REVIEW OF THE STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN BLACK MARLIN (1950-2022)

Author: IOTC Secretariat

Abstract

The document provides an overview of the consolidated knowledge about fisheries catching black marlin (*Istiompax indica*) in the Indian Ocean since the early 1950s based on a range of data sets collected by the Contracting Parties and Cooperating Non-Contracting Parties (CPCs) of the IOTC and curated by the IOTC Secretariat. The available fisheries statistics show a major decline in black marlin catch since the mid-2010s after an increasing trend over several decades. While catches were mostly reported for industrial longline fisheries prior to the 1980s, the contribution of coastal fisheries has steadily increased since then to represent more than 41% of the total black marlin catch in 2022. The recent decline in total catch is explained by the decrease in catch from large-scale longline fisheries which started since 2008 combined with the reduction in catches from small longline fisheries from Sri Lanka and India. Information available on discarding practices of black marlin in industrial fisheries indicates that discard levels are small in longline fisheries while black marlins are more often discarded in large-scale purse seine fisheries, although in small quantities. Discarding in coastal fisheries interacting with the species is poorly known but considered to be negligible. Information available on the spatial distribution of catch and effort has substantially improved over the last decade and shows that black marlins are mostly caught in the northwestern part of the Indian Ocean, with important catches reported along the coasts of the Arabian Sea, India, and Sri Lanka. The reporting of size-frequency data has slightly improved over the last decade but remains very limited for most artisanal and industrial fisheries.

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

Introduction

Black marlin (*Istiompax indica*) is a species of marlin that occurs in tropical and subtropical waters throughout the Pacific and Indian Oceans. Information available from tuna Regional Fisheries Management Organisations (tRFMOs) shows a steady increasing trend of the global black marlin catch between the mid-1970s and 2016 when it reached a maximum reported value of about 32,000 t (**Fig. 1a**) in 2022. The Indian Ocean represents the main fishing grounds of black marlin and contributed to 74% of the global catch in recent years (**Fig. 1b**).

The stock assessment of black marlin conducted in 2016 indicated that the continuous increase in black marlin catches is leading to overfishing of the species in the Indian Ocean ((Yokoi & Nishida 2016) & (Andrade 2016)). However, the exact status of the black marlin stock remains unclear. Despite these warnings, black marlin catches have continued to remain high. Globally, the IUCN classifies black marlin as Data Deficient (DD) due to insufficient information and frequent misidentification of the species with other marlins(Collette et al. 2022).

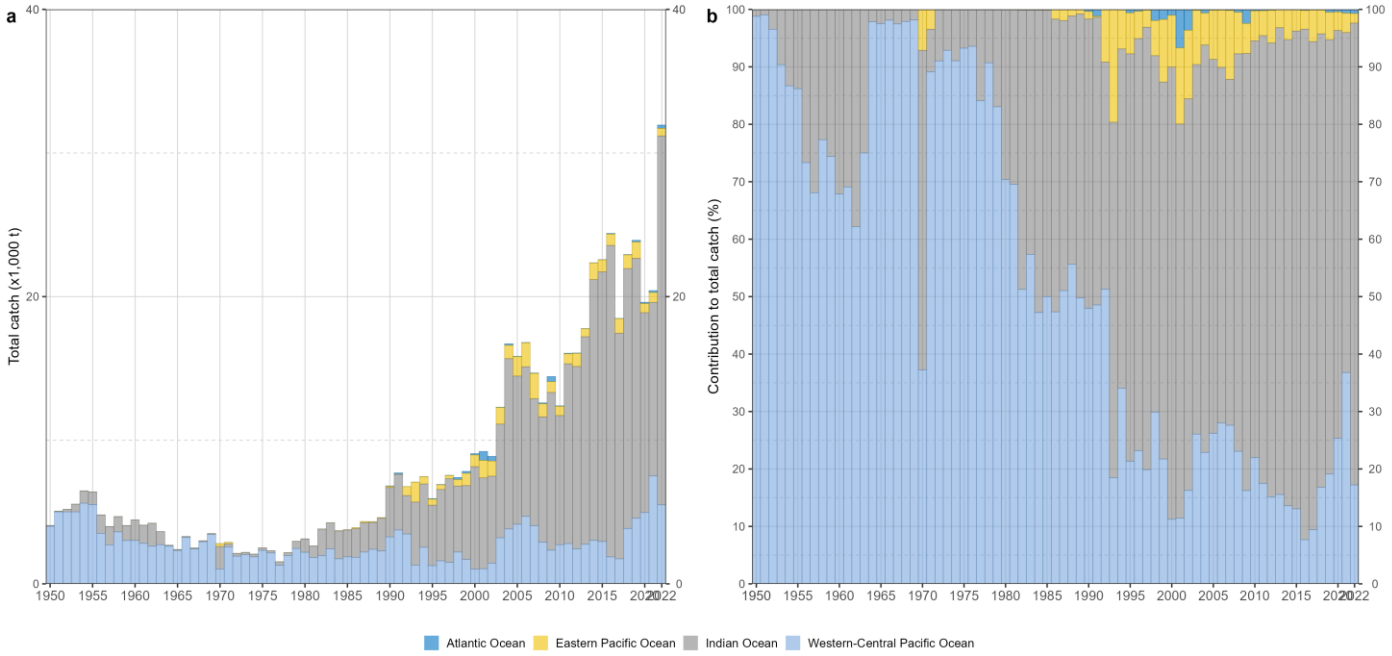

Figure 1: Annual time series of cumulative retained catches (metric tonnes; t) of black marlin by region1950-2022. Source: (https://www.fao.org/fishery/statistics-query/en/capture/capture_quantity))

The overarching objective of this paper is to provide participants at the data preparatory meeting of the 21st Session of the IOTC Working Party on Billfish (WPB22) 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 (**IOTC2024?**).

Total retained (nominal) catch

Historical trends (1950-2022)

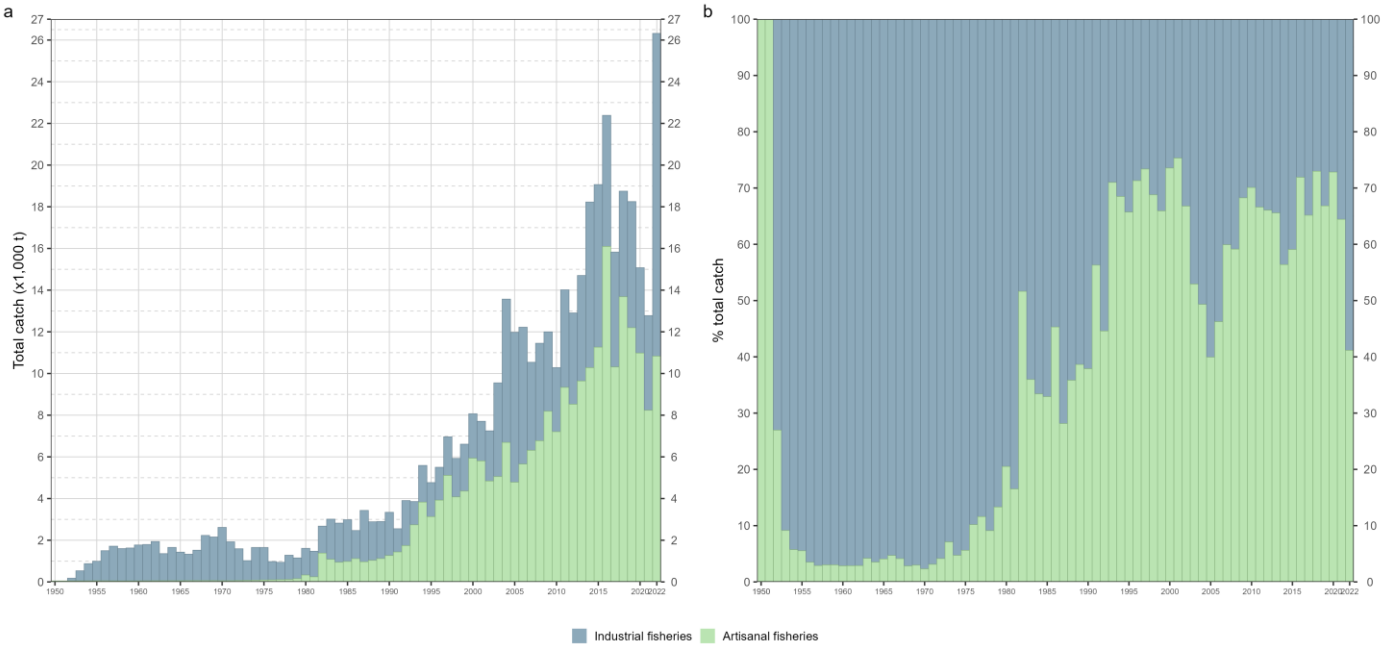

Figure 2: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of black marlin by type of fishery for the period 1950-2022. Data source: best scientific estimates of retained catches

An increasing trend is observed in the catch of black marlin from 1990s, particularly from artisanal fisheries. This is attributed to from gillnet and longline fisheries targeting billfish species between 1970s and 1990s. Although the industrial fisheries, shifted to catching other species from mid-1990s, catches from artisanal fisheries remained high (**Figs. 2-5** and **Tab ??**). Historical, Japanese, Korean and Taiwanese longline fisheries caught majority of the black marlin in the Indian Ocean. Dominant fleet from mid-1980s shifted with the introduction of gillnet combined with longline gears from Sri Lanka, and furthermore, from 2000s, I. R Iran began to record the highest catches of black marlin, resulting in increasing catches from artisanal fisheries (**Fig. 3**). In 2022, coastal fisheries contributed to 41% of the total catch of retained black marlin reported to the Secretariat, with 60% from I. R. Iran.

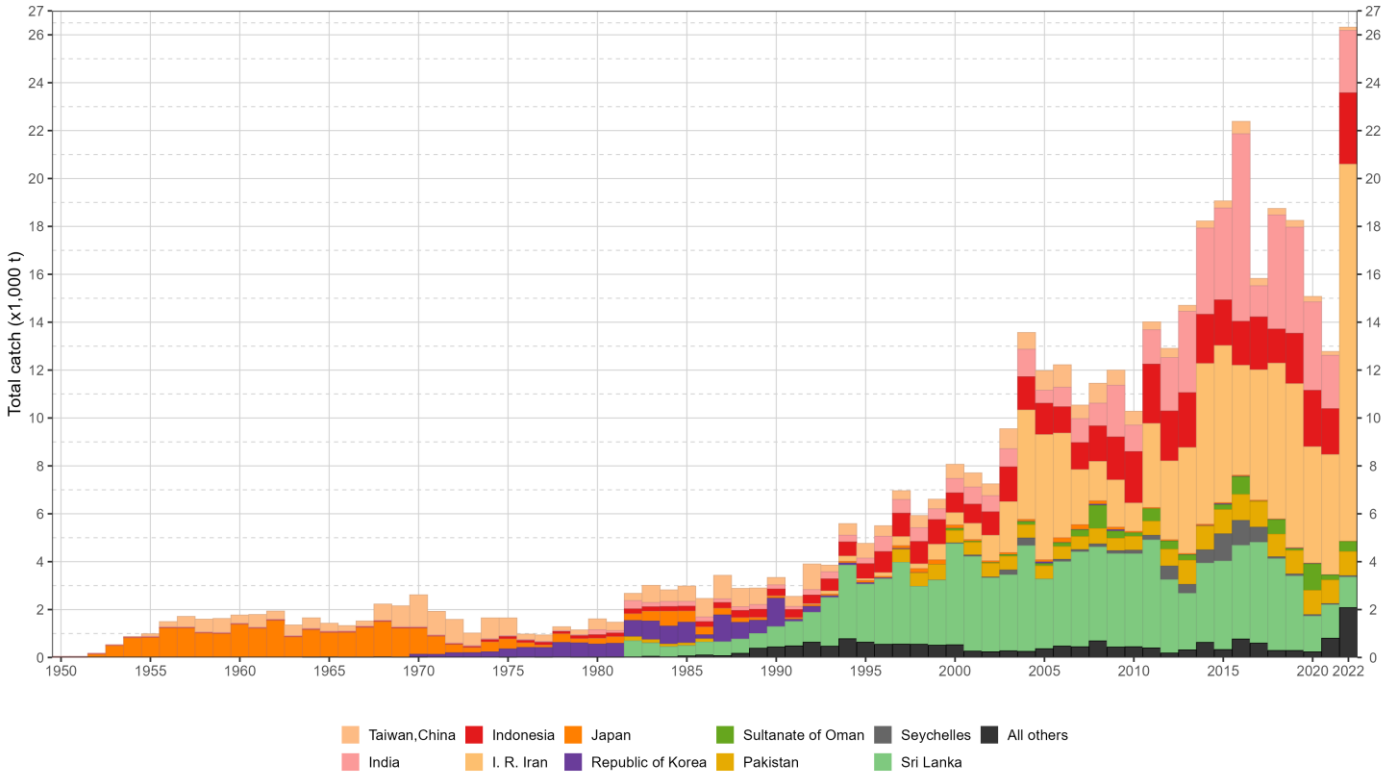

Figure 3: Annual time series of retained catches by fleet for the period 1950-2022. Data source: best scientific estimates of retained catches

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/21/Data/03-NC)

Fishery	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Purse seine | Other	0	0	4	60	95	193	478
Longline | Other	0	0	0	30	866	1,809	692
Longline | Fresh	0	0	24	55	596	1,236	1,165
Longline | Deep-freezing	862	1,661	1,367	1,647	952	724	842
Line | Coastal longline	16	15	21	163	302	706	3,578
Line | Trolling	8	11	20	25	56	118	331
Line | Handline	1	1	1	259	362	199	540
Baitboat	0	0	0	0	0	0	1
Gillnet	26	31	44	368	1,655	5,416	8,742
Other	0	0	1	19	17	33	73
Total	912	1,719	1,482	2,626	4,902	10,434	16,442

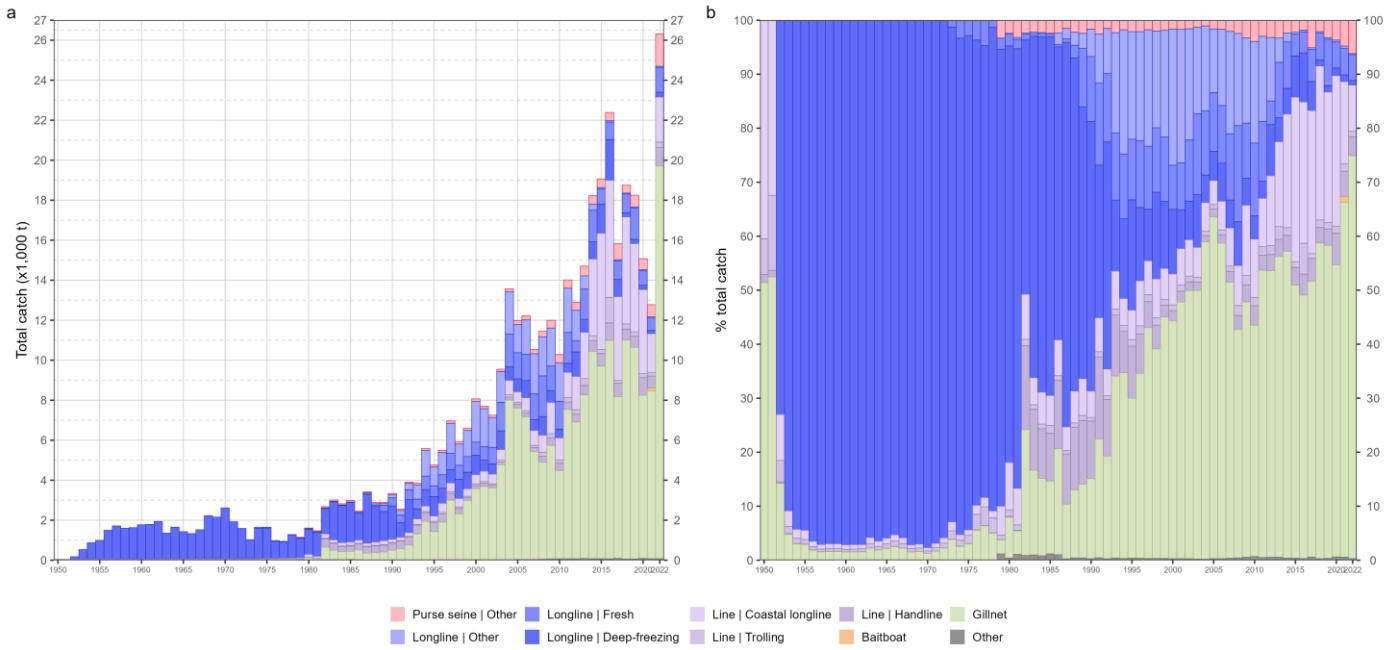

Figure 4: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of black marlin by fishery for the period 1950-2022. Data source: [best scientific estimates of retained catches]

Table 2: Best scientific estimates of annual retained catches (metric tonnes; t) of black marlin by fishery for the period 2013-2022. 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/21/Data/03-NC)

Fishery	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Purse seine | Other	486	428	429	407	807	393	589	555	611	1,625
Longline | Other	661	304	60	73	55	48	54	50	57	55
Longline | Fresh	1,510	1,572	770	874	932	932	1,566	730	627	1,244
Longline | Deep-freezing	653	866	1,461	2,038	858	216	218	215	160	241
Line | Coastal longline	2,310	3,830	5,809	5,857	4,191	5,347	4,406	4,201	1,946	2,251
Line | Trolling	349	263	203	1,275	138	261	224	194	174	277
Line | Handline	472	535	615	872	673	537	551	887	597	915
Baitboat	0	0	6	5	0	1	0	1	140	1
Gillnet	8,180	10,355	9,640	10,917	8,081	10,959	10,578	8,149	8,394	19,635
Other	84	74	73	69	94	55	64	94	75	77
Total	14,704	18,228	19,066	22,387	15,828	18,750	18,251	15,076	12,779	26,320

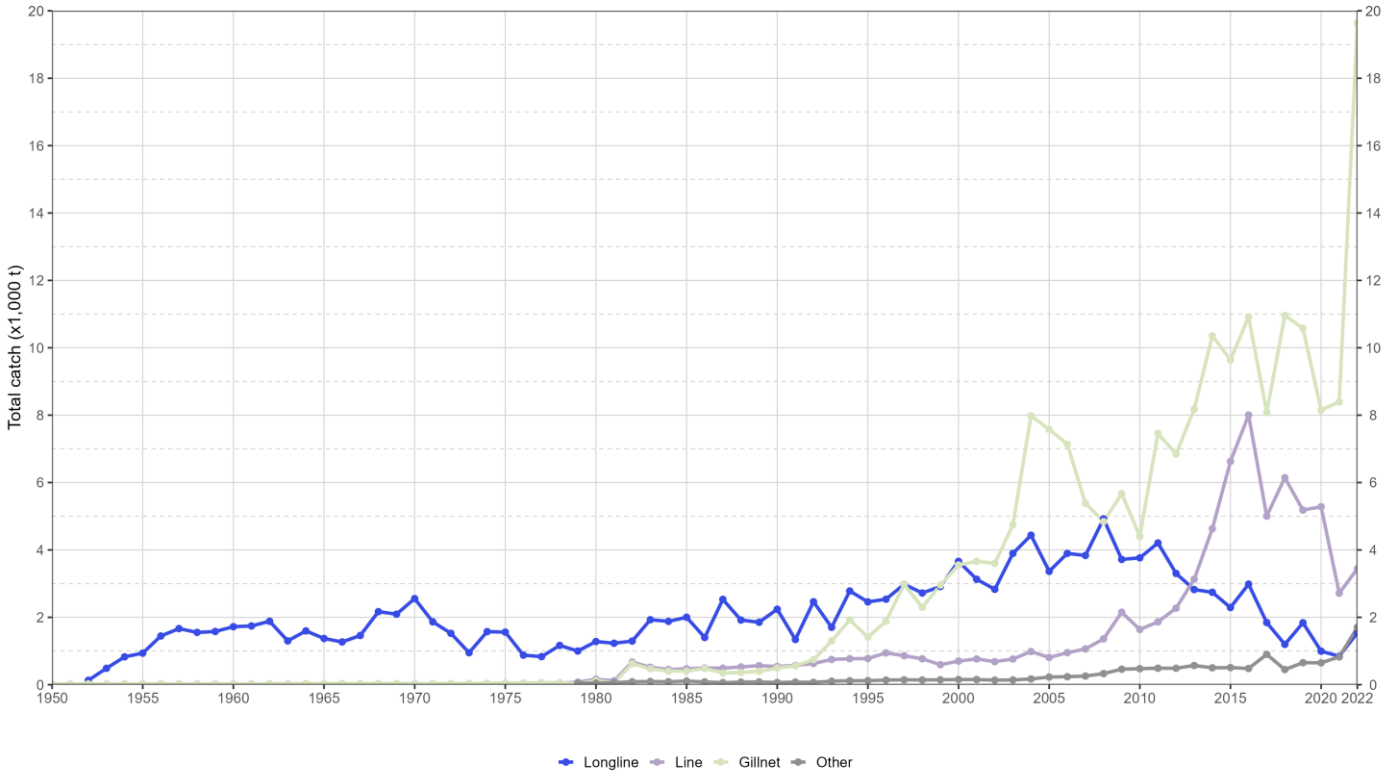

Figure 5: Annual time series of total retained catches (metric tonnes; t) of black marlin by fishery group for the period 1950-2022. Data source: best scientific estimates of retained catches

Main fishery features (2018-2022)

In recent years black marlin have been principally caught by gillnet fisheries, followed by coastal longline fisheries, contributing 63.3 and 19.9, respectively, showing increasing trends from 2013 (**Table 3**). Fleet-wise, I.R. Iran accounted for over 43% of black marlin, solely caught from gillnet fisheries, followed by India and Sri Lanka with 19% and 12%, respectively, from diverse fisheries (**Fig. 6**).

The data shows notable trends by fishery group for individual fleets. In particular, the gillnet fisheries of the Islamic Republic of Iran experienced a peak in 2022, with more than two-fold increased compared to catches in 2021. There was a slight increase in catches from line fisheries, primarily due to higher catches reported from India and Indonesia. Additionally, longline fisheries saw an increase, largely attributed to a rise in industrial longline operations in Indonesia (**Figs. 7-8**).

Table 3: Mean annual catches (metric tonnes; t) of black marlin by fishery between 2018 and 2022. Data source: [best scientific estimates of retained catches](https://www.iotc.org/WPB/21/Data/03-NC)

Fishery	Fishery code	Catch	Percentage
Gillnet	GN	11,543	63.3
Line | Coastal longline	LIC	3,630	19.9
Longline | Fresh	LLF	1,020	5.6
Purse seine | Other	PSOT	755	4.1
Line | Handline	LIH	697	3.8
Line | Trolling	LIT	226	1.2
Longline | Deep-freezing	LLD	210	1.2
Other	OT	73	0.4
Longline | Other	LLO	53	0.3
Baitboat	BB	28	0.2

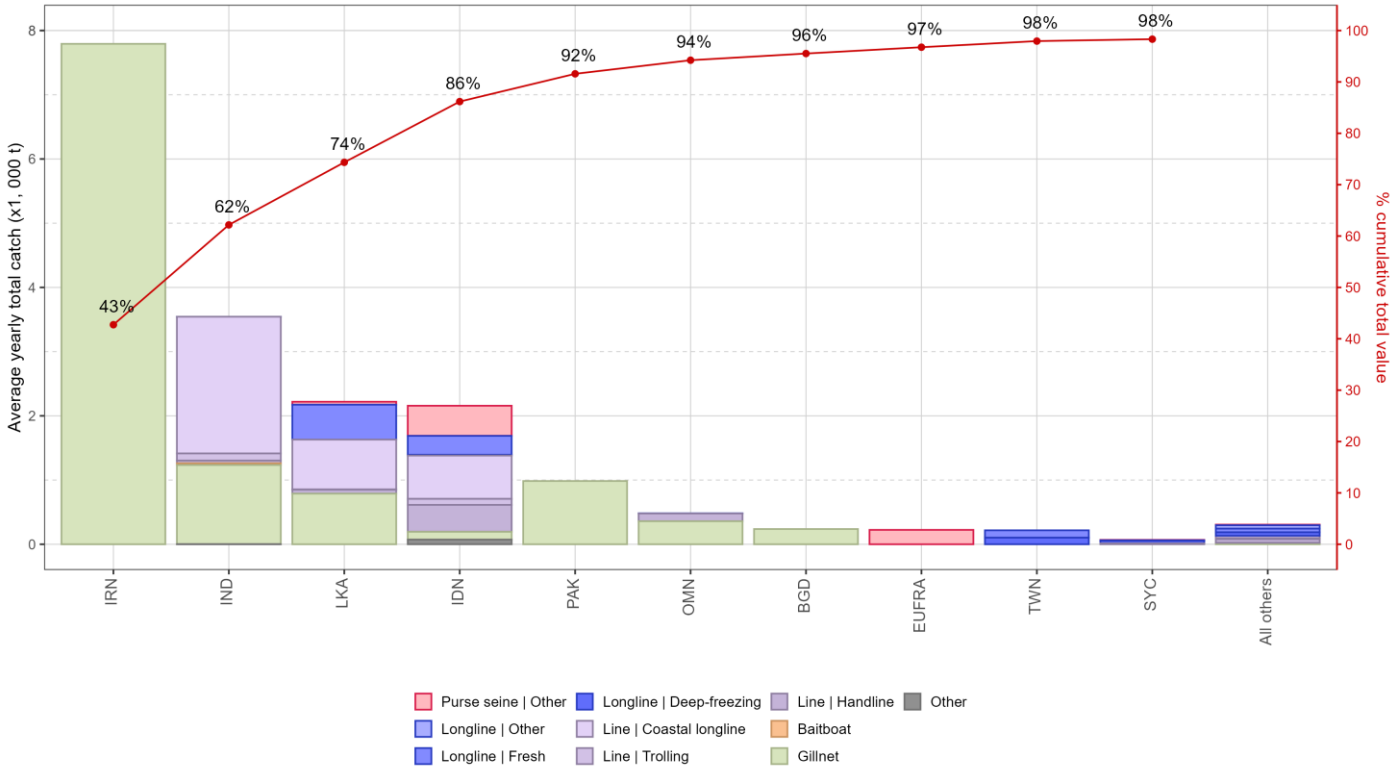

Figure 6: Mean annual catches (metric tonnes; t) of black marlin by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Data source: best scientific estimates of retained catches

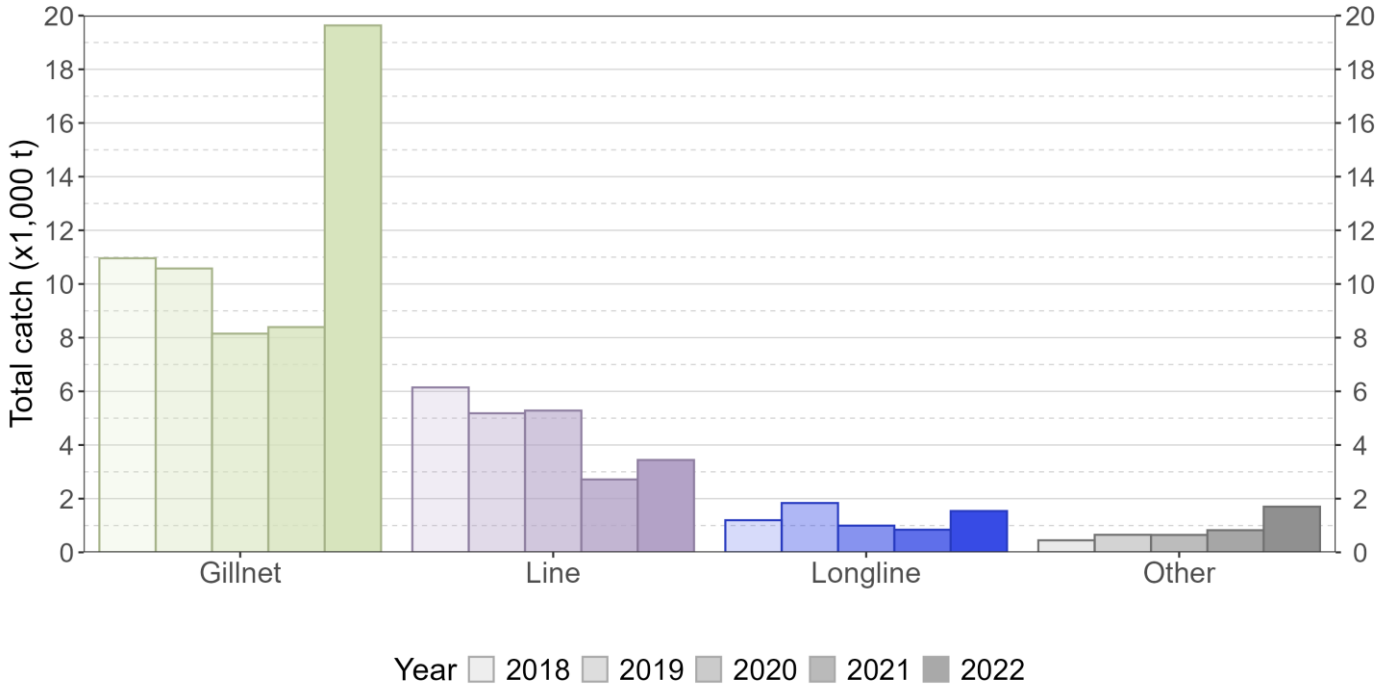

Figure 7: Annual catch (metric tonnes; t) trends of black marlin by fishery group between 2018 and 2022. Data source: best scientific estimates of retained catches

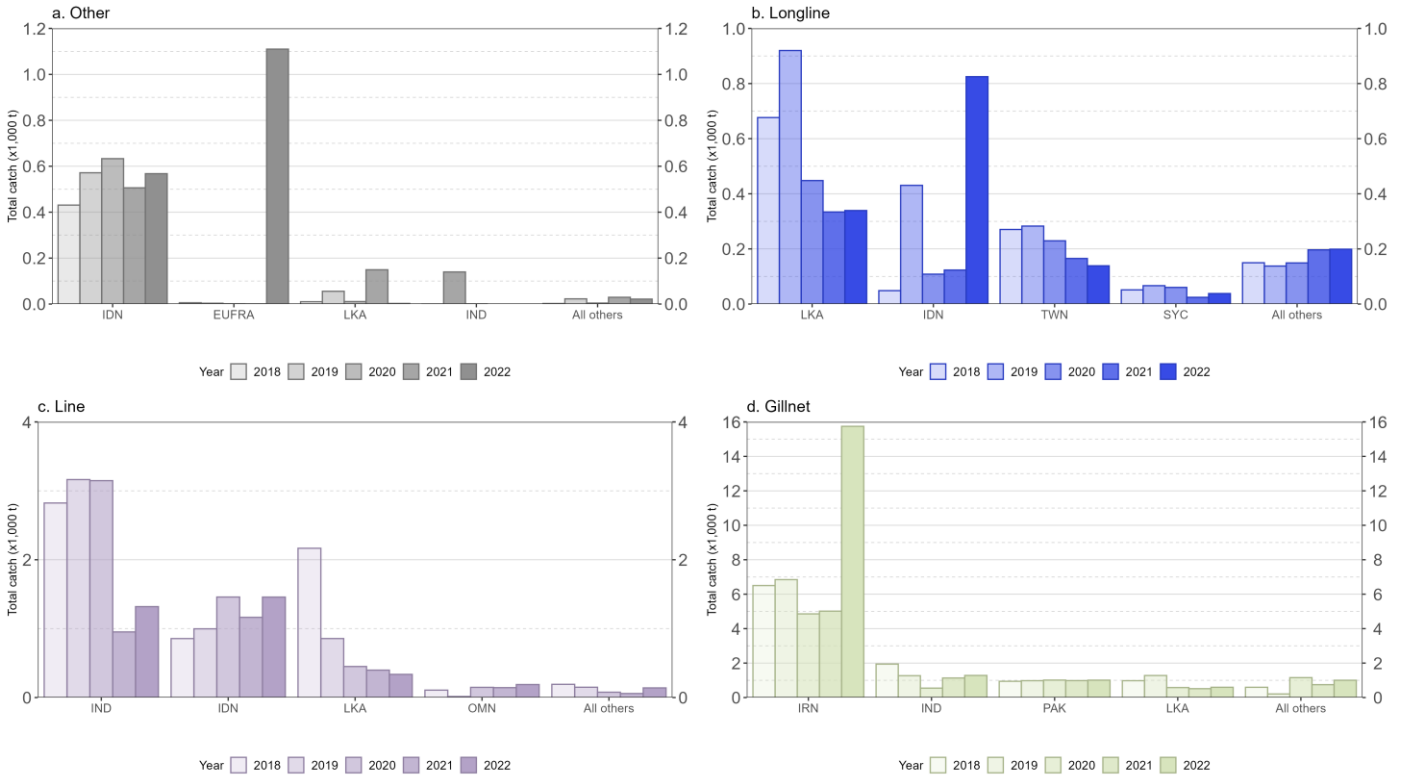

Figure 8: Annual catch (metric tonnes; t) trends of black marlin by fishery group and fleet between 2018 and 2022. Data source: best scientific estimates of retained catches

Changes from previous WPB

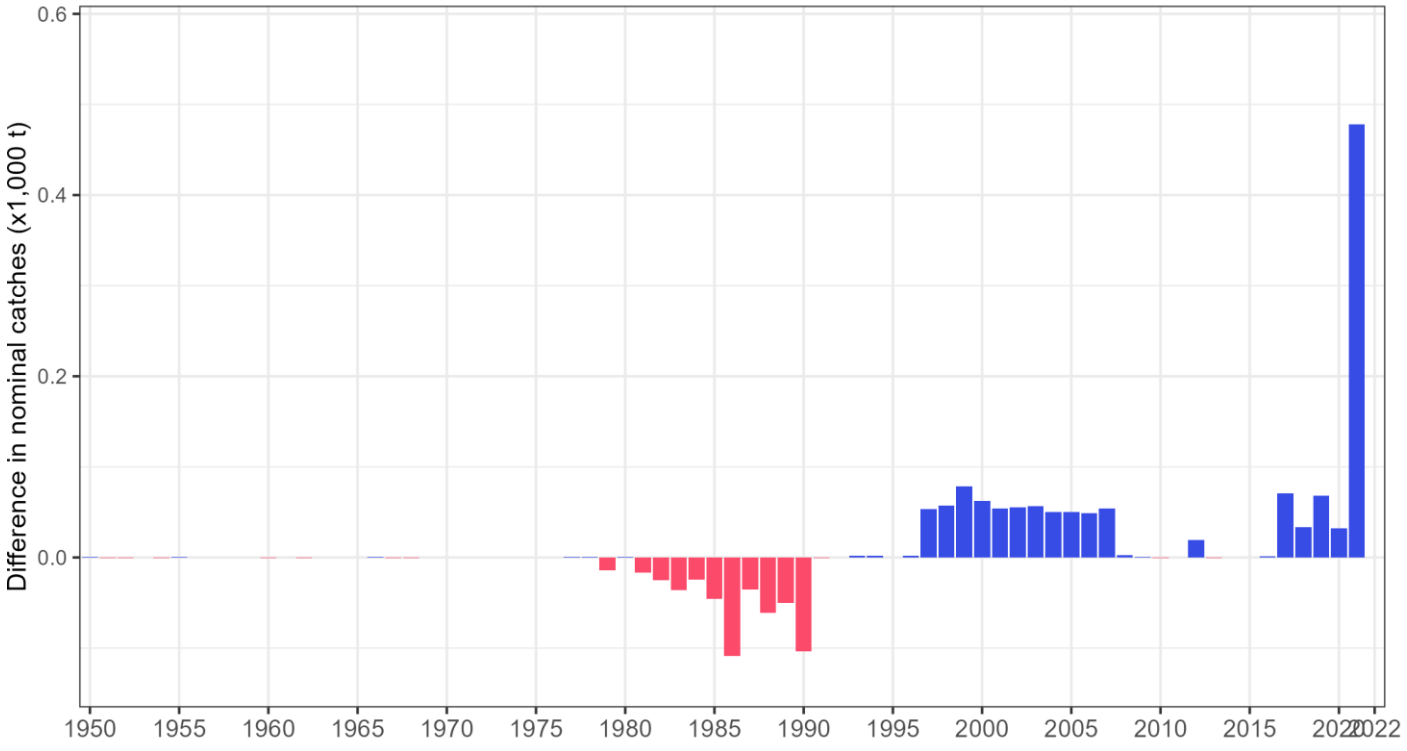

Figure 9: Differences in the available best scientific estimates of retained catches (metric tonnes; t) of black marlin between this WPB and its previous session (WPB21 meeting held in September 2023)

Uncertainties in retained (nominal) catch data

Recent analysis of the data reported to the Secretariat for black marlin reveals that the primary fleets involved in black marlin fishing are generally compliant with reporting requirements of retained catches by species and fisheries. However, only about13.6% are estimated , with 4% in 2022 overall (**Fig. 10**). The partial availability of retained catches of black marlin is mainly from coastal fisheries of India and Indonesia, which although reported catches, the Secretariat has to further re-estimate, as the reported data are uncertain, with continuous high fluctuation in the data by species and gear, which could be attributed to inadequate monitoring of the extensive and diverse fisheries in these countries.

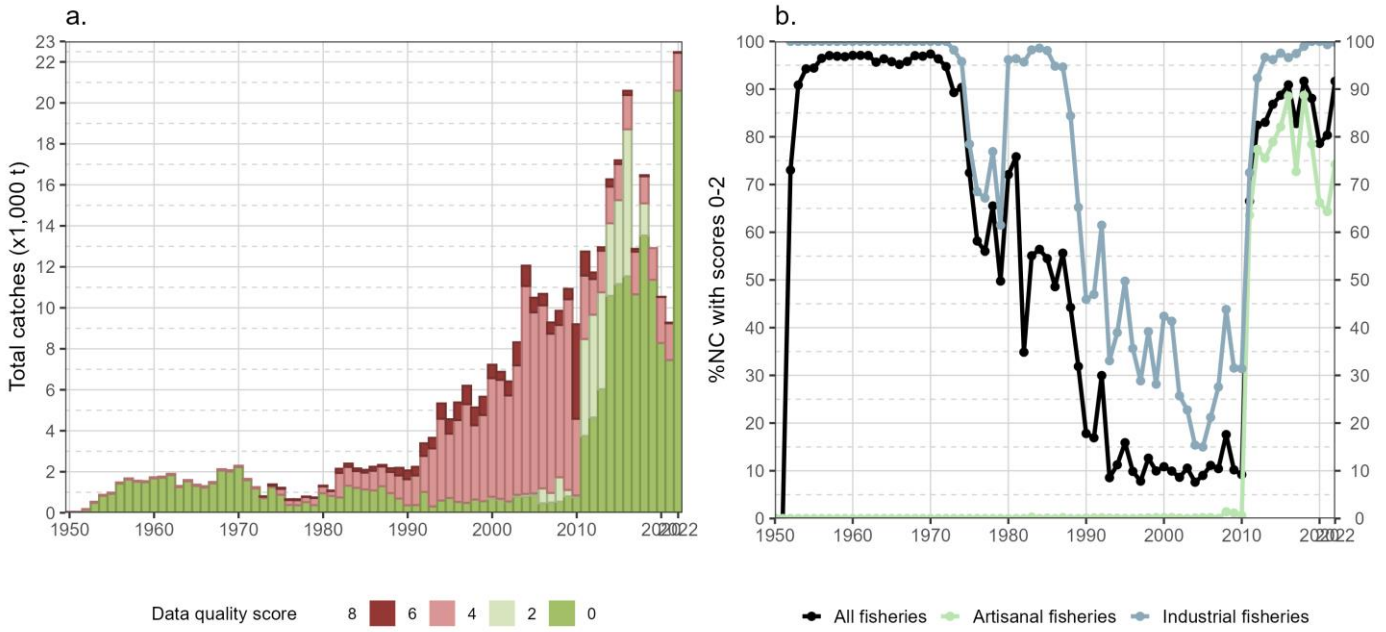

Figure 10: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and (b) percentage of total retained catches fully or partially reported to the IOTC Secretariat for all fisheries and by type of fishery, in the period 1950-2022

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**).

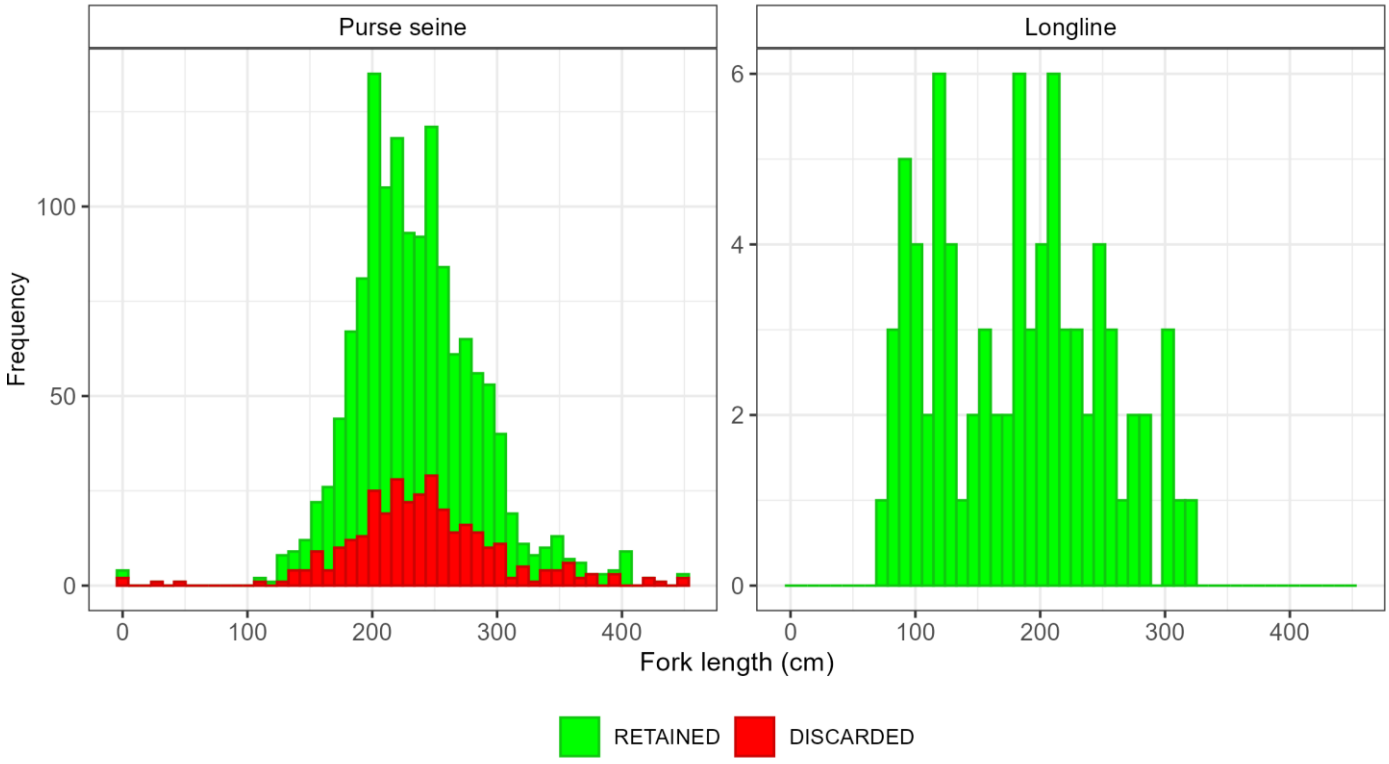

Figure 11: Size (fork length; cm) frequency distribution of black marlin retained and discarded at sea in purse seine and longline fisheries as available in the ROS regional database

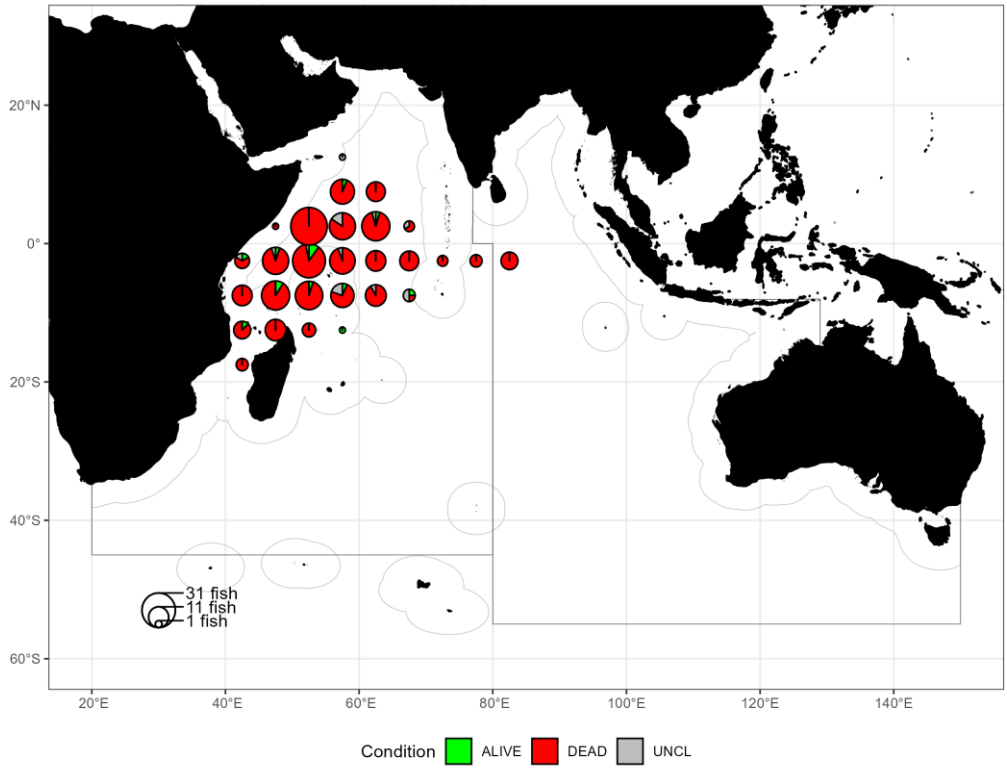

Figure 12: Distribution of black marlins discarded at sea in the western Indian Ocean purse seine fisheries with information on condition at release as available in the ROS regional database

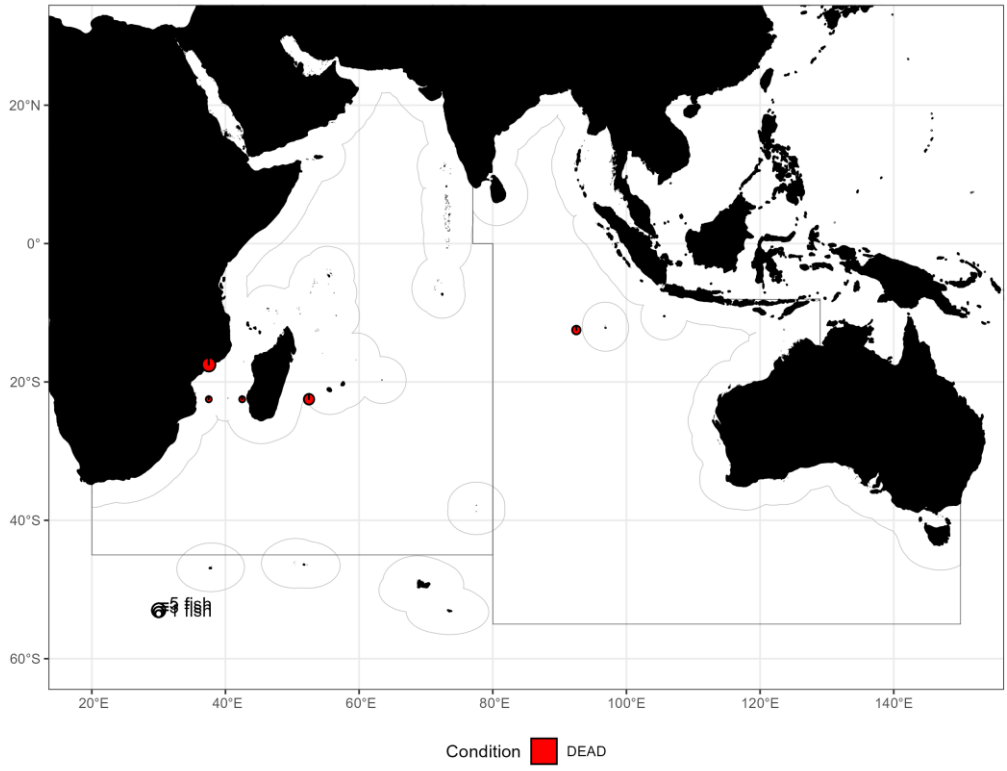

Figure 13: Distribution of black marlins discarded at sea in the Indian Ocean longline fisheries with information on condition at release as available in the ROS regional database

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, primarily from longline fisheries, which have historically been the main source of black marlin catches. In recent years, geo-referenced data from artisanal fisheries have also become available, though these are not fully raised and some CPCs have incomplete reports. **Figs. 14-15-16** illustrate catch distribution across different fisheries over various periods, highlighting regional trends and changes in distribution by fishery type.

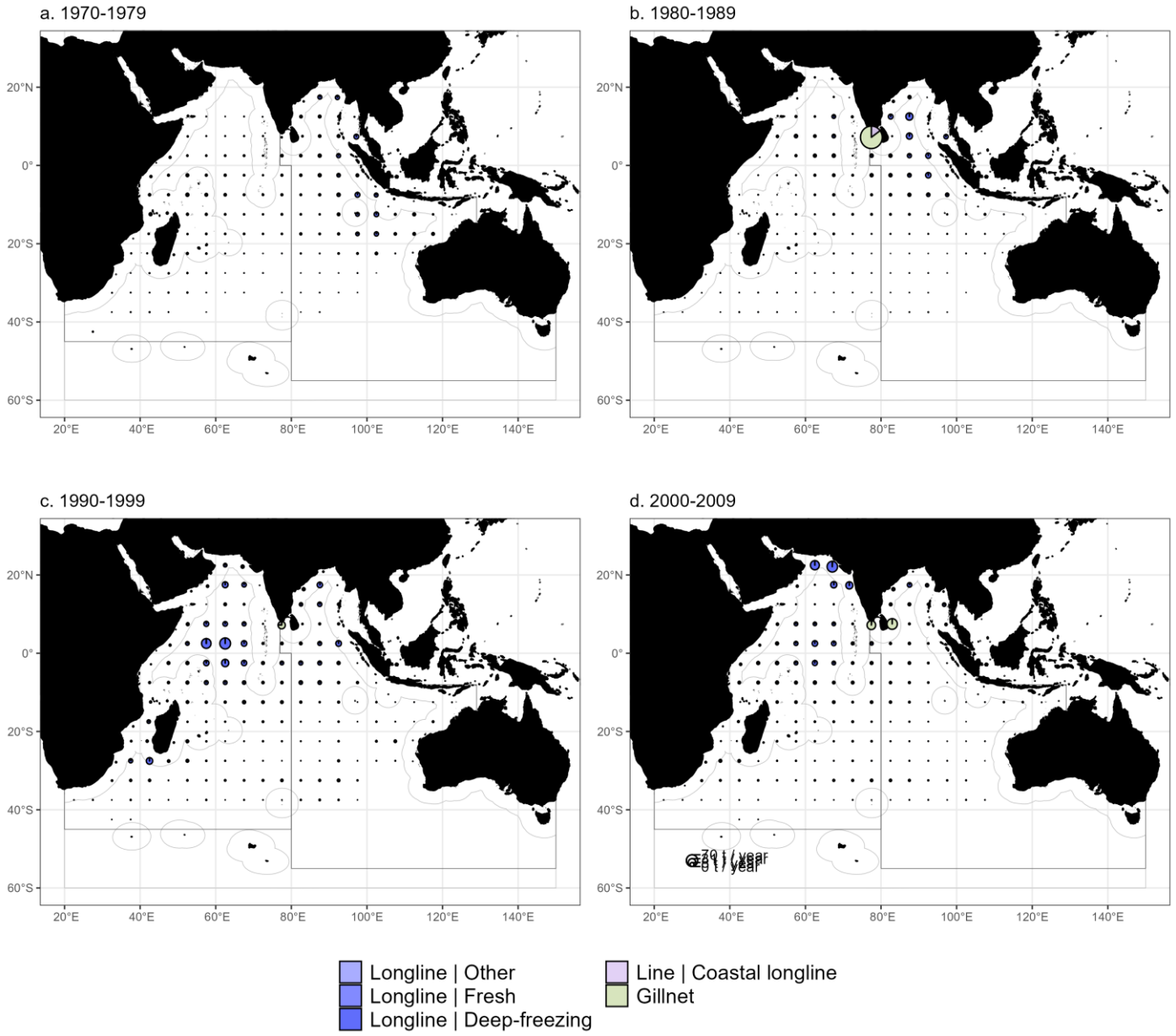

Figure 14: Mean annual time-area catches in weight (metric tonnes; t) of black marlin, by decade, 5x5 grid, and fishery. Data source: time-area catches

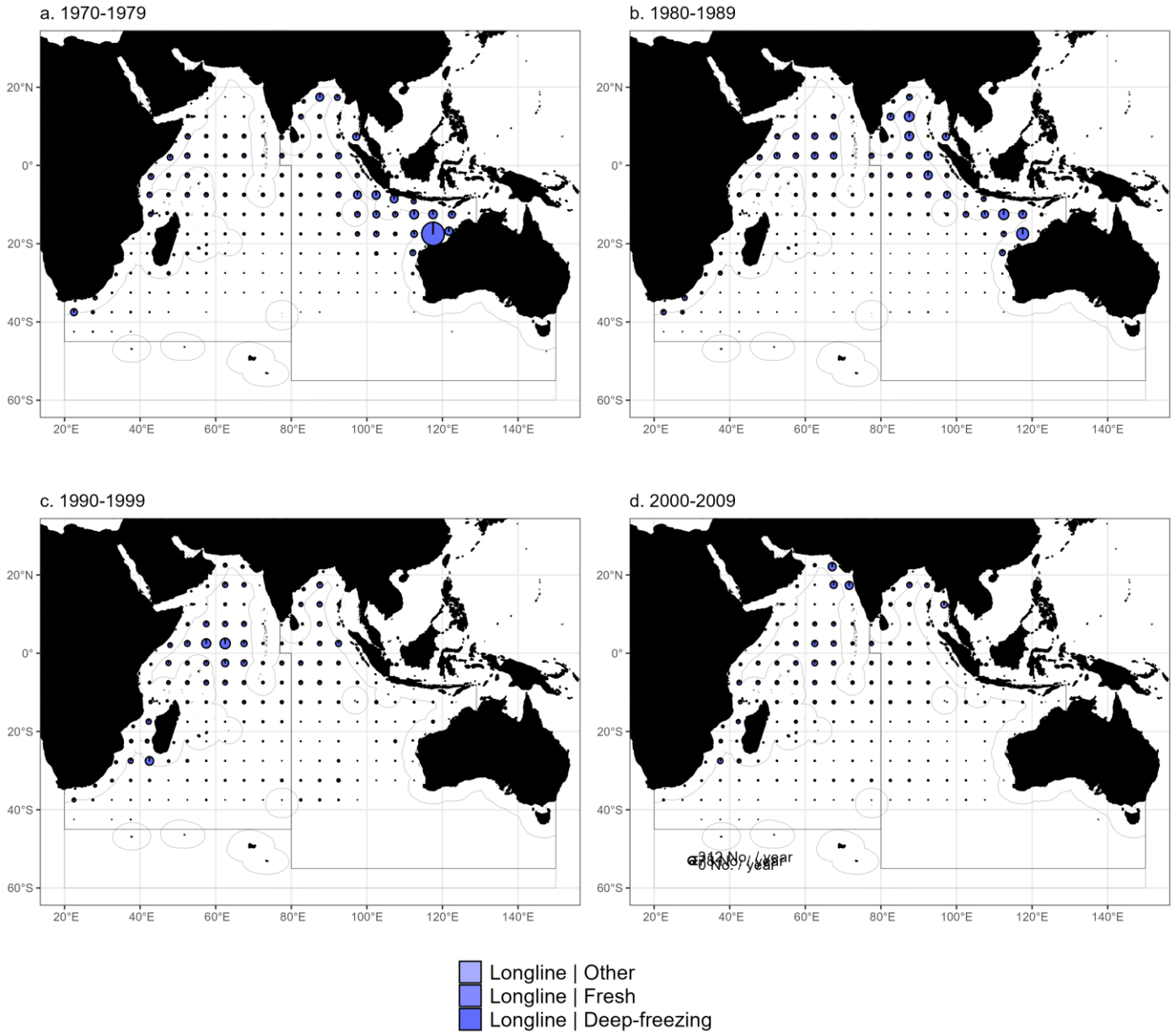

Figure 15: Mean annual time-area catches in numbers of black marlin, by decade, 5x5 grid, and fishery. Data source: time-area catches

Geo-referenced catches by fishery, last years (2018-2022) and decade (2010-2019)

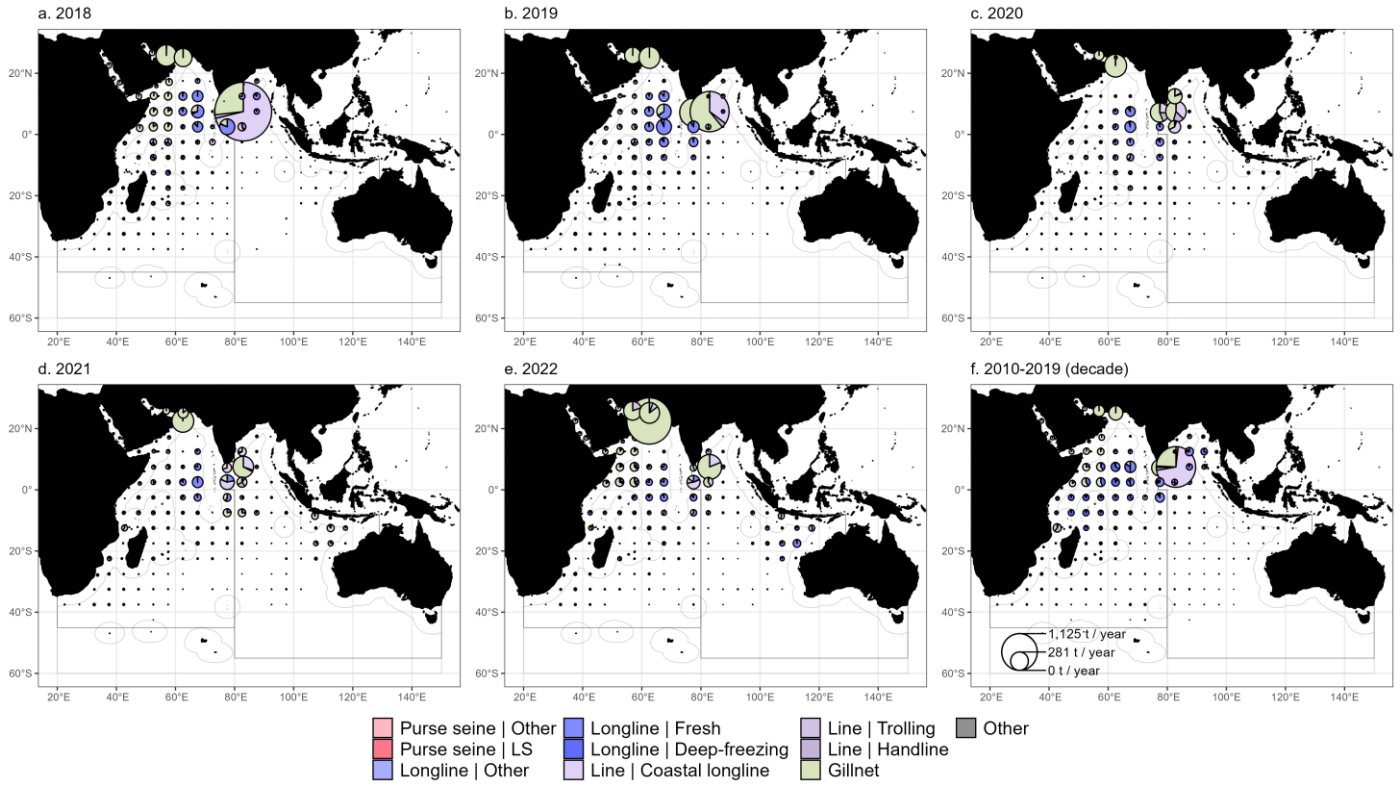

Figure 16: Mean annual time-area catches in weight (metric tonnes; t) of black marlin, by year / decade, 5x5 grid, and fishery. Data source: time-area catches

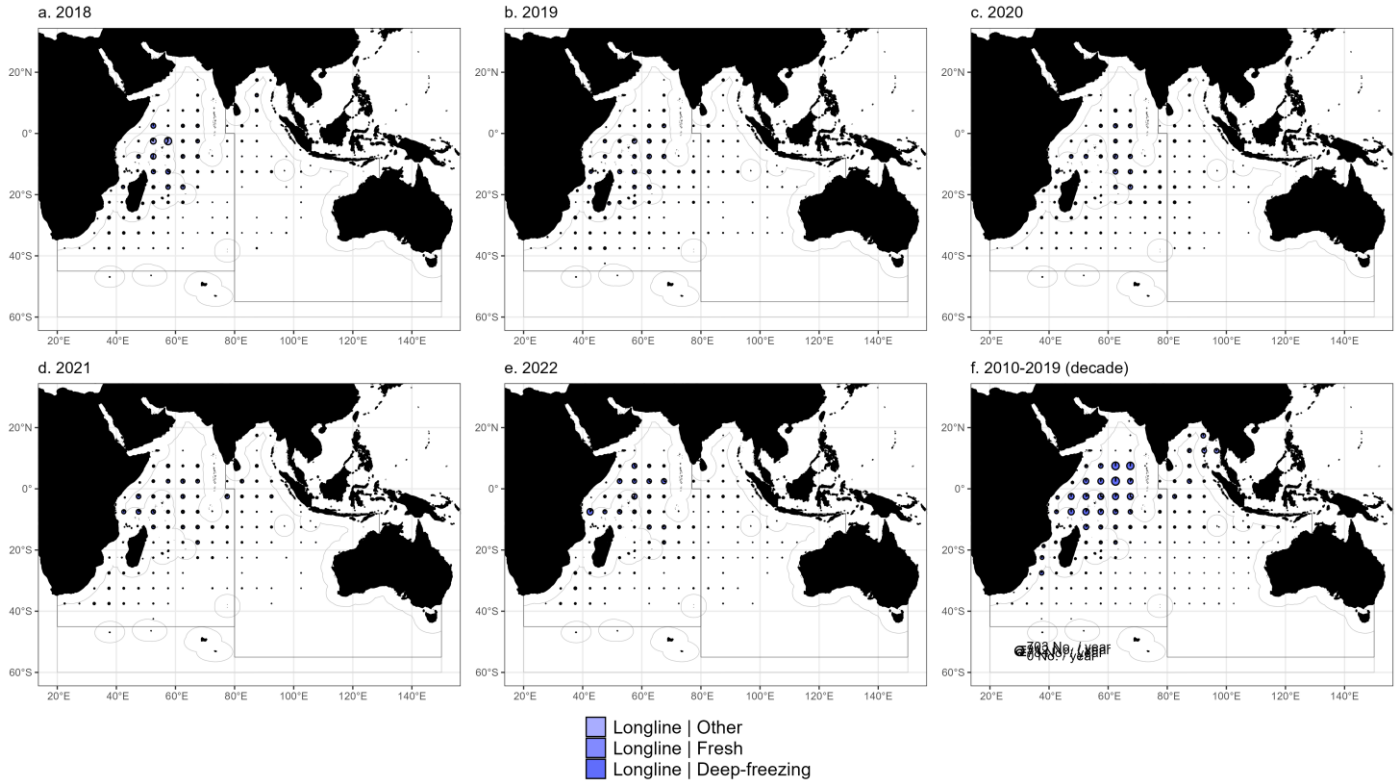

Figure 17: Mean annual time-area catches in numbers of black marlin, by year / decade, 5x5 grid, and fishery. Data source: time-area catches

Uncertainties in catch and effort data

Geo-referenced catch data for black marlin are reported less frequently compared to retained catch data. This discrepancy is due to the fact that not all CPCs with significant black marlin catches have robust data collection systems to record geo-referenced information. In recent years, the Islamic Republic of Iran (post-2010) has reported catch and

effort data, although this data is not fully raised and lacks complete spatial information. Indonesia (post-2017) has provided data with limited coverage, and Sri Lanka (post-2014) has contributed to improvements in the quality of geo-referenced catch data. Overall, between 2018 and 2022, 79% of the geo-referenced catch data for black marlin has been reported as compared to total retained catches (**Fig. 18**).

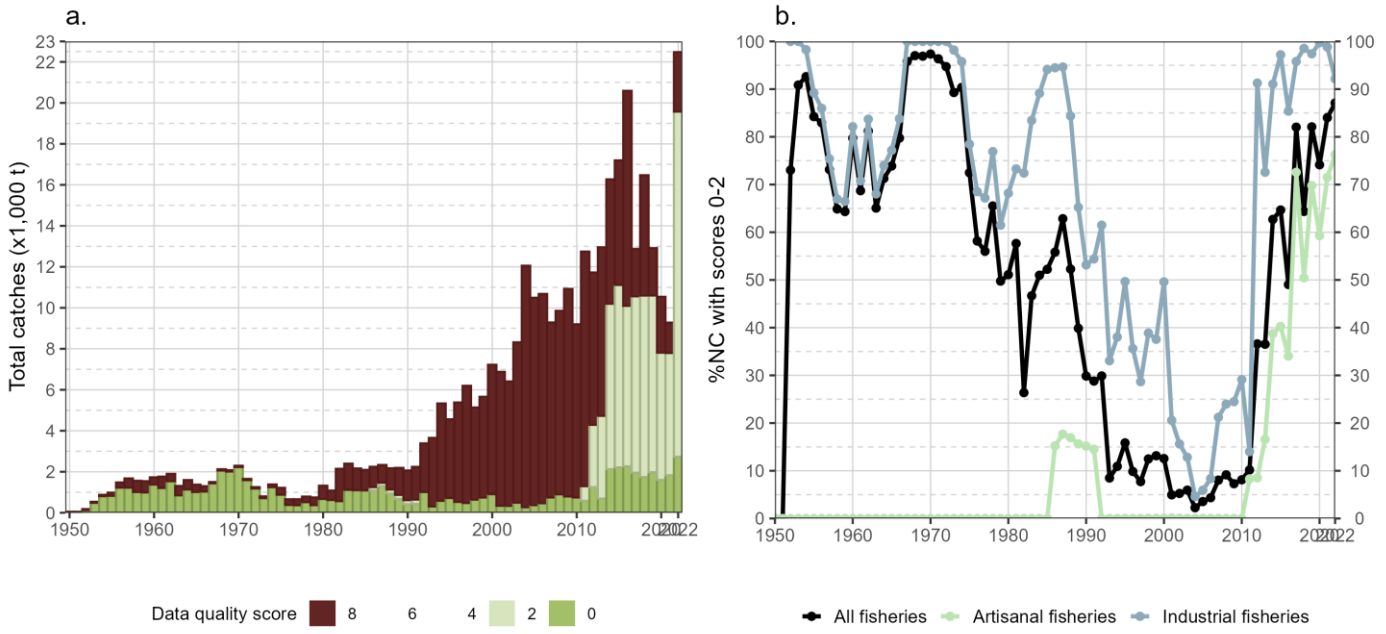

Figure 18: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and (b) percentage of total retained catch for which geo-referenced catches were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950-2022

Size composition of the catch

Samples availability

Size frequency data for black marlin are notably scarce compared to other billfish species, representing only 2.5% of the total size samples available for all billfish species. In recent years, coastal fisheries have increasingly dominated black marlin catches. However, sampling from these fisheries faces several challenges:

(i) Port Sampling Limitations: Sampling is primarily conducted at landing sites, which may not fully capture the complete range of catches.

(ii) Processing Issues: A significant portion of landed marlins are processed (e.g., headed), which complicates species identification and makes size sampling more difficult.

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

- Longline Fisheries: Sampling is conducted throughout the Indian Ocean, with a notable concentration of samples collected around the Somalia area (**Fig. 20**).
- Gillnet Fisheries: Sampling is primarily concentrated around Sri Lanka (**Fig. 21**).
- Line Fisheries: Size samples are collected around the East coast of Africa and in Indonesia (**Fig. 22**).
- Purse Seine Fisheries: Sampling distribution includes the high seas around Sri Lanka and the coast of East Africa. These samples are likely collected from small-scale fisheries and observers on industrial purse seine vessels (**Fig. 23**).

By fishery group

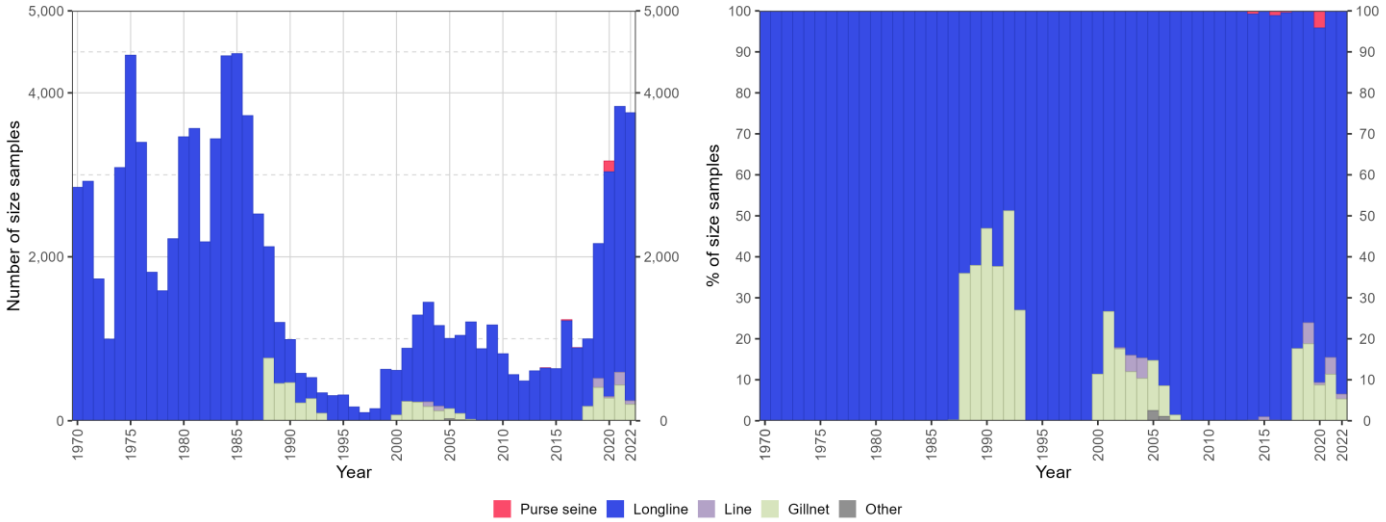

Figure 19: Availability of black marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and fishery group. Data source: standardized size-frequency dataset

Longline fisheries

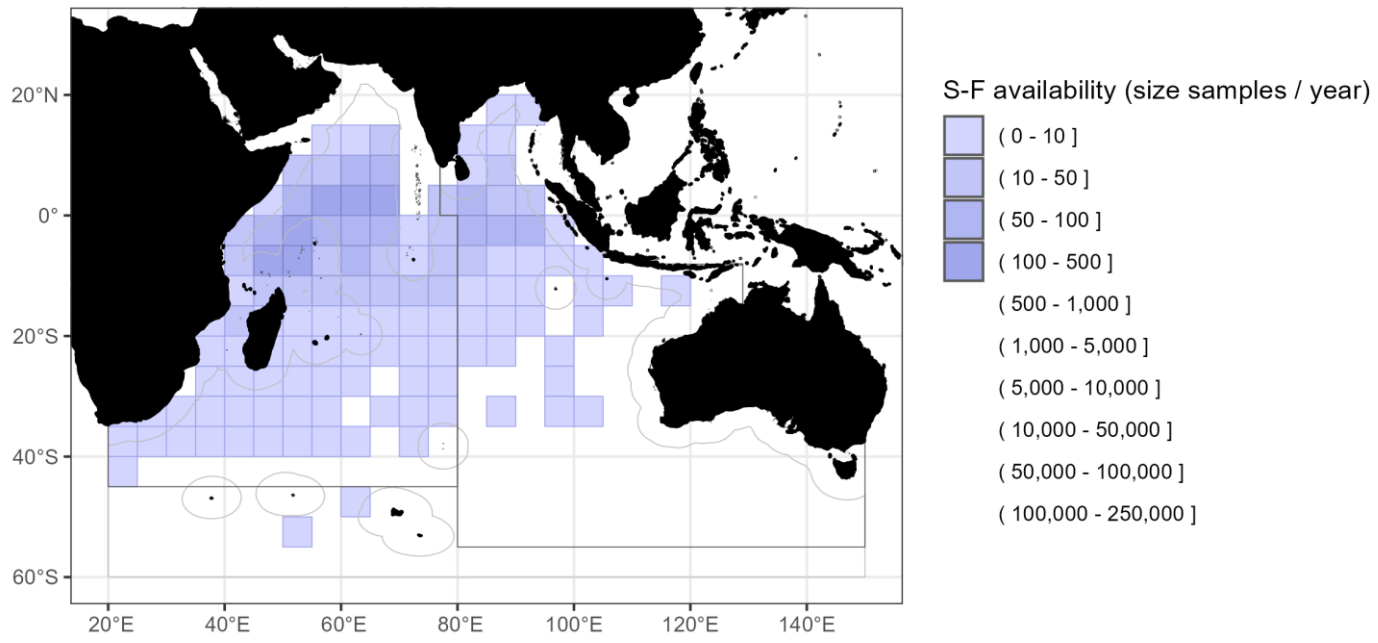

Figure 20: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for longline fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

Gillnet fisheries

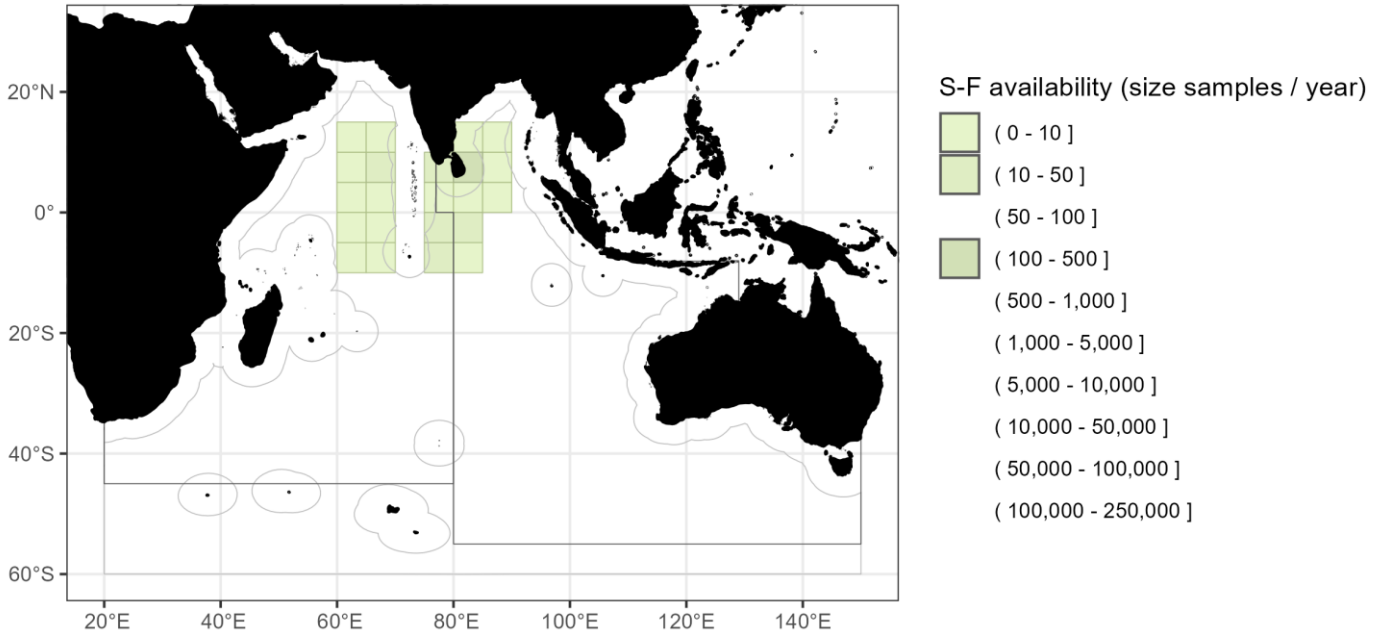

Figure 21: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for gillnet fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

Line fisheries

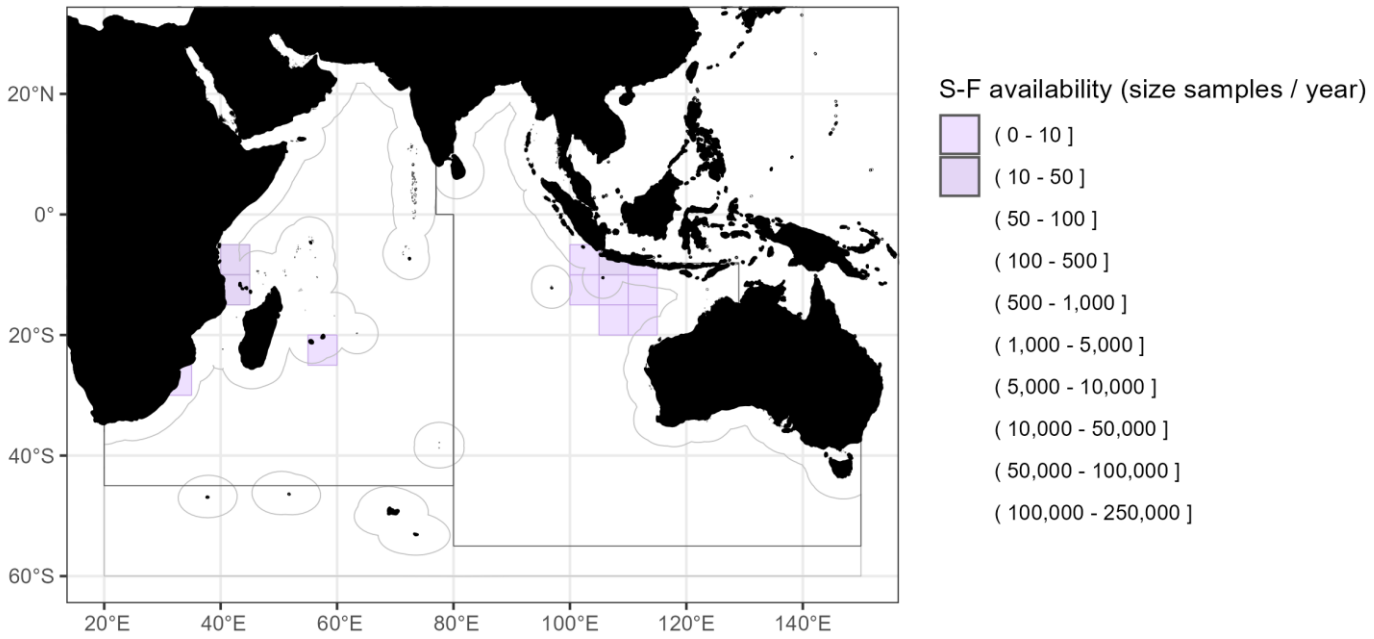

Figure 22: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for line fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

Purse seine fisheries

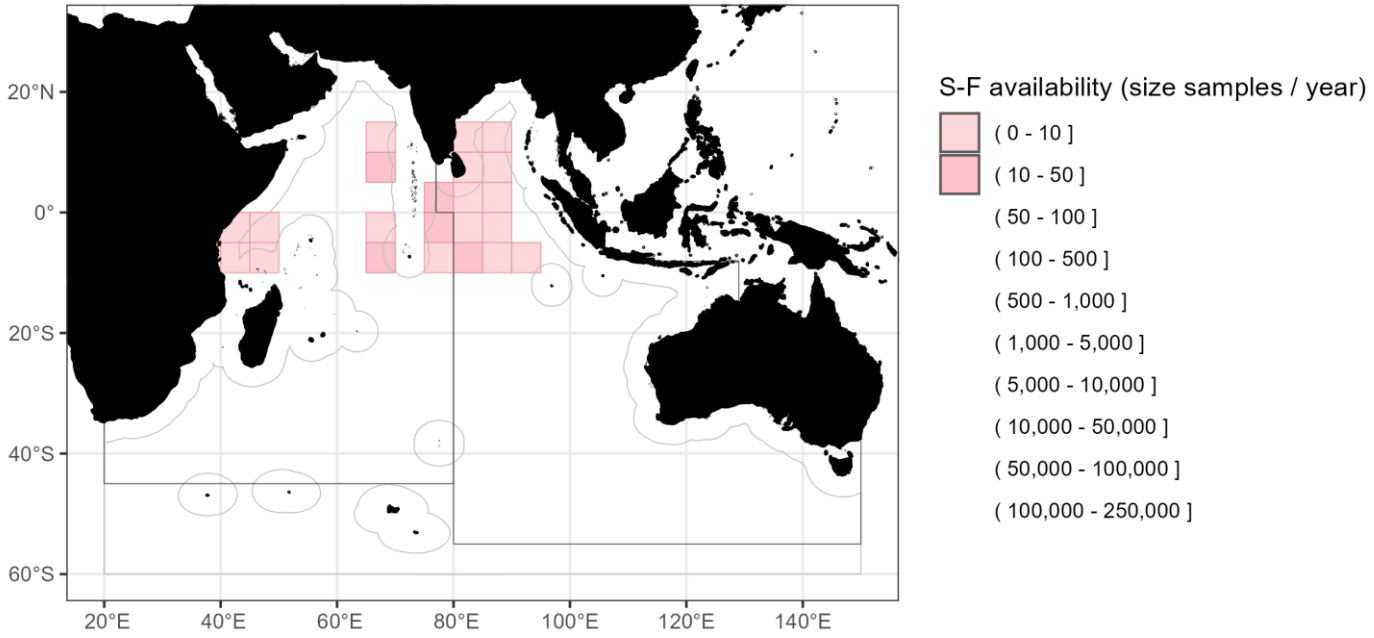

Figure 23: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data for purse seine fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

By fishery

Longline fisheries

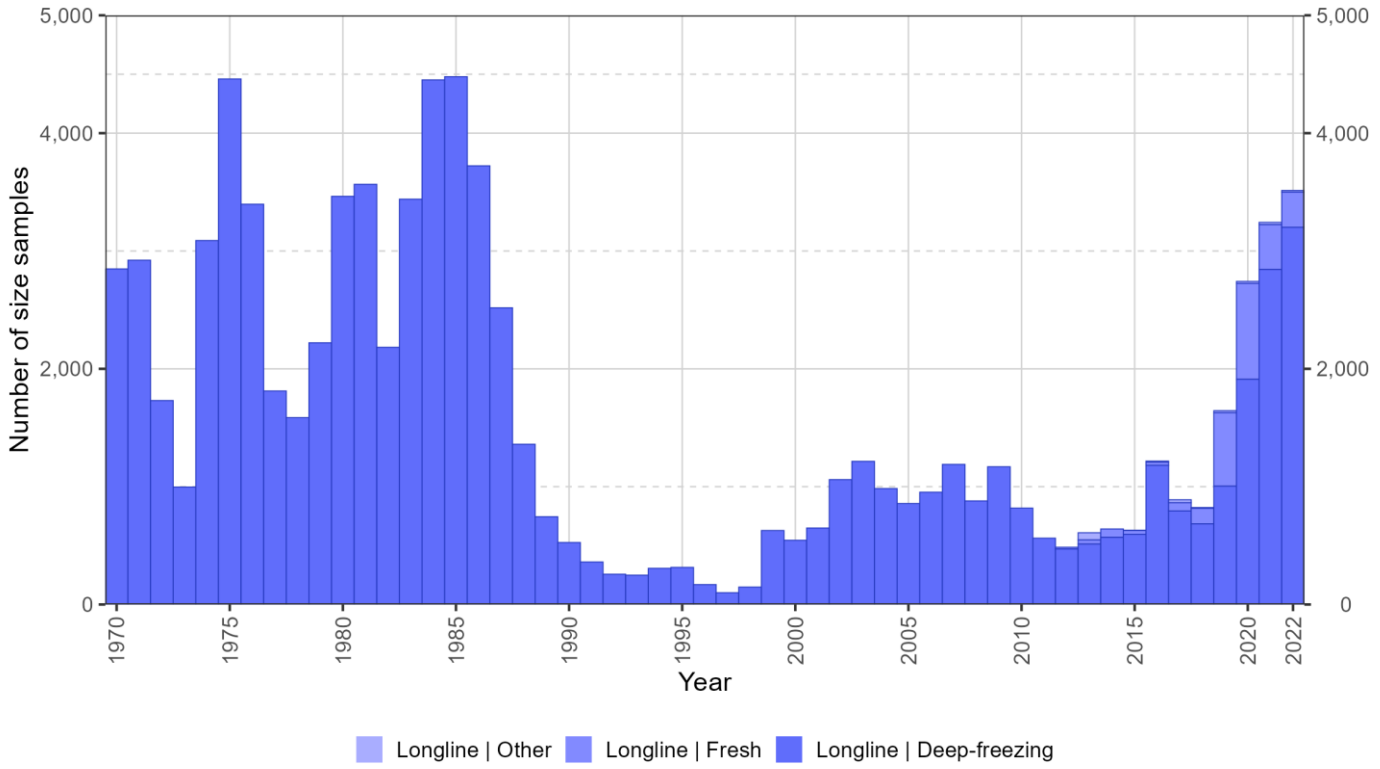

Figure 24: Availability of black marlin size-frequency data as absolute number of samples per year longline fishery. Data source: standardized size-frequency dataset

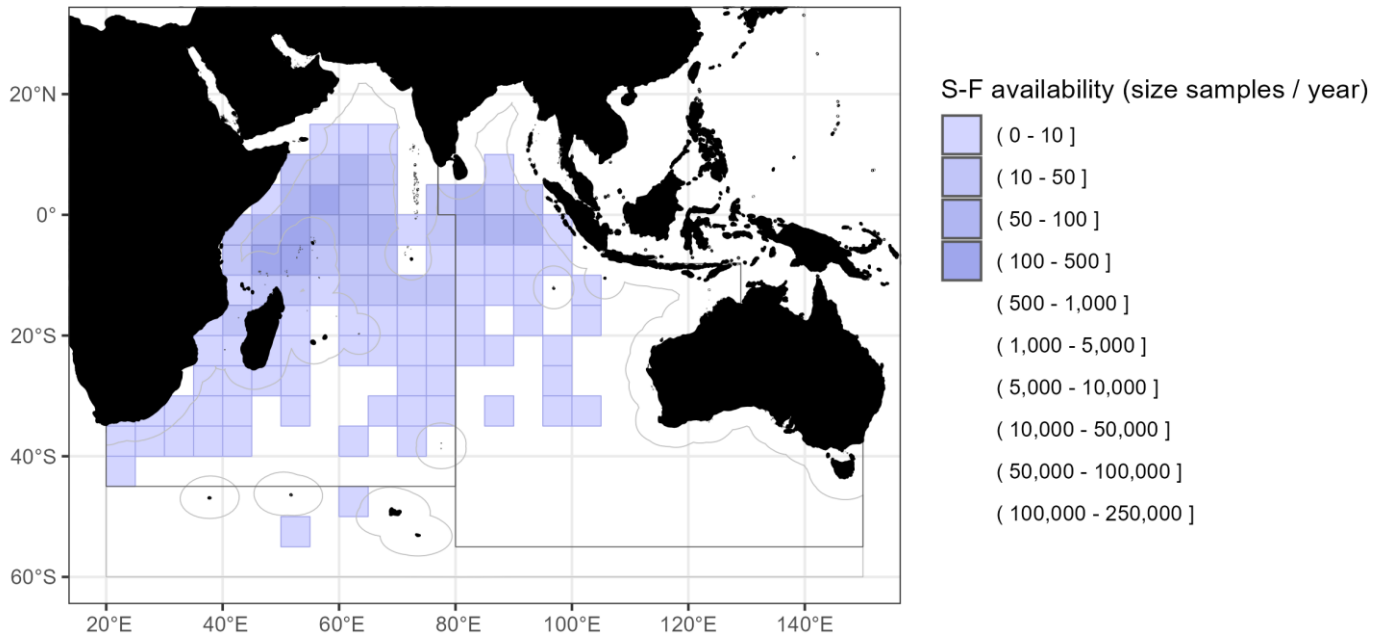

Figure 25: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data in deep-freezing longline fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

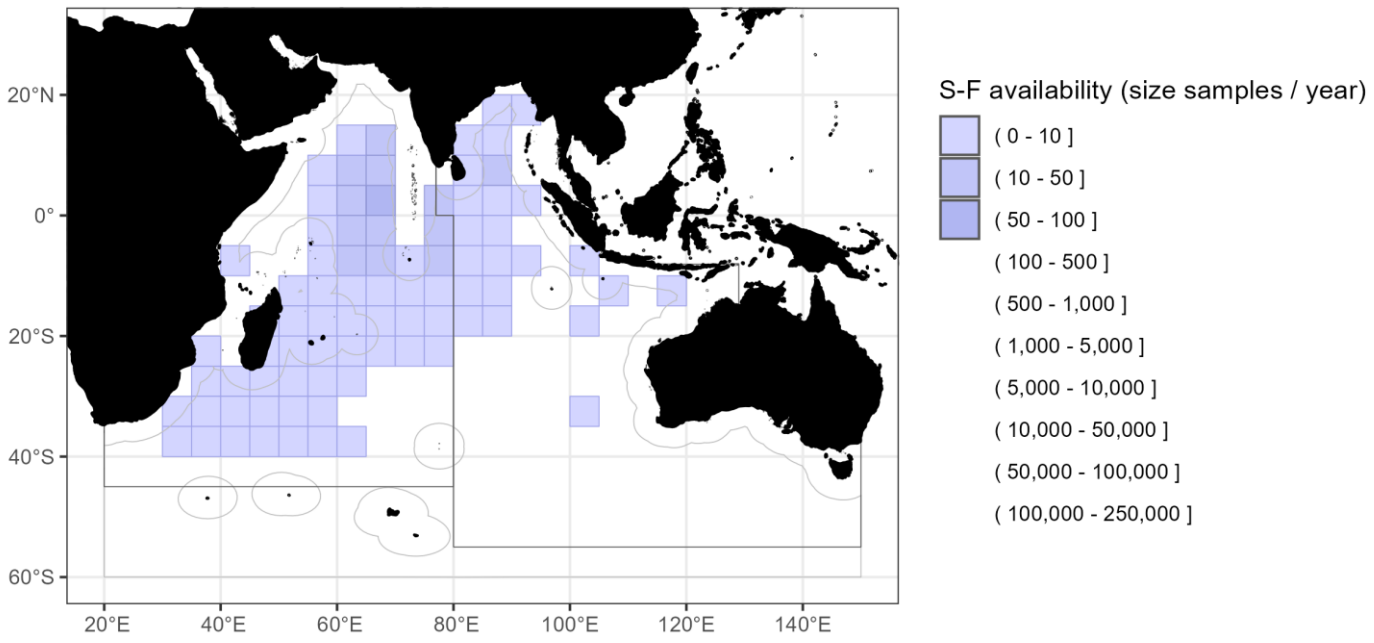

Figure 26: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data in fresh longline fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

Gillnet fisheries

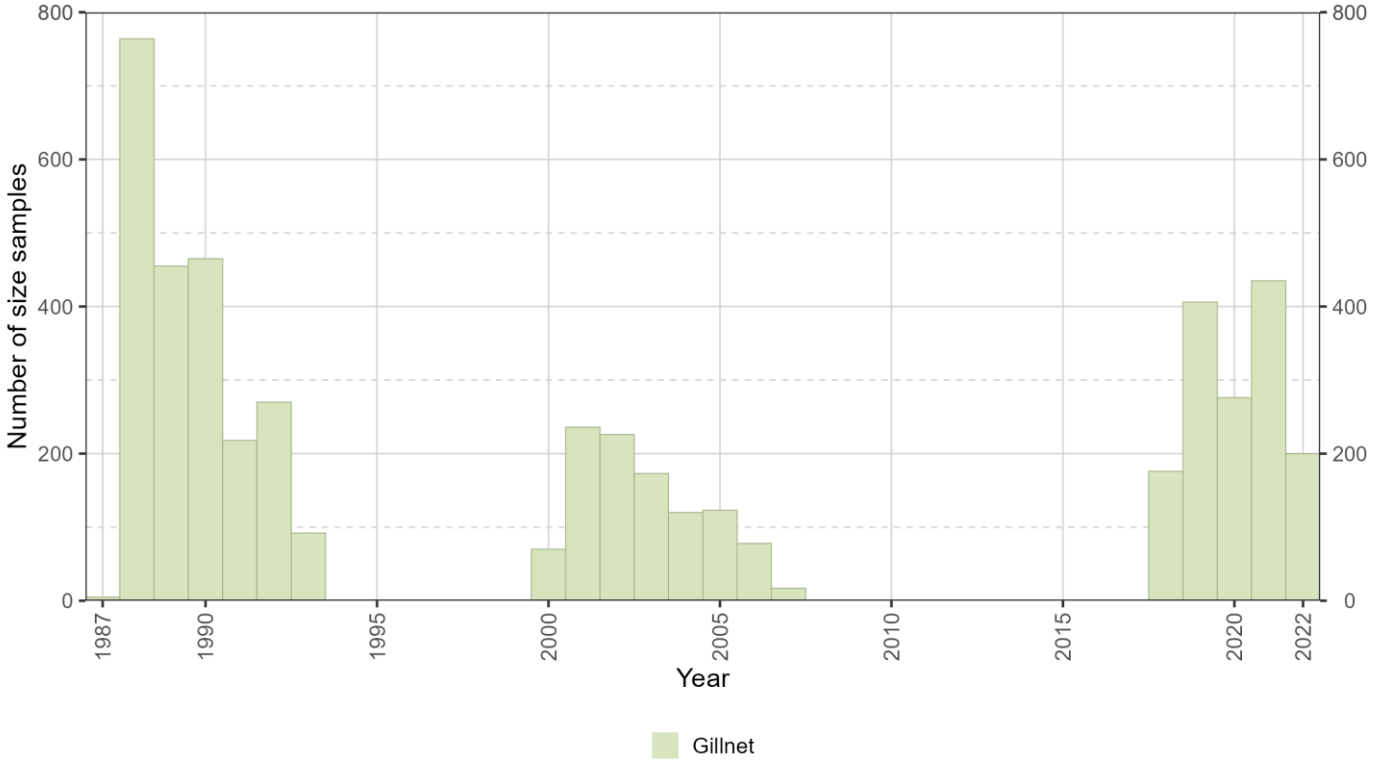

Figure 27: Availability of black marlin size-frequency data as absolute number of samples per year and gillnet fishery. Data source: standardized size-frequency dataset

Line fisheries

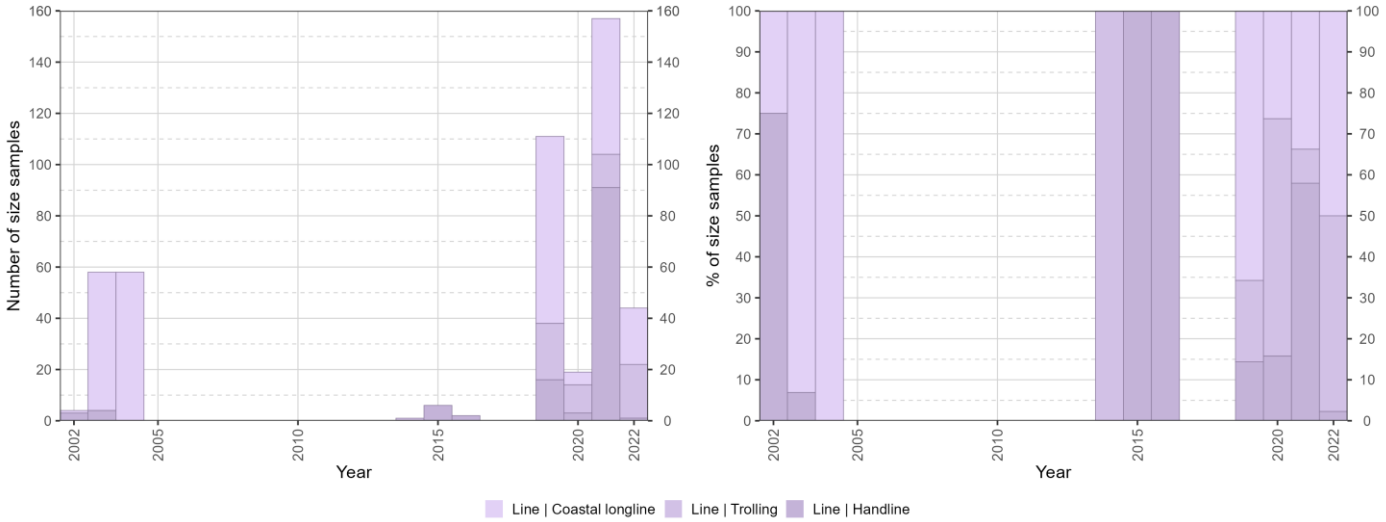

Figure 28: Availability of black marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and line fishery type. Data source: standardized size-frequency dataset

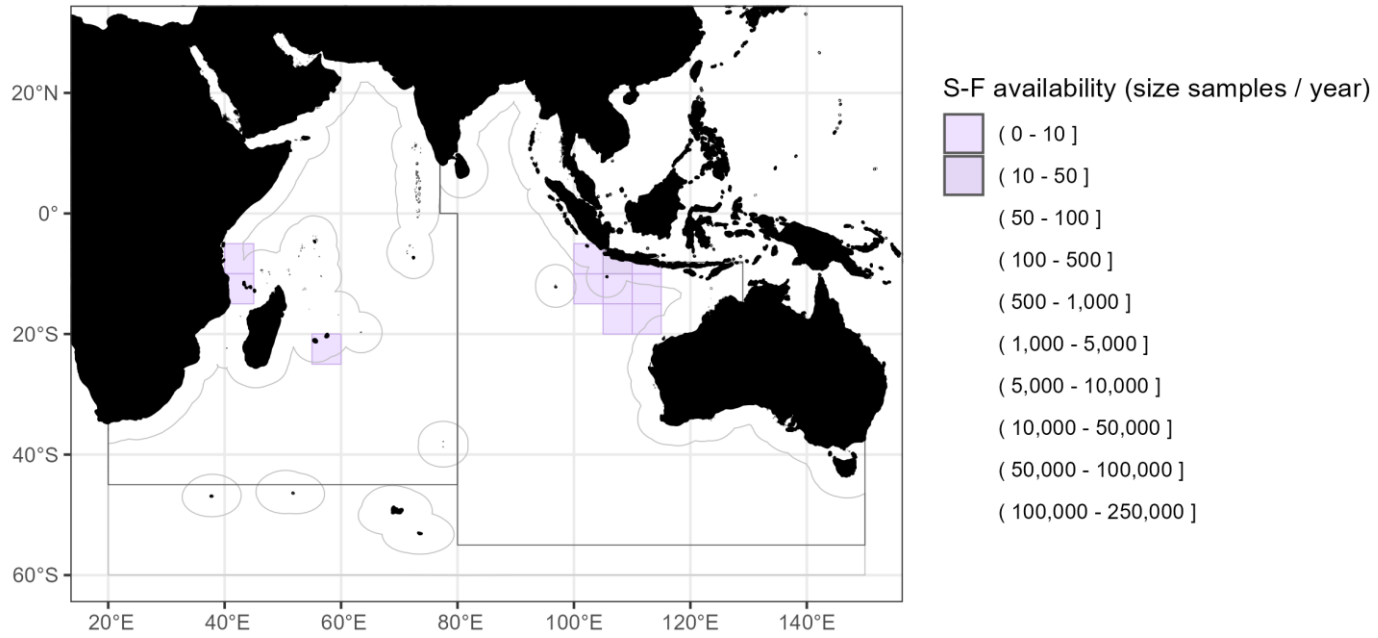

Figure 29: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (coastal longline) fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

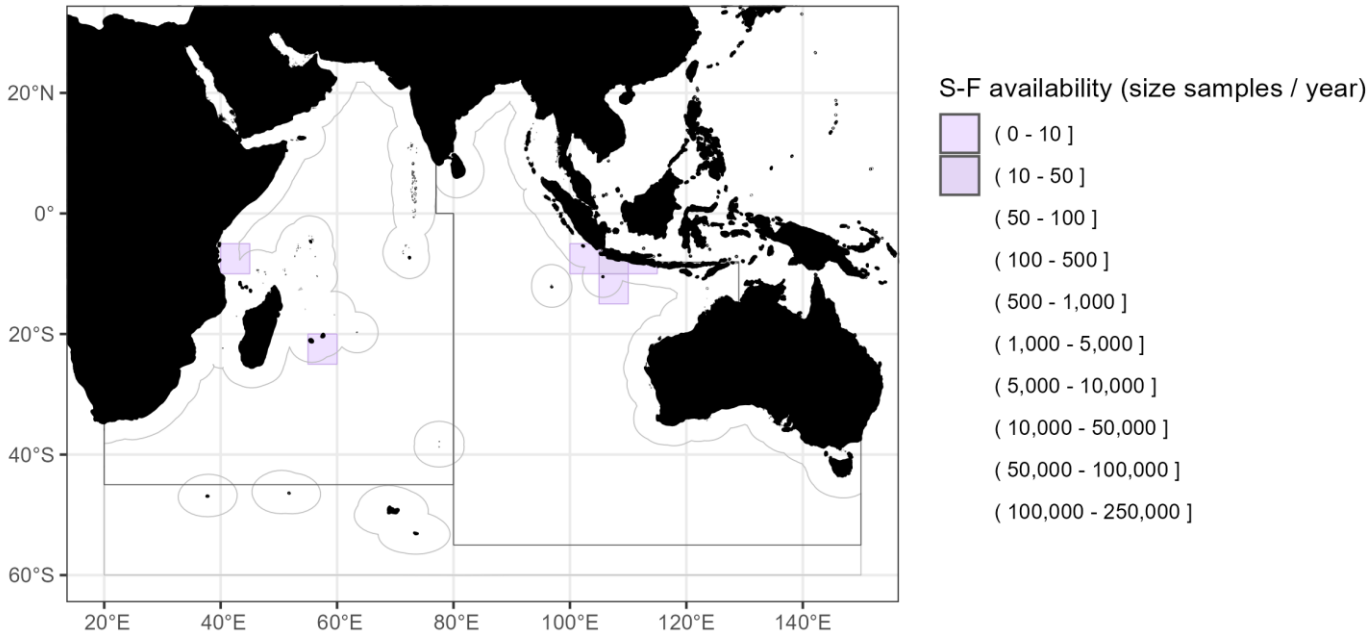

Figure 30: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (handline) fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

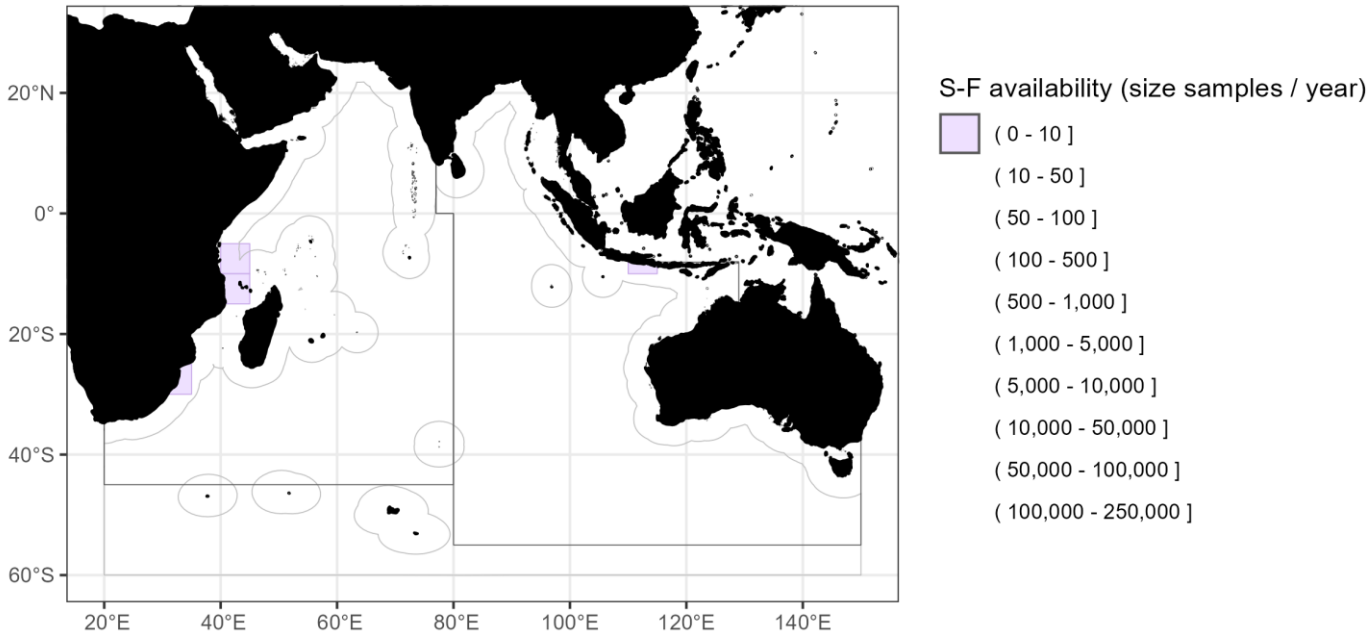

Figure 31: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by line (trolling) fisheries in the period 2018-2022. Data source: standardized size-frequency dataset

Purse seine fisheries

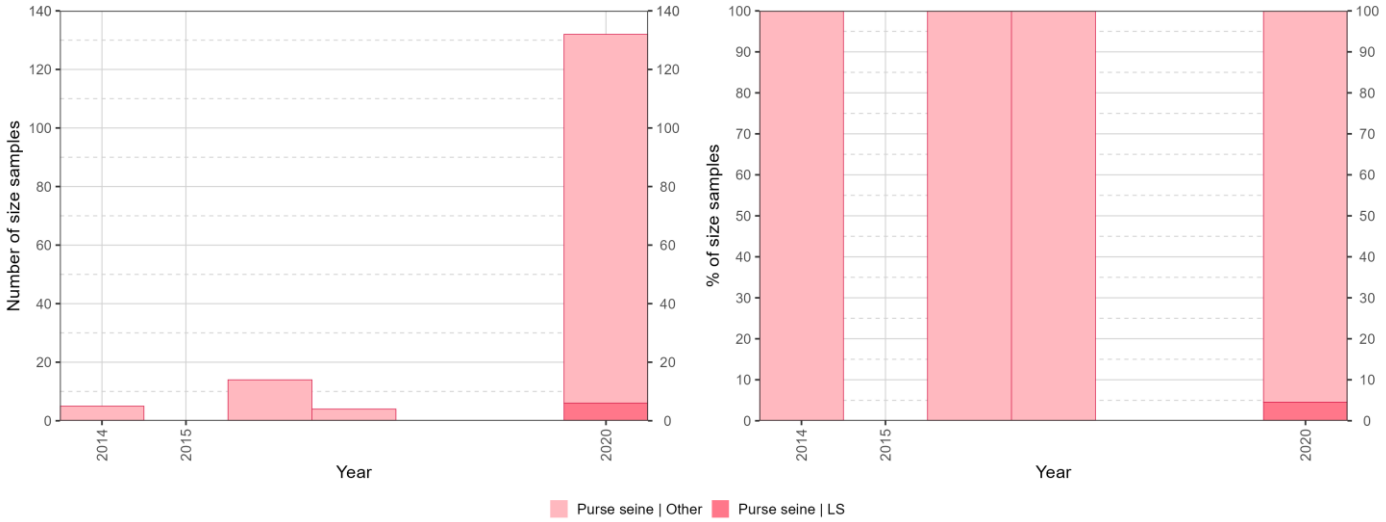

Figure 32: Availability of black marlin size-frequency data as absolute number of samples per year and purse seine fishery. Data source: standardized size-frequency dataset

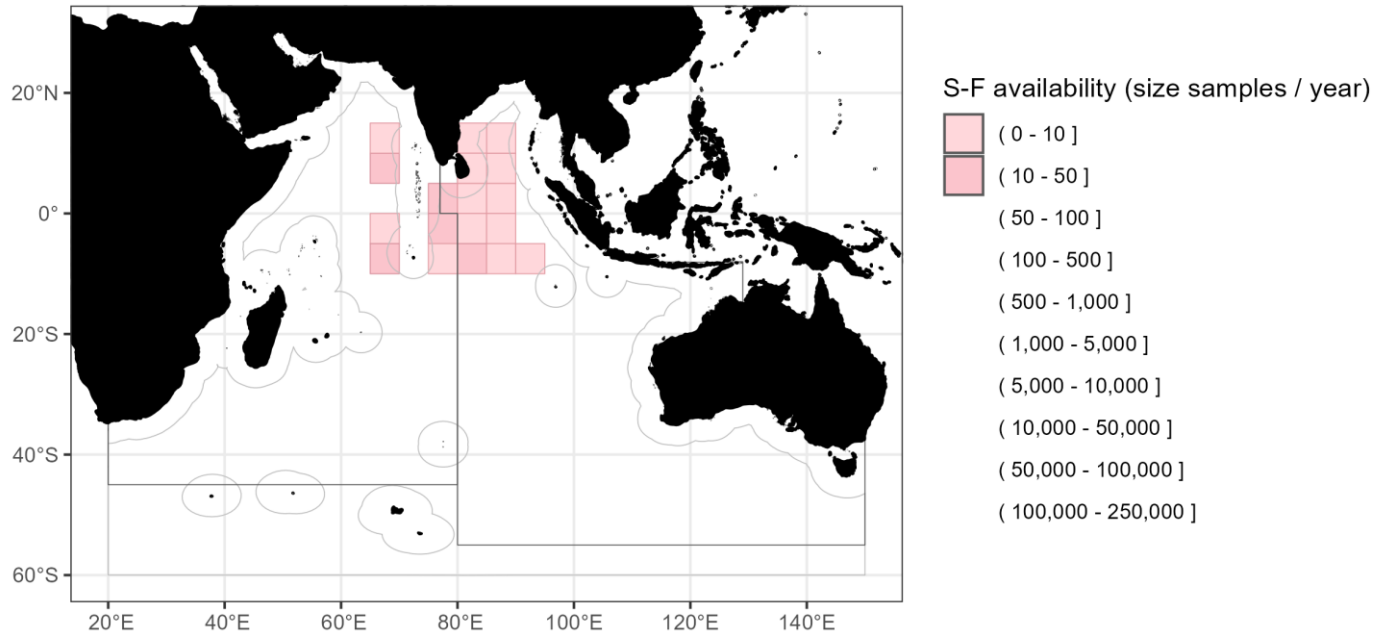

Figure 33: Spatial distribution (average number of samples per grid per year) of available black marlin size-frequency data by purse seine fisheries (other) in the period 2018-2022. Data source: standardized size-frequency dataset

Temporal patterns and trends in size distributions

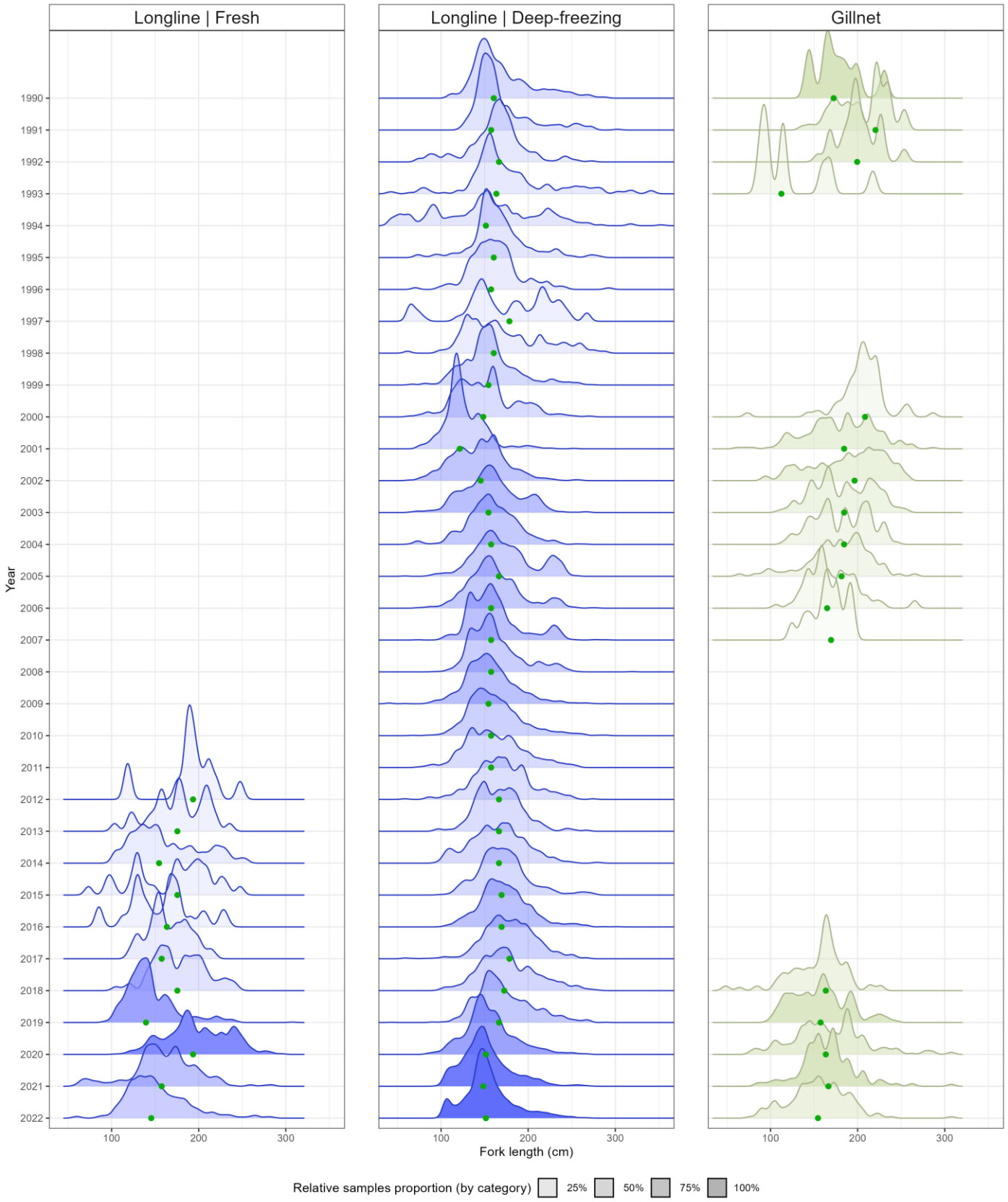

Figure 34: Relative size distribution (fork length; cm) of black marlin caught by purse seine (Other) and gillnet fisheries. Other = no information provided on school association. Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median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

Size distribution by fishery and fleet

Gillnet fisheries

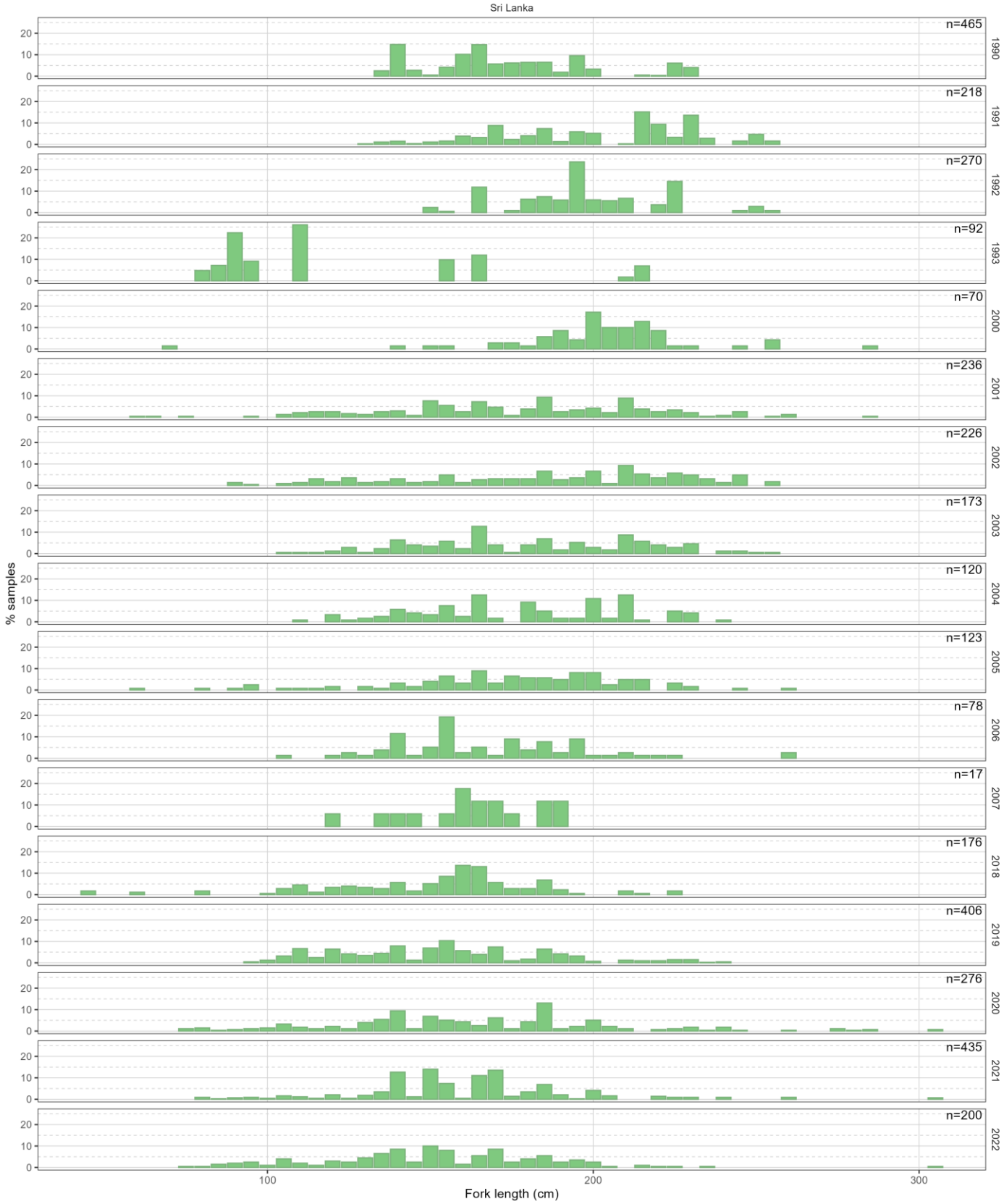

Figure 35: Relative size distribution of black marlin (fork length; cm) recorded for gillnet fisheries by year and main fleet. Data source: standardized size-frequency dataset

Uncertainties in size-frequency data

The availability of size frequency data for black marlin is notably limited compared to the reported retained catches of the species. Major fleets that report black marlin catches frequently do not collect size samples, and only fleets with well-established data collection systems provide size samples for most species. As a result, the quality of the data is considered poor, with only 15% of the size sampling relative to the total black marlin catch reported between 2018 and 2022 (**Fig. 36**).

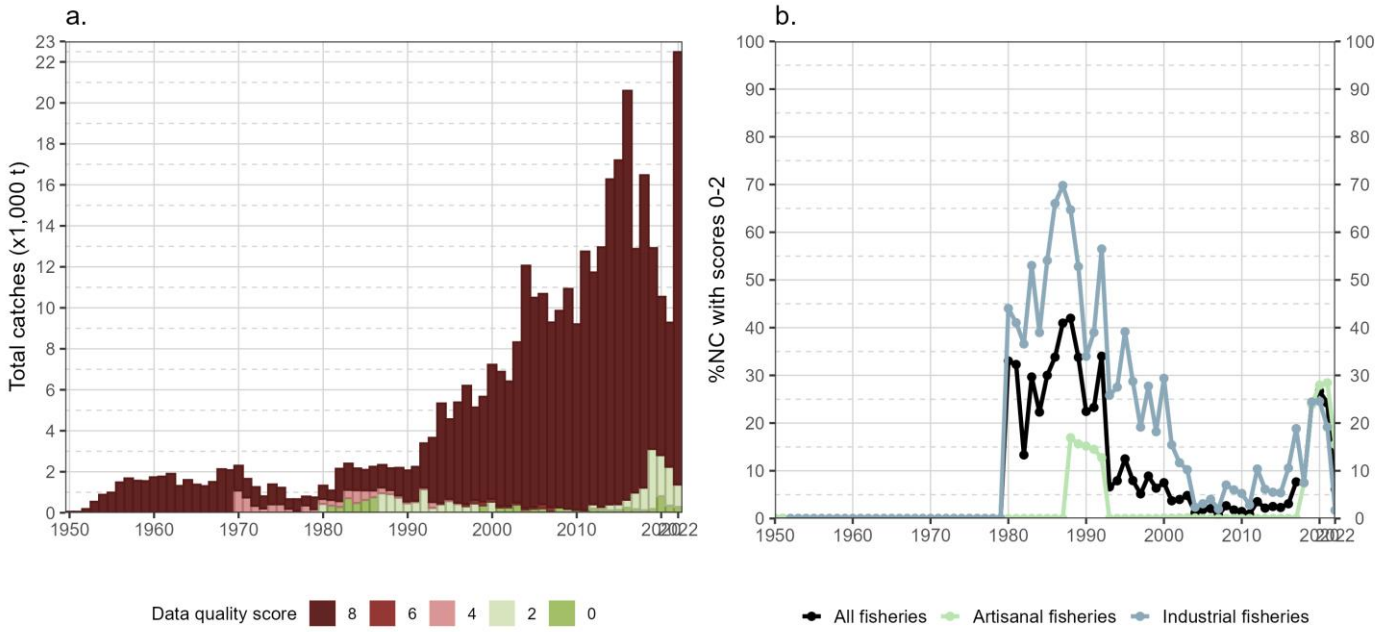

Figure 36: (a) Annual retained catches (metric tonnes; t) of black marlin estimated by quality score and percentage of total retained catches for which geo-referenced size-frequency data were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950–2022

References

Andrade HA (2016) Preliminary stock assessment of black marlin (makaira indica) caught in the indian ocean using a bayesian state-space production model IOTC.

Collette BB, Di Natale A, Fox W, Juan Jorda M, Pohlo B, Graves J, Schratwieser J (2022) IUCN Red List of Threatened Species: Istiompax Indica, Black Marlin.

Yokoi H, Nishida T (2016) Stock assessments of black marlin in the indian ocean using ASPIC IOTC.

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 21st session of the IOTC Working Party on Billfish (WPB21), with overall small modifications in the time series of annual catches (**Fig. 9**). The changes covering the period 2017-2021 were due to: (i) revision of catch by Bangladesh for all fisheries, with more species information, (ii) revised of data from FAO influencing changes in East Timor, and (iii) updating of Mozambique catch.

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)
2021	BGD	Gillnet	Eastern Indian Ocean	550	70	480
2020	TMP	Gillnet	Eastern Indian Ocean	32	0	32
2019	MOZ	Line	Western Indian Ocean	48	7	40
	TMP	Gillnet	Eastern Indian Ocean	27	0	27
2018	MOZ	Line	Western Indian Ocean	26	4	22
	TMP	Gillnet	Eastern Indian Ocean	11	0	11