projections of North Pacific blue shark was also mentioned.

The WG noted that the IATTC was doing similar work, and there may be room for some overlap.

The WG pointed out the issues with identifying which observed effects are related to catchability and which are climate-related, something that will need to be considered in terms of what needs to be accounted for or controlled for in a standardization model. These kinds of issues are difficult to understand but something the WG will need to continue working on.

During the session on blue and mako shark biology, a presentation on blue shark reproduction in the Mexican Pacific was delivered by Javier Tóvar on behalf of the author, Leonardo Castillo-Géniz, who was unable to attend Reproductive biology of the blue shark, Prionace glauca (Linnaeus 1758), that inhabits the waters of the Mexican Pacific, (2018-2023), (Castillo-Géniz, 2025).

The blue shark (Prionace glauca) is the most abundant shark species in the northern and central Mexican Pacific, targeted and caught as bycatch by both industrial and artisanal fisheries. Landings peaked in 2015 with 5,734 tons. Despite its importance, only two studies on its reproductive biology have been published in the last decade.

To better understand its reproductive cycle, a study was conducted from 2018 to 2023, examining 726 sharks (362 males, 364 females) voluntarily provided by 21 longline vessels from Ensenada, Baja California. For each shark, detailed data including capture date, location, measurements, and reproductive organ conditions were collected. Maturity was assessed using Fujinami et al. (2017)'s reproductive scale.

Results showed:

- Females ranged from 76–200 cm PCL; 23% were juveniles, 22% adolescents, 7% adults, 36% pregnant, and 12% postpartum. Overall, 55% were mature.
- Males ranged from 74–219 cm PCL; 43.2% were juveniles, 25.8% adolescents, and 31% mature, meaning 69% were immature.

L50 (length at 50% maturity) was estimated at 148.5 cm PCL for females and 155.7 cm PCL for males (figure 4).

A subsample of 107 females had their oviducal glands examined for sperm, and 49% showed evidence of sperm presence. 128 pregnant females with 2,362 embryos were studied; almost all exhibited capture-induced parturition (premature birth or abortion).

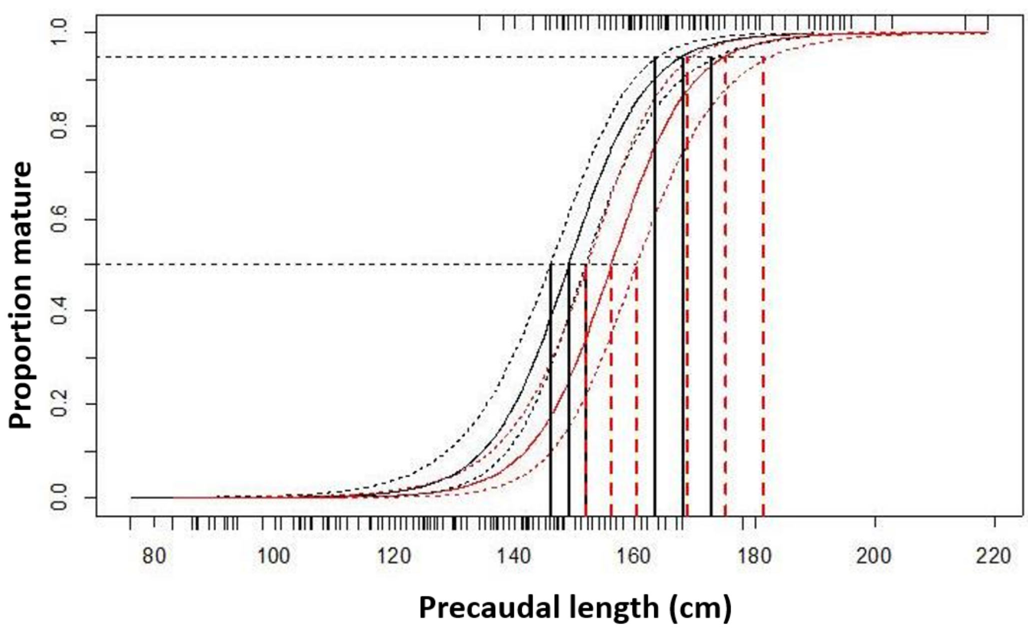

Figure 4. Ojivas de madurez sexual de machos y hembras de tiburón azul del Pacífico oriental mexicano con intervalos de confianza. Línea sólida negra = machos, roja = hembras. Líneas verticales sólidas negras determinan la proporción (probabilidad) de madurez de L50 y L95 en la población de machos. Las líneas verticales cortadas rojas son la L 50 y L 95%.

Embryonic development suggested a gestation period of about 11 months, with most births occurring between May and July. Ovarian follicle growth showed peaks in April–May and October–November. These findings indicate that the blue shark reproductive cycle in the eastern Mexican Pacific is longer than one year, differing from previous studies.

During the discussion, the Working Group (WG) raised several key points regarding the blue shark reproductive study:

- Maturity Size Differences: The WG questioned whether the observed differences in L50 between the eastern and western Pacific were biological or due to methodological inconsistencies. The authors clarified that the same maturity criteria were used in both regions, suggesting the differences are likely biological.
- Reproductive Cycle Confidence: The WG emphasized the importance of accurately identifying the reproductive cycle, especially for future CKMR (Close-Kin Mark-Recapture) work. The authors expressed confidence in their finding that blue sharks have a reproductive cycle longer than one year, supported by the study's sample size and frequency.
- Size Frequency of Samples: The WG inquired about sample size distribution, noting that differences had affected past assessments for mako sharks. The authors responded that this was not a major concern in the current study.
- Resting Periods in Females: The WG asked if non-pregnant adult females were observed, which would suggest a resting period. The authors confirmed that such females were found, indicating that a resting period is likely in blue sharks.
- Follicle Diameter Measurement: The WG noted differences between this study and Fujinami et al. (2017) regarding the relationship between embryo and follicle development. They recommended comparing measurement methods to verify the discrepancies.
- Impact on Assessment and Litter Size Relationship: The WG highlighted that this study will significantly influence the next stock assessment. They questioned whether the relationship between maternal PCL and litter size might be exponential rather than linear. The authors had not yet explored this and agreed to investigate further.
- Climate Change Effects: Lastly, the WG asked about the potential effects of global warming (e.g., SST) on reproduction. The authors stated they had no current opinion or data on this aspect.

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Godínez-Padilla, C., Castillo-Géniz, L., Hernández de la Torre, B., González-Ania, L., Román-Verdesoto, M. (2022). Marine-climate interactions with the blue shark (Prionace glauca) catches in the western coast of Baja California Peninsula, Mexico. 2022. Fisheries Oceanography 31(15) DOI:10.1111/fog.12578

2. TUNAS

In this region the Mexican fleet concentrates mainly in the yellowfin (Thunnus albacares), which is the prime target tuna species. The Mexican tuna purse seine fishery is one of the largest in the (ETP) since the mid 1980's. Due to its large volumes, YFT represents the main component of the catch by Mexico. Other tuna species that are also caught, but contrastingly in lower proportions are: the skipjack, (Katsuwonus pelamis), and for the last 25 years, in northerly zones of the Mexican EEZ, the bluefin (Thunnus orientalis) which is targeted by some vessels and sporadically the albacore (Thunnus alalunga). The fishing operations of the Mexican purse seine fishery comprise a vast area in the EPO, under the IATTC convention area.

The total tuna landings of Mexico in 2003 were 183199 mt. Catch which represented the highest historic record for this fishery but in 2024 a new record of 186439 tons was stablished. Comparatively, the lowest recorded capture in this fishery during recent years was in the 2006 season, with only 102472 mt., value which is closer to the 1980's development phase. After 2008, catch levels recovered. The fleet has compensated partially its catches primarily with skipjack.

These high consistent reported catches are the result of the combination of the fishing experience and performance of the fleet as well as the effect of high recruitments in previous years and are not related with any significant increase in the fishing effort or a greater expansion of its carrying capacity during the corresponding years. Lower catches in 2006 and 2007 are probably related to a decrease in population levels of yellowfin tuna (lower recruitment) and excessive catches of juvenile tunas in coastal areas in the EPO. In recent years catches have recovered to average levels.

The purse seine fleet is subdivided in purse seine vessels, most of them with observers on board all tuna fishing trips and a small quantity of pole and line vessels (Table 3). The whole fleet is quite stable in number, composition and carrying capacity since the 1990´s.

Yellowfin tuna always has been the primary catch, and skipjack is always second in volume. Other tuna species have high values because the fleet has compensated lower yellowfin catches with other tunas, basically with skipjack but a slight increase is related also with Bluefin tuna catches (Table 4).

Table 3. Size, composition and carrying capacity of the active Mexican tuna fleet from 2007 to 2024, in EPO

YEAR	No. of active tuna boats	No. of m PSeiners > 400 m3	No. of PSeiners < 400 m3	No. of active Bait Boats
2007	55	42	11	2
2008	49	39	8	2
2009	46	38	6	2
2010	42	36	3	3
2011	43	38	3	2
2012	45	39	3	3
2013	43	37	3	3
2014	47	42	3	2
2015	47	42	3	1
2016	47	42	3	1
2017	51	46	5	0
2018	53	48	5	0

2019	**51**	**46**	**5**	**0**
2020	**48**	**44**	**4**	**0**
2021	**51**	**46**	**5**	**0**
2022	**52**	**47**	**5**	**0**
2023	**53**	**49**	**4**	**0**
2024	**50**	**47**	**3**	**0**

Table 4. Total tuna catch of YFT, SKJ ALB and PBF by the Mexican fishery (2005-2024)

YEAR	YFT	SKJ	ALB	PBF
2005	113279	32985	0	4542
2006	68644	18655	109	9806
2007	65834	21970	40	4147
2008	85517	21931	10	4407
2009	99157	9310	17	3019
2010	101523	6090	25	7746
2011	102887	8600	0	2731
2012	93686	18259	0	6668
2013	113619	17185	0	3154
2014	120986	8777	0	4862
2015	106188	23497	0	3082
2016	93904	13286	0	2709
2017	80747	21400	0	3643
2018	102000	16700	0	2840
2019	106000	19700	0	2249*
2020	102295	7240	0	3285
2021	108043	7995	0	3027
2022	119555	15609	0	3194
2023	140853	10900	0	3407**
2024	156827	21796	0	3558

*this amount includes 245 tons of PBF released alive
** includes catch of artisanal vessels with longline

2.1. Bluefin Tuna

All the fishing zones for bluefin tuna used by the Mexican fleet are located in the Northwest side of the Baja California peninsula, within Mexico's Exclusive Economic Zone (EEZ), and have been closer to the ranching locations in recent years.Recorded catches of PBF are registered from march to September, time in which the transpacific migration of this stock is closer to the Mexican Pacific coast, due to oceanographic factors. Sea conditions together with the presence of the specie permitted the development of this new fishery predominantly related to ranching activities in the Mexican Northwestern coastal area. Temperature is an important factor defining areas were PBF is to be found. The fishing season has shifted from may-june to the first quarter in recent years (2019-2024).

The time series of bluefin tuna captured by the Mexican tuna purse seine boats from 2005-2024 is presented in Table 3 This represents a small proportion of the Mexican tuna catch, although very valuable. The 3,700 mt. catch reported in 1996 was the first historic highest record for this fishery and the first year bluefin tuna has been targeted by the fleet. Again, in 2004 and 2006 new records were established for this tuna specie in Mexico. In 2007 the catch returned closer to the average. In 2009 due to the international economic crisis many companies did not operate and catches were below average. In 2010 catches increased again and since 2012, management measures were implemented in IATTC area limiting the PBF catch. The catch in the Eastern Pacific nevertheless is below the historic highs observed in the 1960's and 1970's. The information provided makes clear that fishing for bluefin has not been a significant important activity in Mexico for many years. It also shows that even in some fishing seasons there were no captures on this stock, or those were only of low levels. Therefore, it is clear that fishing bluefin in Mexico was considered only oportunistic. However, for more than 25 years (1996-to present time) there has been a greater interest devoted to this species, mainly for the ranching activities developed in the Northwest region of Mexico.

The catches of bluefin for ranching are performed only with commercial purse seiners (normally searching for YFT) with a deeper purse seine net. Bluefin tunas are transferred from the purse seine net to "transfer" nets then to the enclosures and fattening nets located in northern Baja California peninsula.

There is also a US sport fishery that operates in Mexican EEZ that is reported by the US as well as a Mexican sport fishery that caught 48 tons in 2022, 11 tons in 2023 and 4 tons in 2024.

2.2. Effort

Only 6 vessels participated in the purse seine-farming fishery in 2023 plus 3 artisanal vessels that caught 8 tons. In 2024, 12 vessels participated in PBF catch for farming and 6 artisanal vessels with 27 tons catch

2.3. Ranching Activities

Ranching activities started in 1996 but fully developed until 2001. Catch before 2012 (quotas implemented since that year) have been variable, making evident that oceanographic conditions and the eastern distribution of the specie are limiting factors for the Mexican bluefin fishery. In 2005, 2006 an estimated 80% of the catch was transported to the ranching companies and the other 20% went to the Mexican market. In recent years, all PBF is used in ranching activities. This represents an economic incentive for the Mexican tuna fishery and has a regional economic impact especially in northwestern Mexico.

The size composition of the PBF catch for farming is obtained from stereoscopic cameras that are used during transfer operations. Information is available, used to estimate size composition of the catch and shared with ISC as well as IATTC.

2.4. Management

Management of the tuna fishery is done within the framework of the IATTC. For tropical tunas the main aspect of regulation is a time closure and for PBF a Catch quota. The catch of PBF is closely monitored by 100% scientific observer's coverage on board all the fishing activities (both a national and IATTC observer programs). All information is reported and shared between observer programs and based on the quota and catch amount information is reported daily to mexican authority and IATTC to ensure a quick response from managers and timing of the closure season. All catch is within catch limits established in IATTC resolution C-21-05. Part of the PBF catch limit authorized for Mexico has been cut from the available amount for purse seiners in order to give permits for artisanal vessels. The PBF catch of those vessels is small.

2.5. Research

Some of the research related to tuna and tuna like species can be obtained by contact with authors of documents published in "El Vigia" of the PNAAPD (see www.fidemar.org)

In relation to Close Kin program, Mexico is still collecting tissue samples, starting in 2016 and up to the present year

2.6. Climate Change

There is a small group of scientists in IMIPAS involved in climate change with the aim to incorpórate in stock assesments and management advice. IMIPAS has participated internally within the mexican government to address this topic as well as in la iontergovernmental l latinamerican fórum.

Also some work has been done in order to predict recruitment levels for PBF in relation to climate variables and environmental indices. Work that will be presented to the PBFWG

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