



IOTC-2025-WPB23-07 2-BLM

REVIEW OF THE STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN BLACK MARLIN (1950-2023)

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Abstract

Black marlin (Istiompax indica) are found in all oceans worldwide, with the Western-Central Pacific and Indian Oceans being the two primary regions of occurrence. The recent increase in reported black marlin catches in the Indian Ocean reflects the growing intensity of coastal fisheries targeting billfish species. This document provides an overview of consolidated knowledge on fisheries catching black marlin in the Indian Ocean since the early 1950s, based on data sets submitted by the Contracting Parties and Cooperating Non-Contracting Parties (CPCs) of the Indian Ocean Tuna Commission (IOTC) and curated by the IOTC Secretariat. Available fisheries statistics indicate a significant increased in black marlin catches in recent years, following a variation in catches over several decades. While industrial longline fisheries were the primary source of reported catches before the 1980s, the contribution from coastal fisheries has steadily grown since then, accounting for over 48% of the total black marlin catch in 2023. The peak in catches observed over the past two years is primarily attributed to high landings from Iranian gillnet fisheries. Meanwhile, catches from industrial fisheries, particularly longliners, have declined, largely due to shifts in target species (mainly tunas for other markets) and changes in fishing grounds around 2010. Longline fisheries from Sri Lanka and India have also seen a reduction in activity during this period. Available data on discard in industrial fisheries suggest that discard rates are low in longline operations. However, black marlin are more frequently discarded, albeit in small quantities, in largescale purse seine fisheries. Discards in coastal fisheries are poorly documented but are believed to be negligible. Information on the spatial distribution of catch and fishing effort has significantly improved over the last decade. It shows that black marlin are primarily caught in the northwestern Indian Ocean, with notable catches along the coasts of the Arabian Sea, India, and Sri Lanka. Reporting of size-frequency data has also slightly improved, though it remains limited for most artisanal and industrial fisheries.

Keywords: billfish | black marlin | Indian Ocean | tuna fisheries

Introduction

Black marlin is distributed throughout tropical and subtropical waters of the Pacific and Indian Oceans. Data from tuna Regional Fisheries Management Organizations (tRFMOs) indicate a steady increase in global black marlin catches from the mid-1970s until 2016, when reported landings peaked at approximately 32,000 t (**Fig. 1a**). Historically, the Pacific Ocean accounted for the majority of black marlin catches, up to 66%, until the mid-1970s, when the expansion of longline fisheries in the Indian Ocean began to shift this distribution. Since then, the Indian Ocean has become the primary fishing ground for black marlin, contributing up to 73% of global catches in recent years (**Fig. 1b**).

The stock assessment conducted in 2016 suggested that the continued increase in catches was likely contributing to overfishing of the black marlin population in the Indian Ocean ((Yokoi & Nishida 2016)) & (Andrade 2016)). Although reported catches declined between 2017 and 2021, they have nearly doubled over the past two years. Nevertheless, the current status of the black marlin stock remains uncertain. Despite these concerns, catch levels have remained high. Globally, the IUCN classifies the black marlin as Data Deficient (DD) due to limited information and frequent misidentification with other marlin species (Collette et al. 2022).

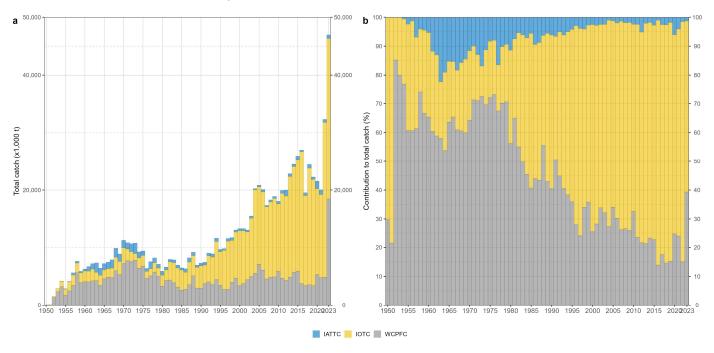


Figure 1: Annual time series of cumulative retained catches (metric tonnes; t) of black marlin by region1950-2023. Source: (https://www.fao.org/fishery/statistics-query/en/capture/capture_quantity))

The overarching objective of this paper is to provide participants at the data preparatory meeting of the 23rd Session of the IOTC Working Party on Billfish (WPB23) with a review of the status of the information available on black marlin, in the Indian Ocean through temporal and spatial trends in catches and their main recent features, as well as an assessment of the reporting quality of the data sets. A full description of the data collated and curated by the Secretariat is available in (IOTC2025?).

Total retained (nominal) catch

Historical trends (1950-2023)

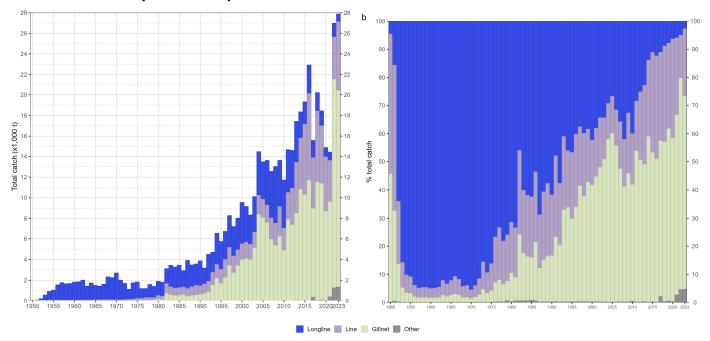


Figure 2: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of black marlin by group of fishery for the period 1950-2023. Data source: best scientific estimates of retained catches

An increasing trend in black marlin catches has been observed since the 1990s, particularly from gillnet fisheries. This rise is largely attributed to the expansion of offshore fisheries in Sri Lanka beginning in the mid-1990s, which specifically targeted billfish species, and to the growth of Iranian fisheries from the mid-2000s onward. While industrial fisheries began shifting their focus to other target species during the mid-1990s, catches from medium- and small-scale fisheries have remained consistently high (Figs. 2-5 and Table 1). Historically, Japanese, Korean, and Taiwanese longline fleets accounted for the majority of black marlin catches in the Indian Ocean. However, this dominance shifted in the mid-1980s with the emergence of Sri Lankan fleets using a combination of gillnet and longline gears. From the 2000s, the Islamic Republic of Iran began reporting the highest catches of black marlin, significantly contributing to the overall increase in offshore fishery landings (Fig. 3). In 2023, gillnet fisheries accounted for 68% of the total retained black marlin catch reported to the IOTC Secretariat, with Iran alone contributing 48% of that total.

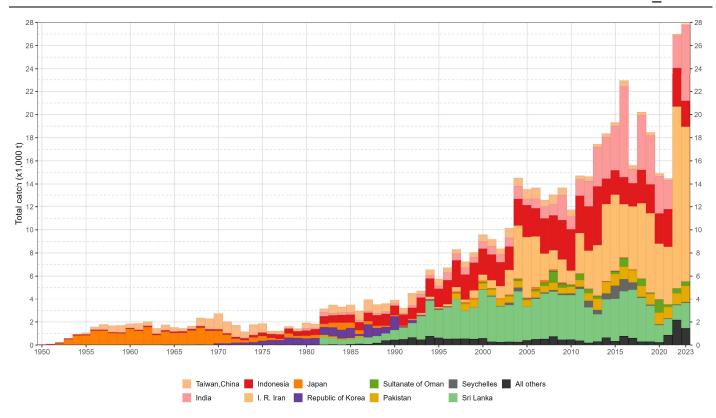


Figure 3: Annual time series of retained catches by fleet for the period 1950-2023. Data source: best scientific estimates of retained catches

Table 1: Best scientific estimates of average annual retained catches (metric tonnes; t) of black marlin by decade and fishery for the period 1950-2019. The background intensity color of each cell is directly proportional to the catch level. Data source: [best scientific estimates of retained catches](https://www.iotc.org/WPB/23/Data/03-NC)

Fishery	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Purse seine Other	0	1	2	7	9	14	59
Longline Other	0	0	0	30	866	1,809	692
Longline Fresh	10	16	37	131	578	1,242	1,253
Longline Deep-freezing	870	1,673	1,396	1,724	1,147	991	947
Line Coastal longline	30	43	88	260	583	1,011	3,174
Line Trolling	16	22	44	135	309	544	804
Line Handline	9	13	26	312	432	301	1,100
Baitboat	0	0	0	1	2	3	9
Gillnet	32	41	71	491	1,962	5,886	9,288
Other	0	0	1	9	3	5	9
Total	966	1,811	1,664	3,100	5,890	11,806	17,335

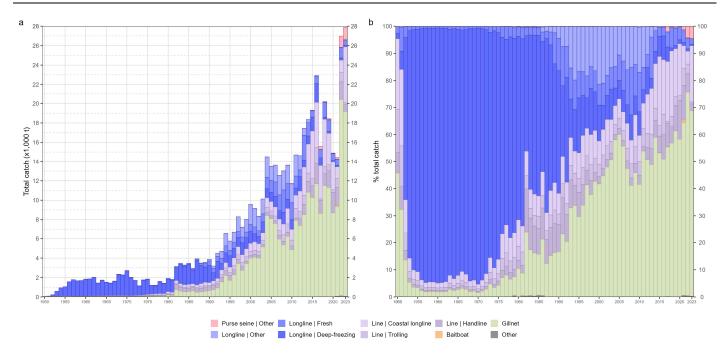


Figure 4: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of black marlin by fishery for the period 1950-2023. Data source: best scientific estimates of retained catches

Table 2: Best scientific estimates of annual retained catches (metric tonnes; t) of black marlin by fishery for the period 2014-2023. The background intensity color of each cell is directly proportional to the catch level. Data source: [best scientific estimates of retained catches](https://www.iotc.org/WPB/23/Data/03-NC)

Fishery	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Purse seine Other	7	13	12	315	61	94	26	188	1,154	1,269
Longline Other	304	60	73	55	48	54	50	57	55	37
Longline Fresh	1,382	636	727	822	1,504	1,158	668	625	1,036	540
Longline Deep-freezing	833	1,439	2,013	832	222	218	218	167	237	156
Line Coastal longline	3,032	4,948	4,623	3,447	4,884	3,282	2,868	1,189	1,271	5,800
Line Trolling	834	731	1,716	120	774	597	256	908	970	207
Line Handline	1,126	1,177	2,072	1,344	1,213	1,731	2,119	1,876	1,858	706
Baitboat	9	22	7	18	2	2	5	142	1	0
Gillnet	10,815	10,275	11,680	8,626	11,490	11,306	8,684	9,236	20,285	19,086
Other	9	11	7	22	8	8	11	80	118	76
Total	18,350	19,312	22,931	15,601	20,208	18,451	14,904	14,468	26,985	27,878

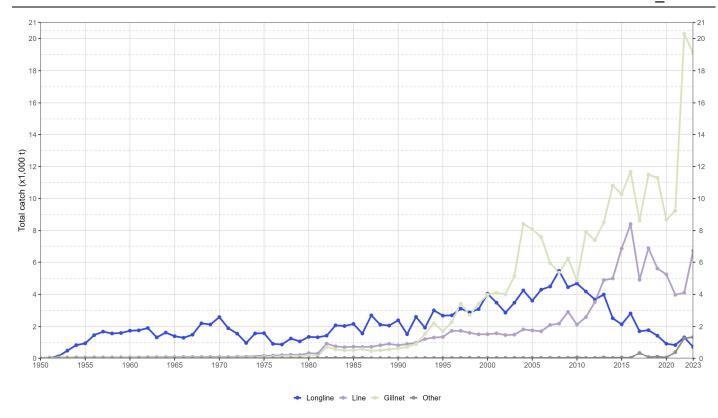


Figure 5: Annual time series of total retained catches (metric tonnes; t) of black marlin by fishery group for the period 1950-2023. Data source: best scientific estimates of retained catches

Main fishery features (2019-2023)

In addition to the rising black marlin catches from gillnet fisheries, catches from line fisheries, particularly coastal longline fisheries, have also shown an upward trend. Coastal longline catches have varied over time, with a notable peak of 5,800t recorded in 2023. By contrast, gillnet fisheries experienced a steady increase beginning around 2014, with catches averaging approximately 10,000 t annually between 2014 and 2021. This was followed by a substantial rise, with average catches doubling to around 20,000 t between 2022 and 2023. In recent years, more than 92% of total black marlin catches have been attributed to gillnet and line fisheries (**Table 3**).

Fleet-wise, the Islamic Republic of Iran contributed over 45% of the total black marlin catch, all of which was derived from gillnet fisheries. India and Sri Lanka followed, accounting for approximately 19% and 9% of the total catch, respectively, from several gear types (**Fig. 6**).

The data reveal notable trends in catch composition by fishery and fleet. In particular, Iran's gillnet fisheries continued to grow in 2022 and beyond, with catches more than doubling compared to 2021 levels. A moderate increase in catches from line fisheries was also observed, primarily due to higher landings reported by India and Indonesia. Additionally, industrial longline fisheries recorded increased catches, largely driven by expanded operations in Indonesia (Figs. 7-8).

Table 3: Mean annual catches (metric tonnes; t) of black marlin by fishery between 2019 and 2023. Data source: [best scientific estimates of retained catches](https://www.iotc.org/WPB/23/Data/03-NC)

Fishery	Fishery code	Catch	Percentage
Gillnet	GN	13,719	66.8
Line Coastal longline	LIC	2,882	14.0
Line Handline	LIH	1,658	8.1
Longline Fresh	LLF	806	3.9
Line Trolling	LIT	588	2.9
Purse seine Other	PSOT	546	2.7
Longline Deep-freezing	LLD	199	1.0
Other	ОТ	59	0.3
Longline Other	LLO	51	0.2
Baitboat	ВВ	30	0.1

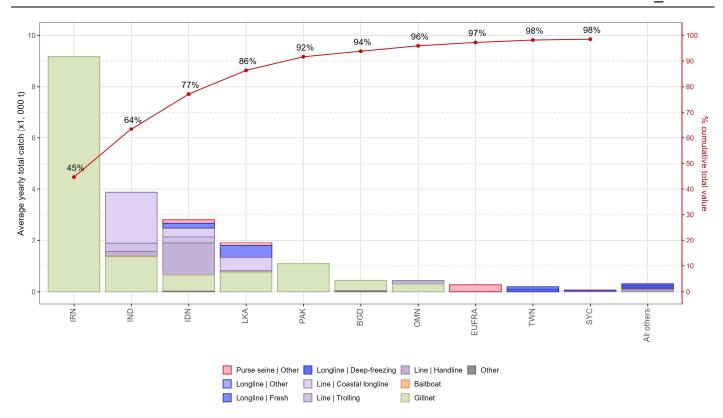


Figure 6: Mean annual catches (metric tonnes; t) of black marlin by fleet and fishery between 2019 and 2023, with indication of cumulative catches by fleet. Data source: best scientific estimates of retained catches

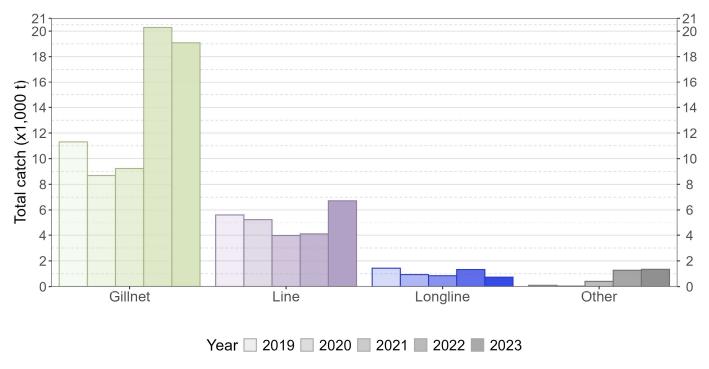


Figure 7: Annual catch (metric tonnes; t) trends of black marlin by fishery group between 2019 and 2023. Data source: <u>best scientific estimates</u> of retained catches

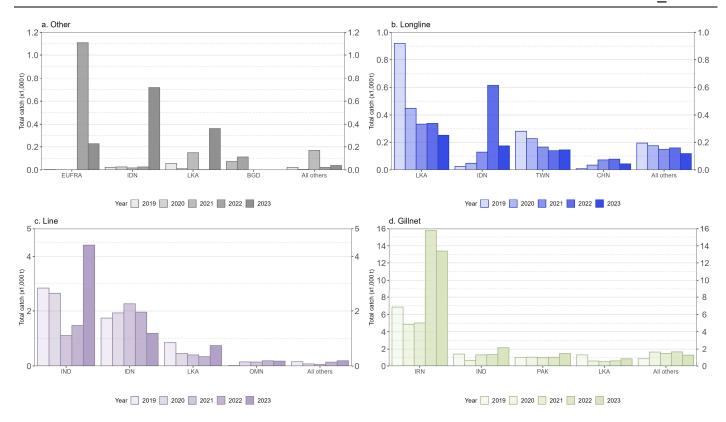


Figure 8: Annual catch (metric tonnes; t) trends of black marlin by fishery group and fleet between 2019 and 2023. Data source: <u>best scientific estimates of retained catches</u>

Changes from previous WPB

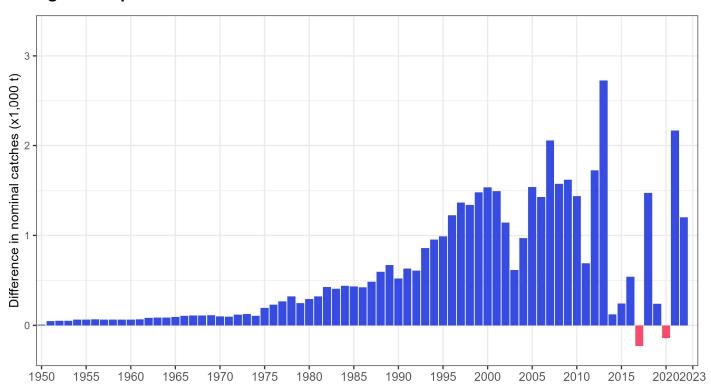


Figure 9: Differences in the available best scientific estimates of retained catches (metric tonnes; t) of black marlin between this WPB and its previous session (<u>WPB21</u> meeting held in September 2023)

Uncertainties in retained (nominal) catch data

Recent analysis of black marlin data reported to the Secretariat indicates that the primary fleets involved in its harvest are generally compliant with the reporting requirements for retained catches by species and fishery. However, only a small portion of the total catch is currently estimated—approximately 2% overall, increasing to 5% in 2023 (**Fig. 10**). The incomplete reporting of retained black marlin catches primarily stems from coastal fisheries in India and Indonesia. Although these countries submit catch data, the Secretariat often needs to re-estimate the values due to inconsistencies, aggregation, and uncertainties. Reported figures exhibit large and frequent fluctuations by species and gear type, likely due to insufficient monitoring of the highly diverse and widespread coastal fisheries operating in these regions.

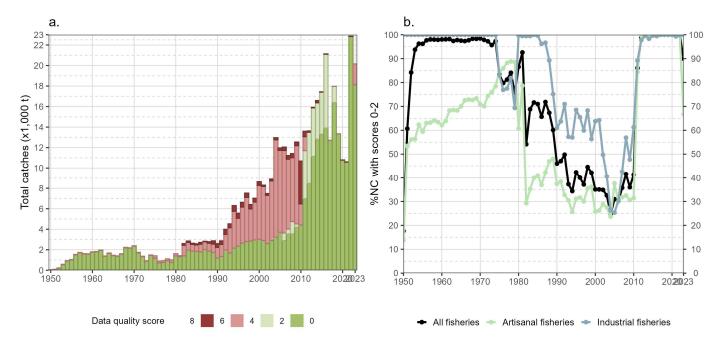


Figure 10: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and (b) percentage of total retained catches fully or partially reported to the IOTC Secretariat for all fisheries and by type of fishery, in the period 1950-2023

Discard levels

The majority of black marlin caught are retained, as shown in **Fig. 11** of the ROS data report. However, purse seine fisheries discard some black marlin for reasons such as lack of commercial value or poor condition of the fish. The map in **Fig. 11** illustrates that most of the discarded black marlin from purse seine fisheries are discarded dead. Although discard rates for black marlin from longline fisheries are lower, the majority of discarded fish are also discarded dead (**Fig. 13**).

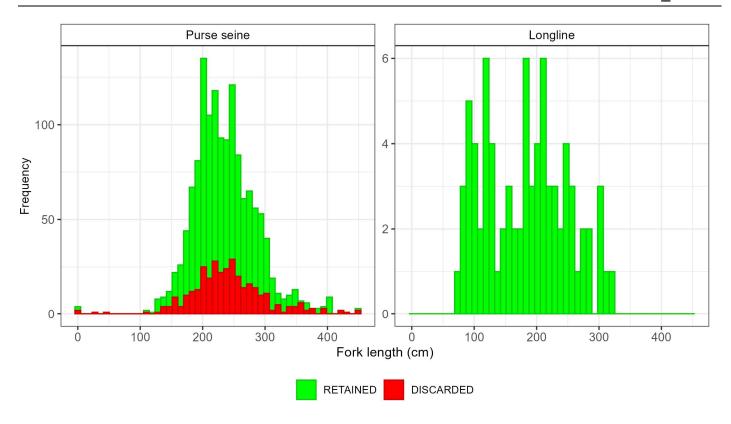


Figure 11: Size (fork length; cm) frequency distribution of black marlin retained and discarded at sea in purse seine and longline fisheries as available in the ROS regional database

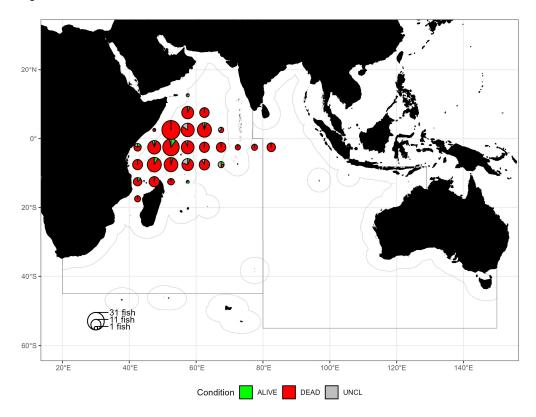


Figure 12: Distribution of black marlins discarded at sea in the western Indian Ocean purse seine fisheries with information on condition at release as available in the ROS regional database

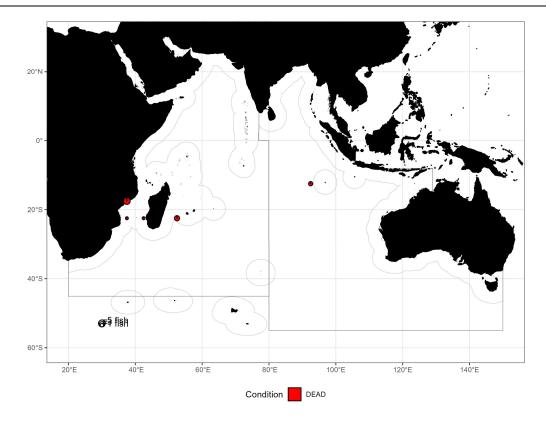


Figure 13: Distribution of black marlins discarded at sea in the Indian Ocean longline fisheries with information on condition at release as available in the ROS regional database

Geo-referenced catch

Spatial distribution of catches

Geo-referenced catches by fishery and decade (1950-2009)

Geo-referenced catch data for black marlin have been available since the early decades of reporting, primarily from longline fisheries, which have historically been the main contributors to black marlin catches. In addition to industrial fisheries, geo-referenced data are also available for some offshore and coastal fisheries, namely from Sri Lanka, the Islamic Republic of Iran, and, to a lesser extent, Indonesia, though the overall coverage remains low. Geo-referenced data from artisanal fisheries are not fully raised, and reporting remains incomplete for some Contracting Parties and Cooperating Non-Contracting Parties (CPCs). **Figs. 14-15-16** illustrate the spatial distribution of catches across different fisheries over various time periods, highlighting regional patterns and changes in distribution by fishery type.

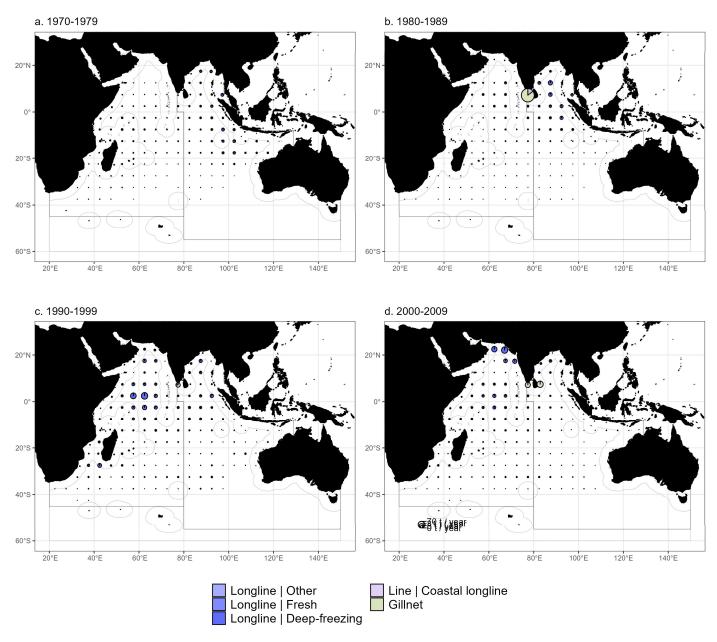


Figure 14: Mean annual time-area catches in weight (metric tonnes; t) of black marlin, by decade, 5x5 grid, and fishery. Data source: <u>time-area catches</u>

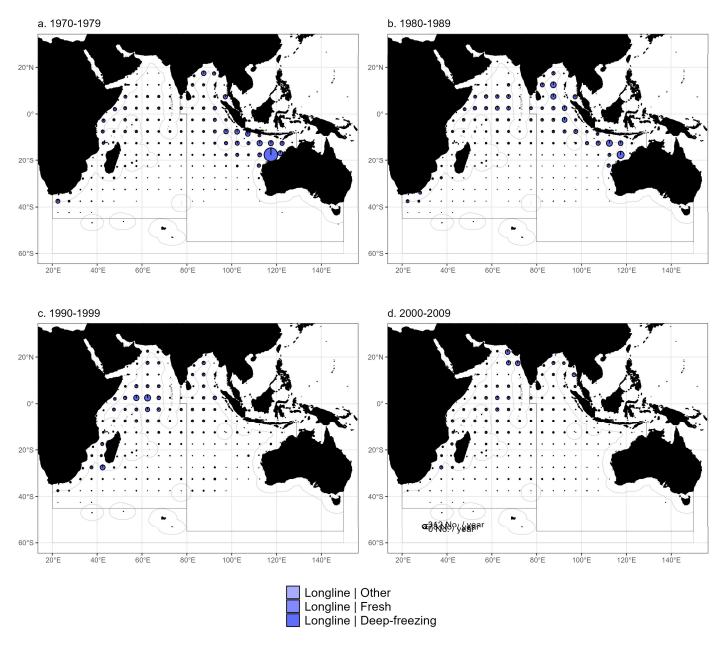


Figure 15: Mean annual time-area catches in numbers of black marlin, by decade, 5x5 grid, and fishery. Data source: <u>time-area catches</u>

Geo-referenced catches by fishery, last years (2019-2023) and decade (2010-2019)

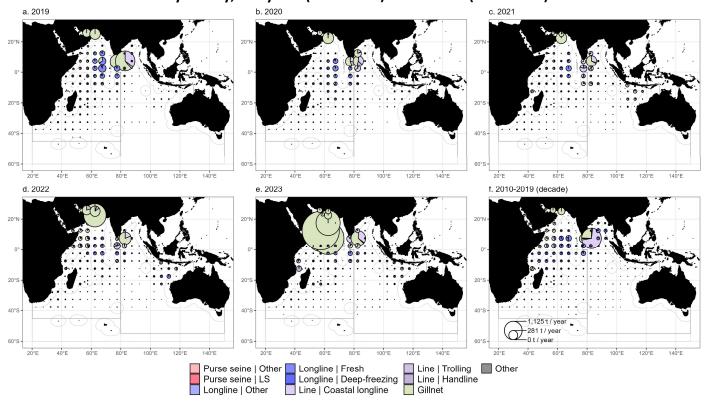


Figure 16: Mean annual time-area catches in weight (metric tonnes; t) of black marlin, by year / decade, 5x5 grid, and fishery. Data source: time-area catches

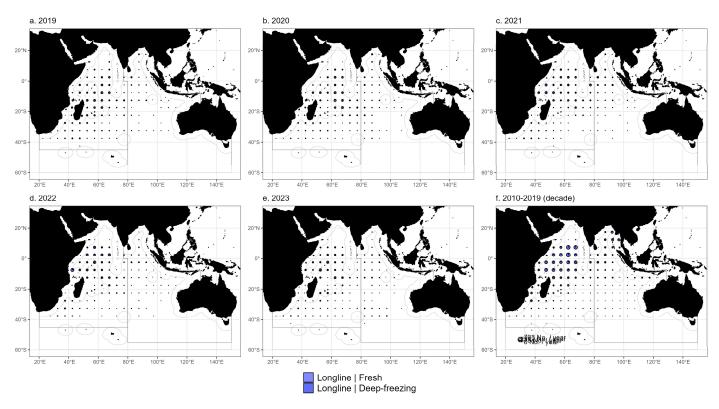


Figure 17: Mean annual time-area catches in numbers of black marlin, by year / decade, 5x5 grid, and fishery. Data source: time-area catches

Uncertainties in catch and effort data

Although BLM catches have increased since the 1990s, geo-referenced catch data are reported less frequently than total retained catch data. This discrepancy arises because not all CPCs with significant black marlin catches have robust data collection systems capable of recording spatial (geo-referenced) information. In recent years, the Islamic Republic

of Iran (2007-2021) has submitted catch and effort data, with improvement in data submitted for 2022; however, these data are not fully raised and often lack complete -spatial resolution. Indonesia (post-2017) has also reported georeferenced data, though with limited coverage, and not covering all fisheries. Sri Lanka (post-2014) has contributed to improvements in the quality and consistency of geo-referenced reporting. Overall, between 2019 and 2023, georeferenced catch data accounted for approximately 82% of the total retained black marlin catches (**Fig. 18**).

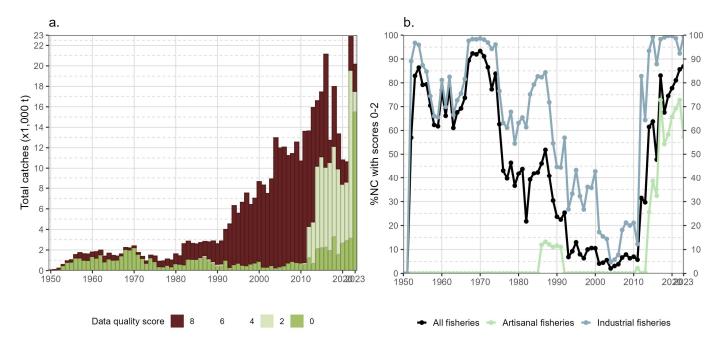


Figure 18: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and (b) percentage of total retained catch for which geo-referenced catches were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950-2023

Size composition of the catch

Samples availability

Sampling of billfish species, including BLM, remains particularly challenging in small-scale fisheries. Despite increasing catches of BLM, especially from coastal fisheries, most biological samples continue to come from industrial fleets. Size frequency data for black marlin are notably scarce compared to other billfish species, representing only 2.5% of the total size samples collected across all billfish. In recent years, coastal fisheries have contributed an increasingly large share of black marlin catches. However, sampling efforts in these fisheries face several key challenges:

- (i) Port Sampling Limitations: Sampling is typically conducted at landing sites, which may not adequately capture the full scope of the catch.
- (ii) Processing Issues: A substantial portion of landed marlins are processed (e.g., headed) before landing, complicating species identification and making accurate size measurements difficult.

Geo-referenced size sampling for black marlin is most extensively available from longline fisheries, with limited samples reported from gillnet and line fisheries (**Fig. 19**). The distribution of available size samples by fishery group is summarized below:

- Longline Fisheries: Samples are collected throughout the Indian Ocean, with a notable concentration around the Somalia region (Fig. 20).
- Gillnet Fisheries: Sampling is primarily concentrated around Sri Lanka (Fig. 21).
- Line Fisheries: Size samples have been collected along the East African coast and in Indonesian waters (Fig. 22).

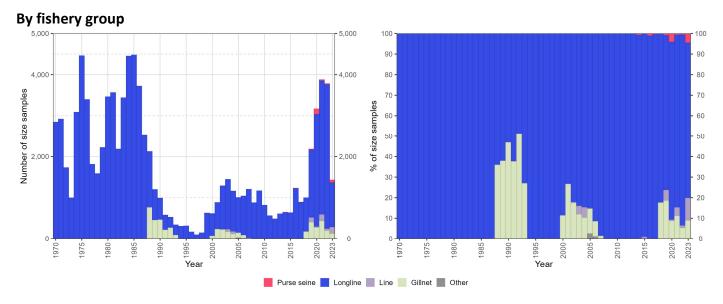


Figure 19: Availability of black marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and fishery group. Data source: standardized size-frequency dataset

Longline fisheries

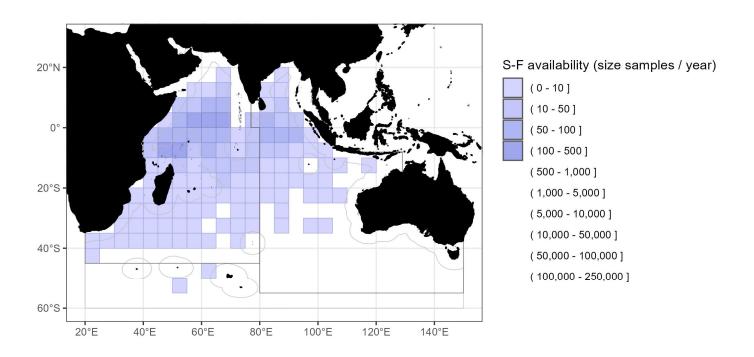


Figure 20: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for longline fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

Gillnet fisheries

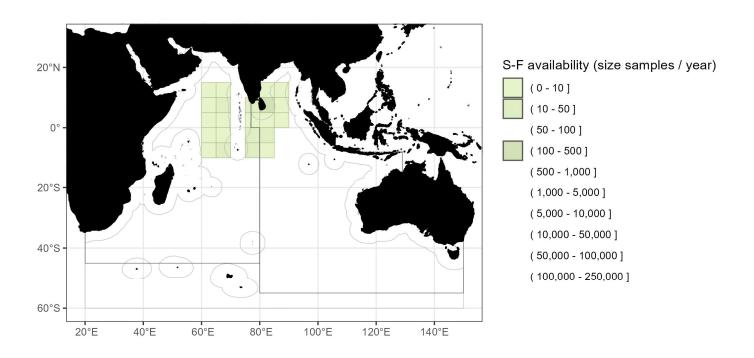


Figure 21: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for gillnet fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

Line fisheries

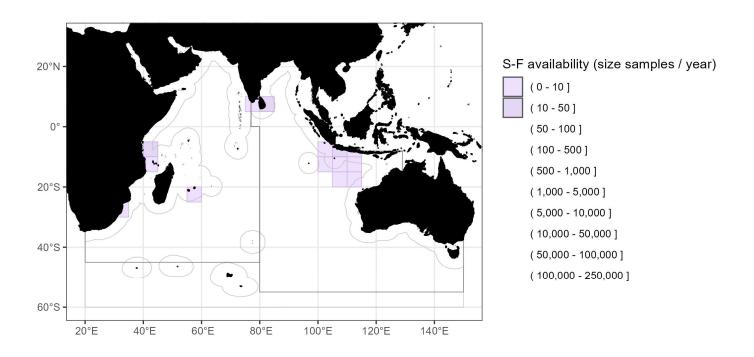


Figure 22: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for line fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

Purse seine fisheries

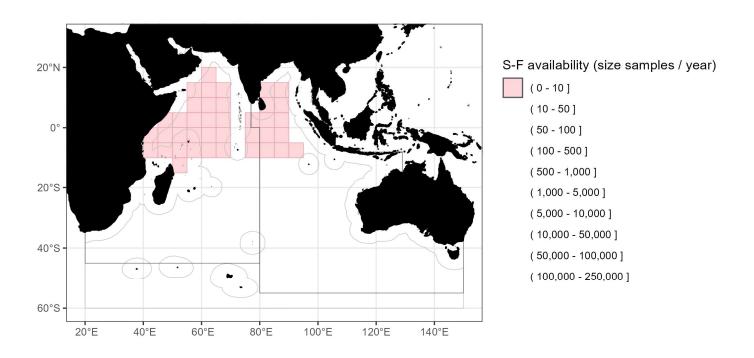


Figure 23: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for purse seine fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

By fishery

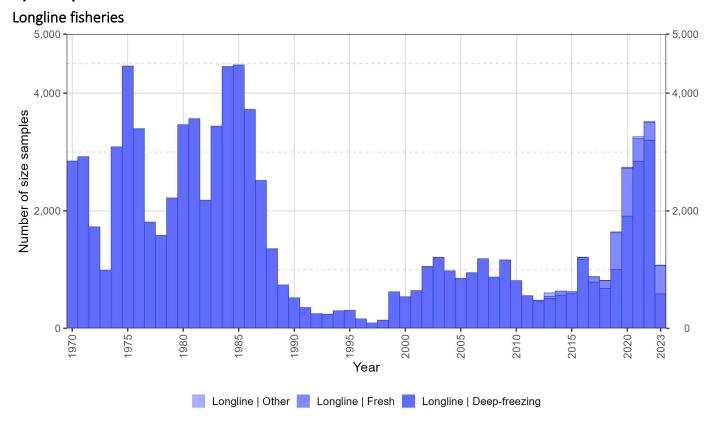


Figure 24: Availability of black marlin size-frequency data as absolute number of samples per year longline fishery. Data source: standardized size-frequency dataset

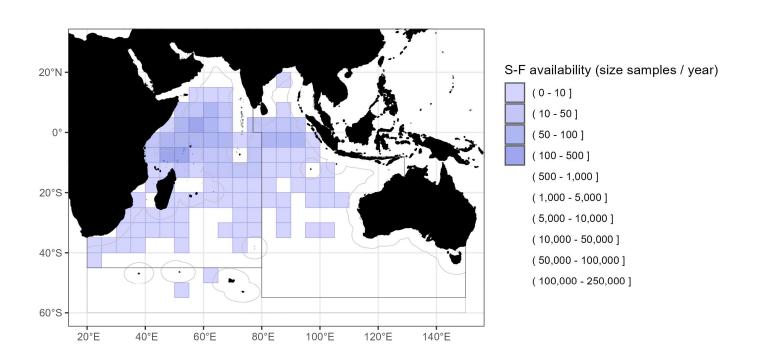


Figure 25: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data in deep-freezing longline fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

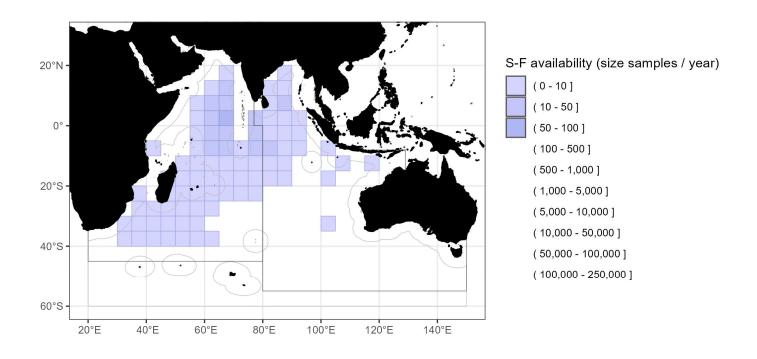


Figure 26: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data in fresh longline fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

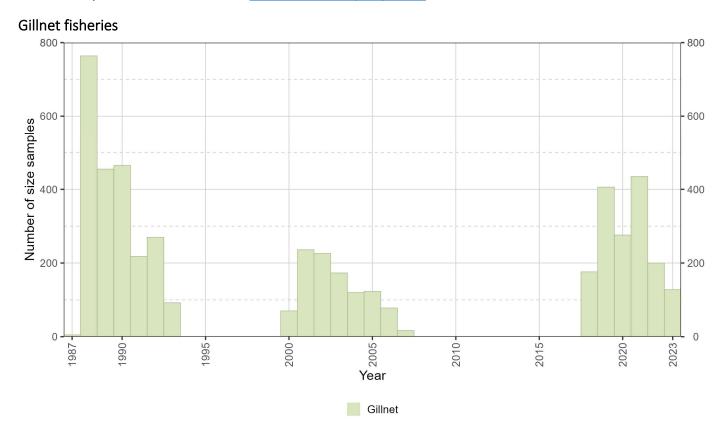


Figure 27: Availability of black marlin size-frequency data as absolute number of samples per year and gillnet fishery. Data source: standardized size-frequency dataset

Line fisheries Number of size samples % of size samples Year Year Line | Coastal longline Line | Trolling Line | Handline

Figure 28: Availability of black marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and line fishery type. Data source: standardized size-frequency dataset

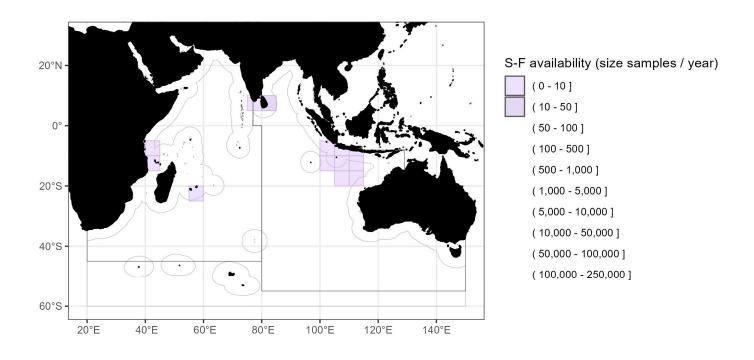


Figure 29: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (coastal longline) fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

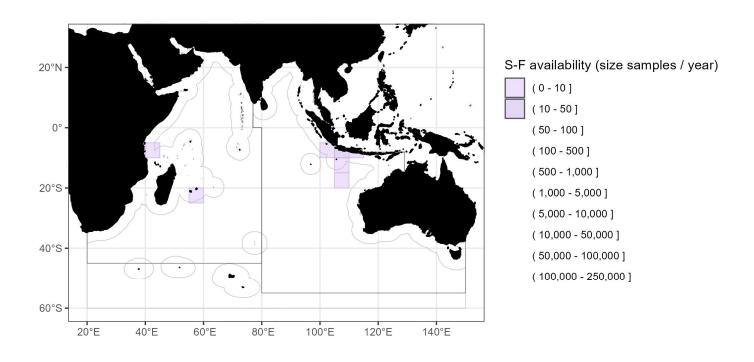


Figure 30: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (handline) fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

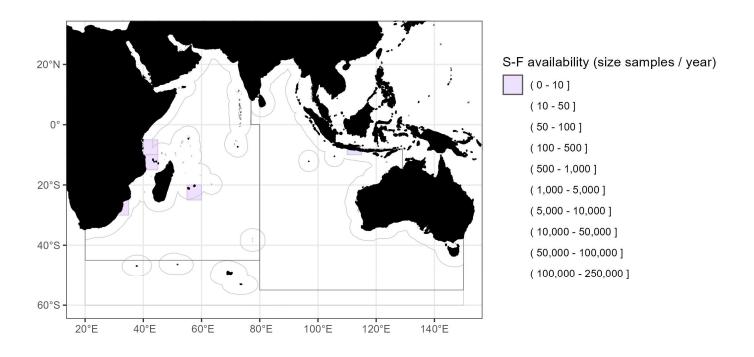


Figure 31: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (trolling) fisheries in the period 2019-2023. Data source: standardized size-frequency dataset

Purse seine fisheries Number of size samples of size samples Year Year Purse seine | Other Purse seine | FS Purse seine | LS

Figure 32: Availability of black marlin size-frequency data as absolute number of samples per year and purse seine fishery. Data source: standardized size-frequency dataset

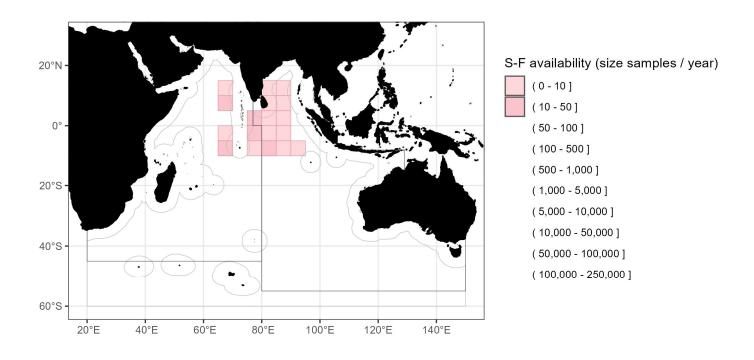


Figure 33: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by purse seine fisheries (other) in the period 2019-2023. Data source: standardized size-frequency dataset

Temporal patterns and trends in size distributions

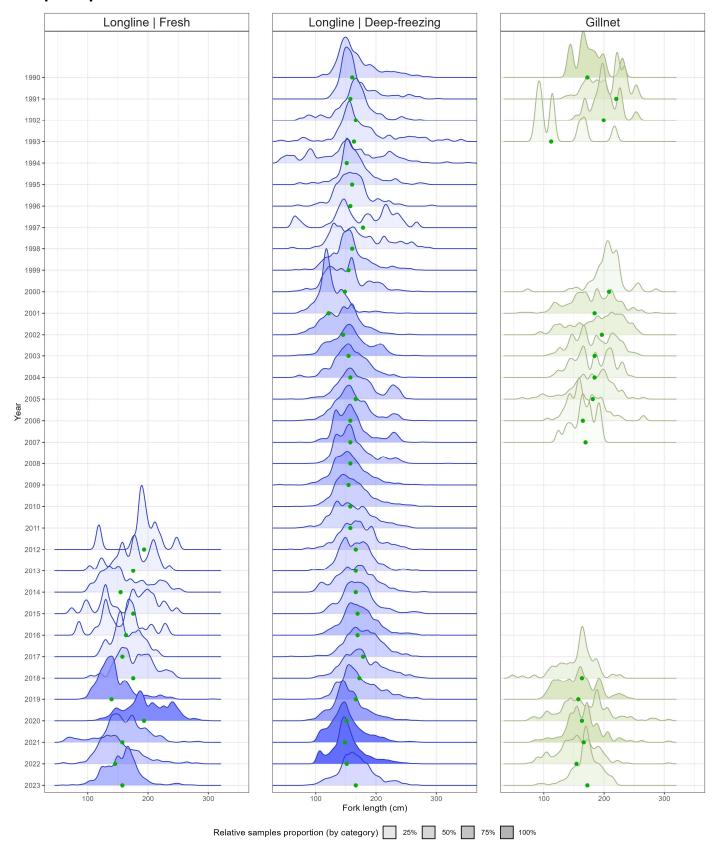


Figure 34: Relative size distribution (fork length; cm) of black marlin caught by purse seine (Other) and gillnet fisheries. Other = no information provided on school association. Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median value. Data source: standardized size-frequency dataset

Size distribution by fishery and fleet

Gillnet fisheries

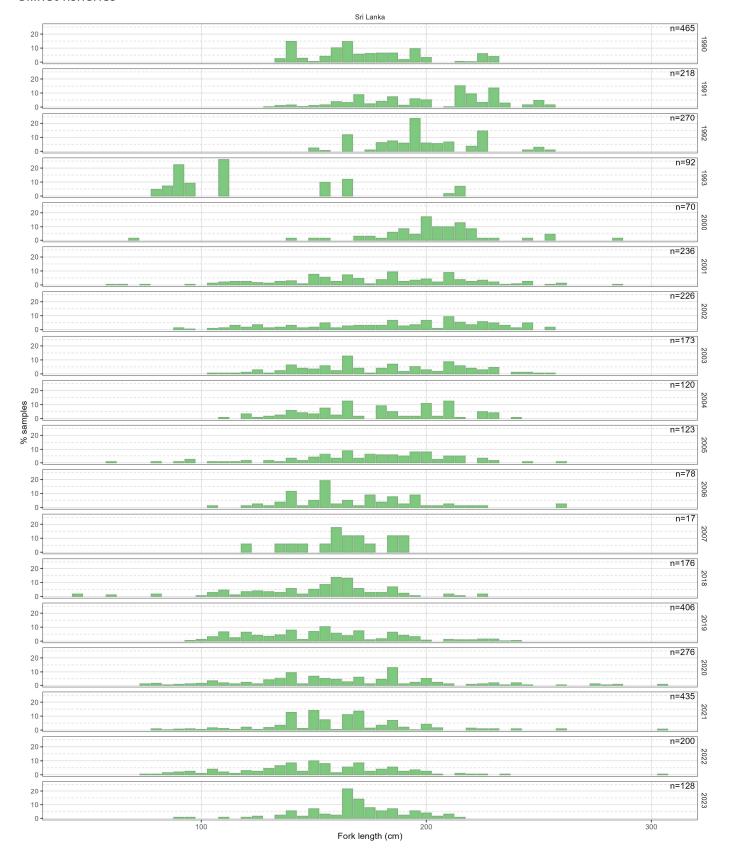


Figure 35: Relative size distribution of black marlin (fork length; cm) recorded for gillnet fisheries by year and main fleet. Data source: standardized size-frequency dataset

Uncertainties in size-frequency data

The availability of size frequency data for black marlin is significantly limited when compared to the volume of reported retained catches. Many of the major fleets reporting black marlin catches do not collect size data, and only those with well-established data collection systems routinely provide size samples across most species. As a result, the overall quality and representativeness of the size frequency data are considered low. Between 2019 and 2023, size sampling accounted for only 17% of the total reported black marlin catch (**Fig. 36**).

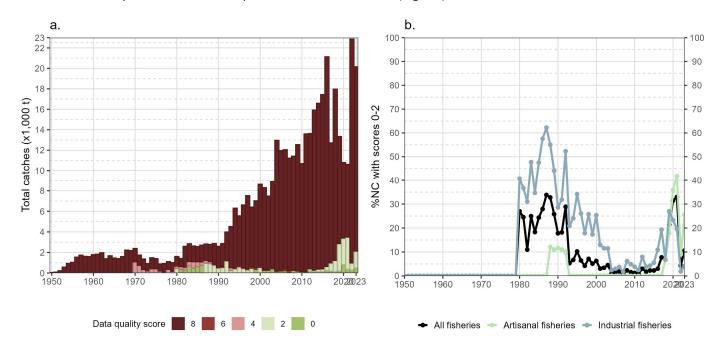


Figure 36: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and percentage of total retained catches for which geo-referenced size-frequency data were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950–2023

References

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Appendices

Appendix I: Taxonomy

Rank	Taxon
Kingdom	Animalia
Subkingdom	Bilateria
Infrakingdom	Deuterostomia
Phylum	Chordata
Subphylum	Vertebrata
Infraphylum	Gnathostomata
Superclass	Actinopterygii
Class	Teleostei
Superorder	Acanthopterygii
Order	Perciformes
Suborder	Xiphioidei
Family	Istiophoridae
Genus	Istiompax
Species	Istiompax indica

Appendix II: Changes in best scientific estimates of retained catches from previous WPB

Some improvements were made to the best scientific estimates of retained catches of black marlin since the 22nd session of the IOTC Working Party on Billfish (WPB22), with overall modifications in the time series of annual catches (**Fig. 9**). The changes covering the period 1950-2022 were due to: (i) revision of catch by Bangladesh for all fisheries, with more species information (2021-2022), (ii) revised of data from FAO and (iii) historical revision of catch for all fisheries by Indonesia.

Table 4: Changes in best scientific estimates of annual retained catches (metric tonnes; t) of black marlin by year, fleet, fishery group and main Indian Ocean area, limited to absolute values higher than 10 t

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
2022	BGD	Gillnet	Eastern Indian Ocean	611	107	504
		Other	Eastern Indian Ocean	112	0	112
	IDN	Gillnet	Eastern Indian Ocean	777	132	645
		Line	Eastern Indian Ocean	1,958	1,458	500
		Longline	Eastern Indian Ocean	613	825	-212
		Other	Eastern Indian Ocean	6	77	-71
		Purse seine	Eastern Indian Ocean	20	491	-471
	IND	Gillnet	Eastern Indian Ocean	234	202	32
		Line	Eastern Indian Ocean	1,411	1,254	156
2021	BGD	Gillnet	Eastern Indian Ocean	529	70	459
		Other	Eastern Indian Ocean	73	0	73
	IDN	Gillnet	Eastern Indian Ocean	846	124	722
		Line	Eastern Indian Ocean	2,259	1,164	1,094
		Other	Eastern Indian Ocean	7	75	-68
		Purse seine	Eastern Indian Ocean	9	431	-423
	IND	Gillnet	Eastern Indian Ocean	459	317	142
		Line	Eastern Indian Ocean	1,067	905	163
2020	IDN	Gillnet	Eastern Indian Ocean	609	155	454
		Line	Eastern Indian Ocean	1,929	1,459	470
		Longline	Eastern Indian Ocean	48	108	-60
		Other	Eastern Indian Ocean	11	94	-82
		Purse seine	Eastern Indian Ocean	10	539	-529
	IND	Gillnet	Eastern Indian Ocean	319	232	87
		Line	Eastern Indian Ocean	2,594	3,104	-510
	ТМР	Gillnet	Eastern Indian Ocean	26	0	26

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
2019	IDN	Gillnet	Eastern Indian Ocean	745	106	639
		Line	Eastern Indian Ocean	1,743	998	745
		Longline	Eastern Indian Ocean	25	431	-405
		Other	Eastern Indian Ocean	8	64	-56
		Purse seine	Eastern Indian Ocean	12	508	-496
	IND	Gillnet	Eastern Indian Ocean	622	522	100
		Line	Eastern Indian Ocean	2,785	3,105	-320
	MOZ	Line	Western Indian Ocean	52	36	16
	TMP	Gillnet	Eastern Indian Ocean	16	0	16