

## REVIEW OF THE STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN STRIPED MARLIN (1950-2020)

Author: [IOTC Secretariat](#)

### Abstract

The document provides an overview of the consolidated knowledge about fisheries catching striped marlin (*Kajikia audax*) in the Indian Ocean since the early 1950s based on a range of data sets collected by Contracting Parties and Cooperating Non-Contracting Parties (CPCs) of the IOTC and curated by the IOTC Secretariat. The available fisheries statistics indicate that striped marlins have been essentially caught in industrial deep-freezing longline fisheries until the 2000s, with some large interannual variability in the catches reported to the Secretariat. While longline catches of striped marlin have shown a major decline since the mid-1990s, becoming very small (~300 t) in recent years, catches of striped marlin from the coastal gillnet fisheries of I.R. Iran and Pakistan have steadily increased to exceed 1,500 t and contribute to more than 60% of the total catches of striped marlin in 2020. Information available on discarding practices of striped marlin in industrial fisheries indicates that discard levels are small in both longline and purse seine fisheries, and all individuals discarded at sea were assessed to be dead. Discarding in coastal fisheries interacting with the species is poorly known but considered to be negligible. Most information available on the spatial distribution of catch and effort comes from large-scale longline fisheries while almost no information is available on the fishing grounds of the coastal gillnet and longline fisheries catching striped marlin. Consequently, the quality of the geo-referenced catch data reported to the Secretariat has substantially decreased over the last three decades. Very little information is available on the size composition of the catch of striped marlin in the Indian Ocean, except for large-scale longline fisheries.

**Keywords:** billfish | striped marlin | Indian Ocean | tuna fisheries

## Introduction

The overarching objective of this paper is to provide participants in the data preparatory meeting of the 20<sup>th</sup> Session of the IOTC Working Party on Billfish ([WPB20](#)) with a review of the status of the information available on striped marlin (*Kajikia audax*), 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 IOTC ([2022](#)).

## Nominal catch

### Historical trends (1950-2020)

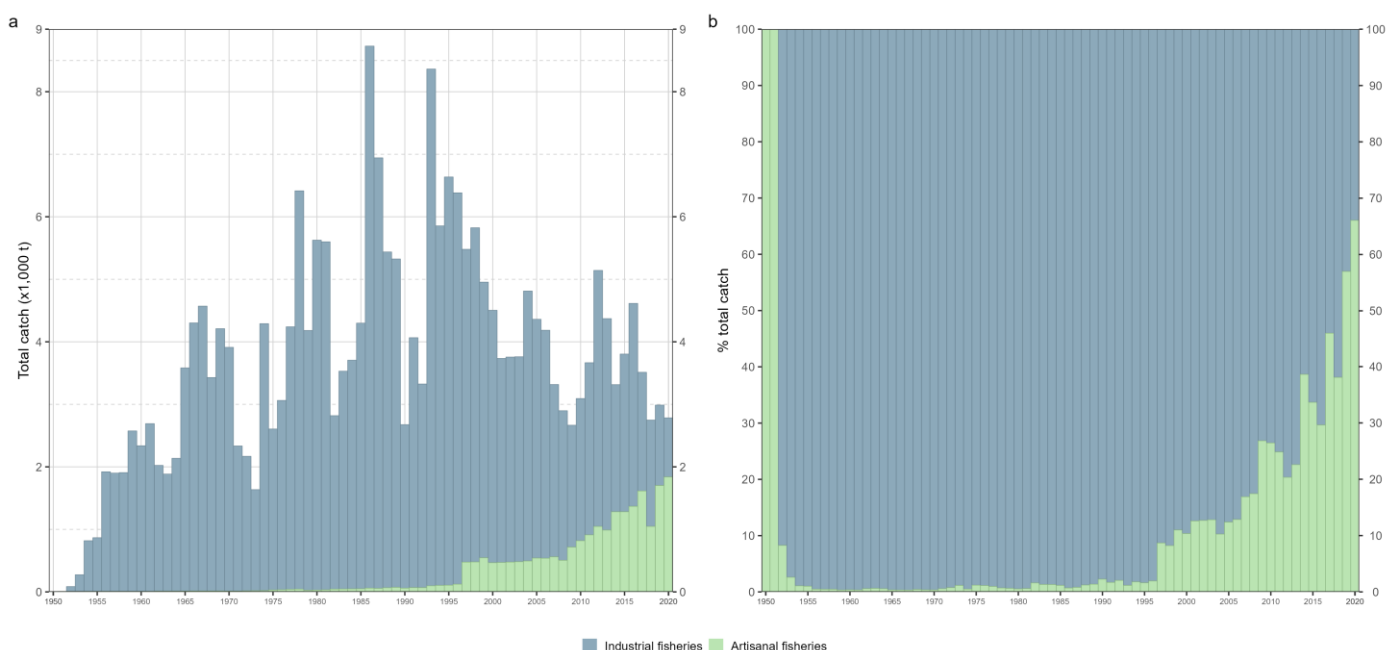


Figure 1: Annual time series of cumulative nominal absolute (a) and relative (b) catches (metric tons; t) of striped marlin by type of fishery for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

Table 1: Best scientific estimates of average annual nominal catches (metric tons; t) of striped 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 estimate of nominal catches](#)

Fishery	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Purse seine   Other	0	0	0	5	8	17	40
Longline   Other	0	0	0	12	51	89	79
Longline   Fresh	0	0	18	63	832	744	635
Longline   Deep-freezing	1,028	3,104	3,441	5,068	4,232	2,103	1,272
Line   Coastal longline	0	0	1	24	47	96	231
Line   Trolling	3	5	9	6	14	23	46
Line   Handline	0	0	0	2	9	18	30
Gillnet	5	8	16	20	160	707	1,385
Other	0	0	0	1	2	3	7
<b>Total</b>	<b>1,036</b>	<b>3,117</b>	<b>3,485</b>	<b>5,201</b>	<b>5,356</b>	<b>3,799</b>	<b>3,725</b>

Table 2: Best scientific estimates of annual nominal catches (metric tons; t) of striped marlin by fishery for the period 2011-2020. The background intensity color of each cell is directly proportional to the catch level. Data source: [best scientific estimate of nominal catches](#)

Fishery	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Purse seine   Other	36	36	41	37	36	37	79	30	32	47
Longline   Other	65	111	137	56	82	103	88	53	54	36
Longline   Fresh	1,212	767	935	577	672	366	326	206	360	190
Longline   Deep-freezing	1,031	2,893	1,817	729	967	2,161	926	733	319	321
Line   Coastal longline	206	205	238	247	255	254	277	247	183	204
Line   Trolling	46	45	51	47	46	49	51	37	48	60
Line   Handline	40	38	44	25	0	29	24	6	55	163
Gillnet	1,022	1,040	1,100	1,590	1,738	1,608	1,735	1,430	1,930	1,753
Other	7	7	8	8	8	7	7	6	7	10
<b>Total</b>	<b>3,666</b>	<b>5,142</b>	<b>4,371</b>	<b>3,315</b>	<b>3,804</b>	<b>4,614</b>	<b>3,513</b>	<b>2,748</b>	<b>2,988</b>	<b>2,784</b>

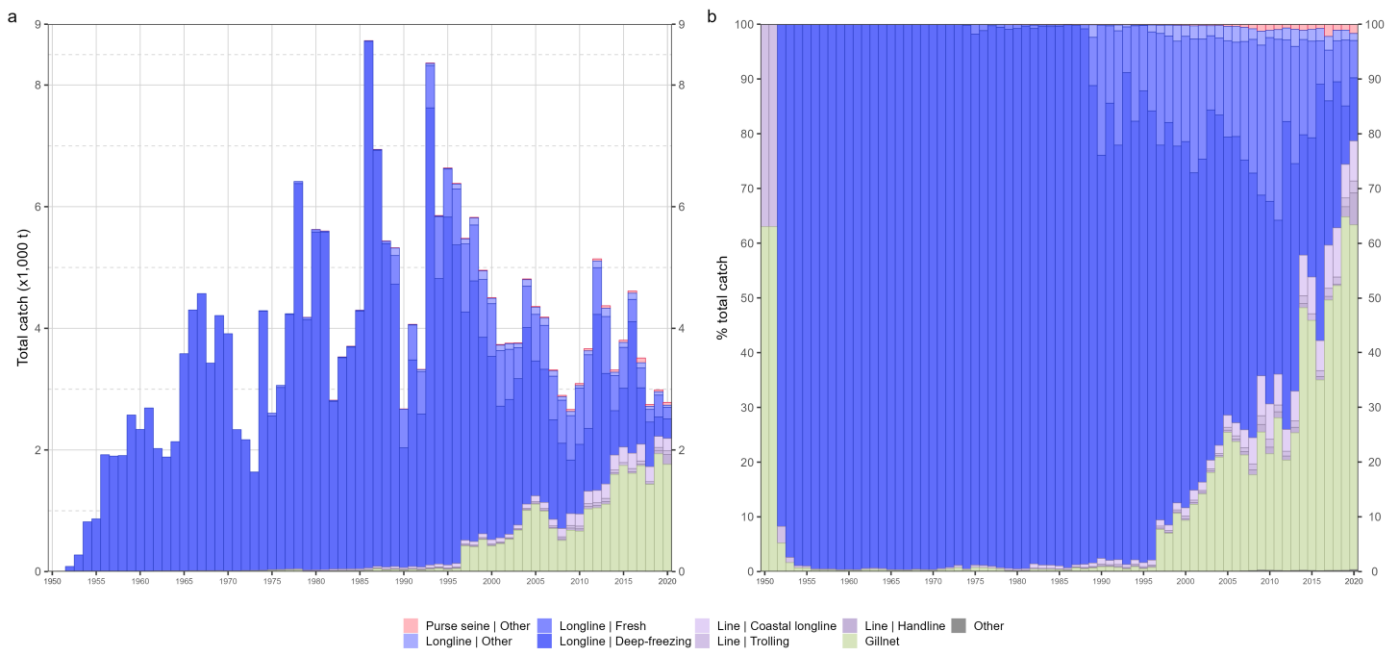


Figure 2: Annual time series of cumulative nominal absolute (a) and relative (b) catches (metric tons; t) of striped marlin by fishery for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

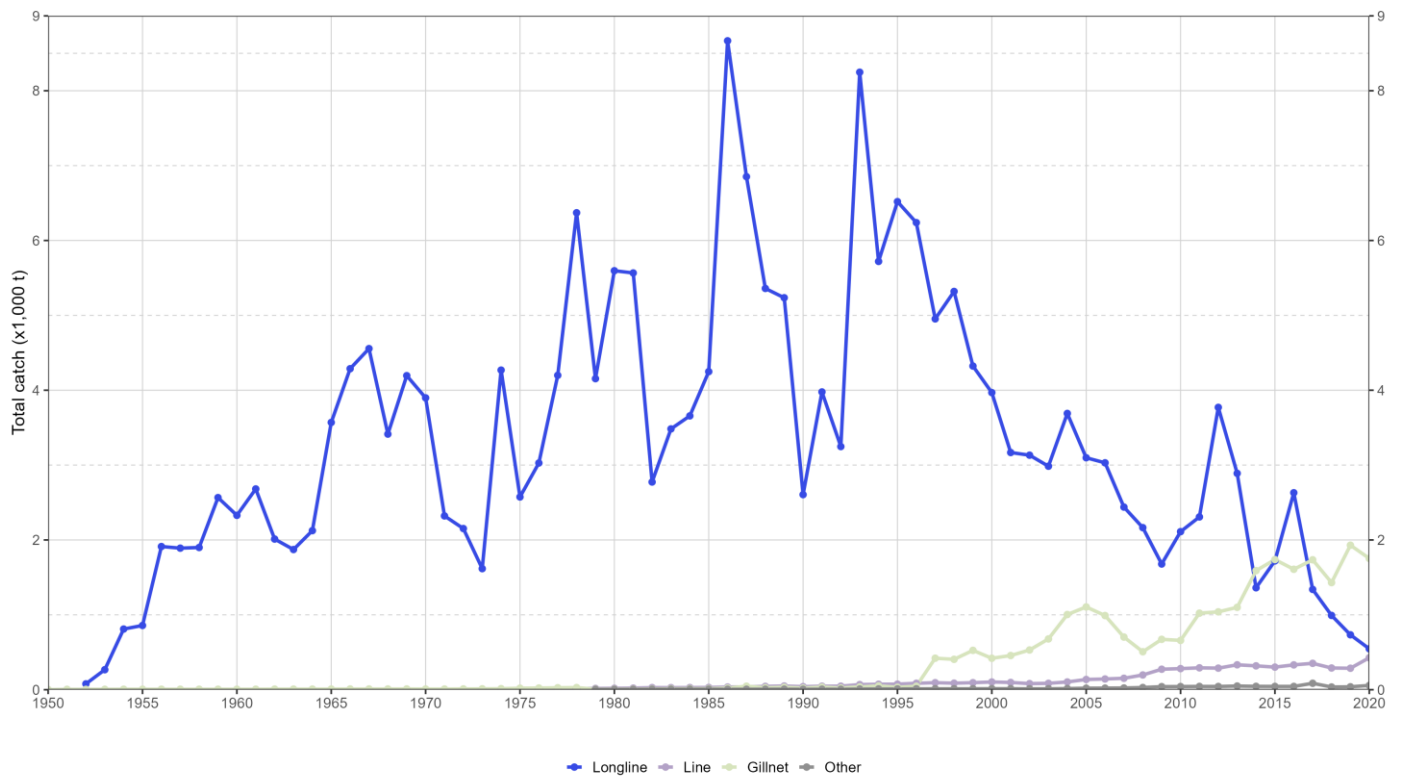


Figure 3: Annual time series of nominal catches (metric tons; t) of striped marlin by fishery group for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

### Main fishery features (2016-2020)

Table 3: Mean annual catches (metric tons; t) of striped marlin by fishery between 2016 and 2020. Data source: [best scientific estimate of nominal catches](#)

Fishery	Fishery code	Catch	Percentage
Gillnet	GN	1,691	50.8
Longline   Deep-freezing	LLD	892	26.8
Longline   Fresh	LLF	289	8.7
Line   Coastal longline	LIC	233	7.0
Longline   Other	LLO	67	2.0
Line   Handline	LIH	55	1.7
Line   Trolling	LIT	49	1.5
Purse seine   Other	PSOT	45	1.4
Other	OT	7	0.2

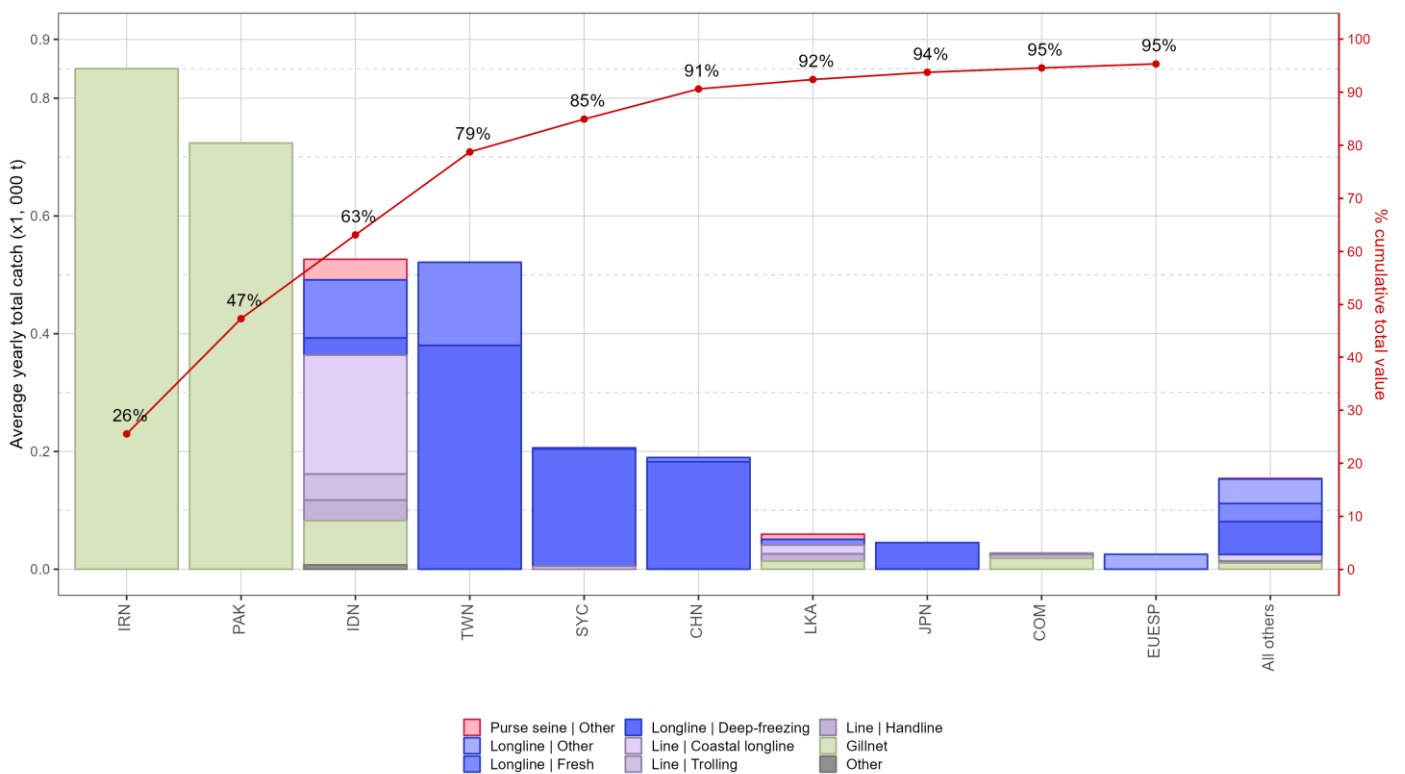


Figure 4: Mean annual catches (metric tons; t) of striped marlin by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet. Data source: [best scientific estimate of nominal catches](#)

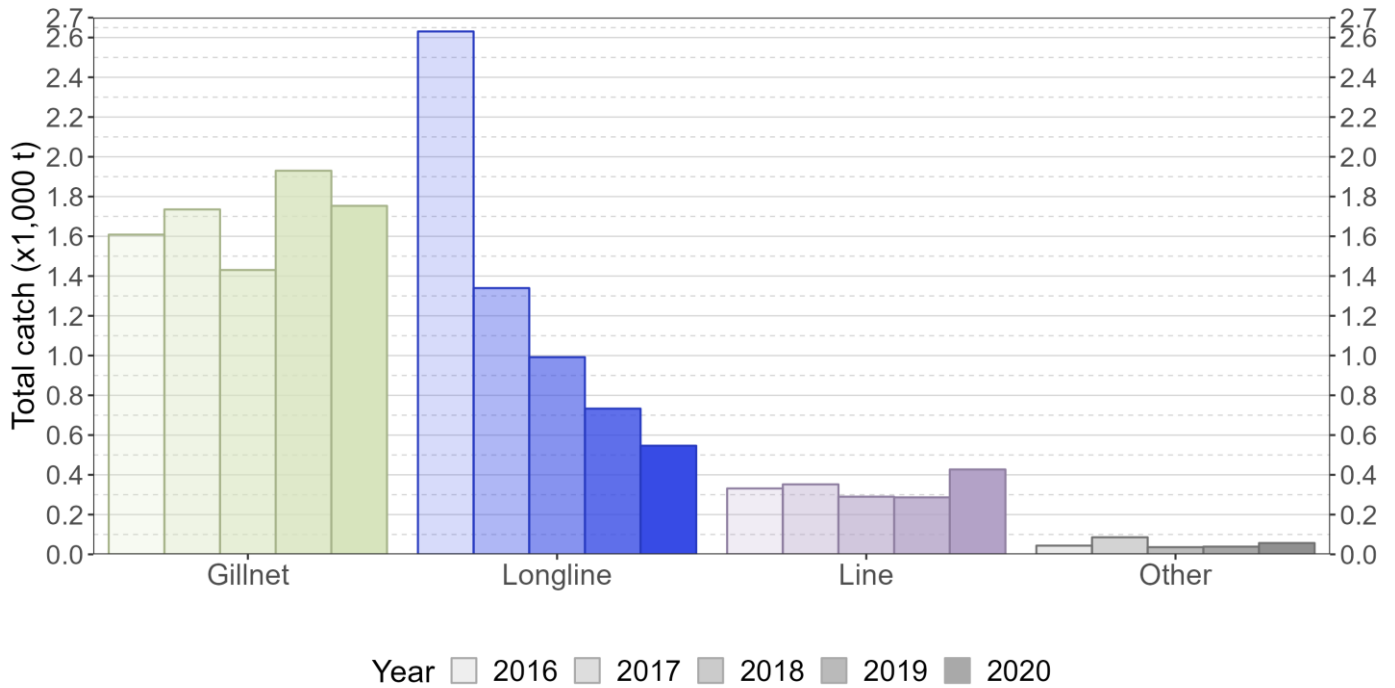


Figure 5: Annual catch (metric tons; t) trends of striped marlin by fishery group between 2016 and 2020. Data source: [best scientific estimate of nominal catches](#)

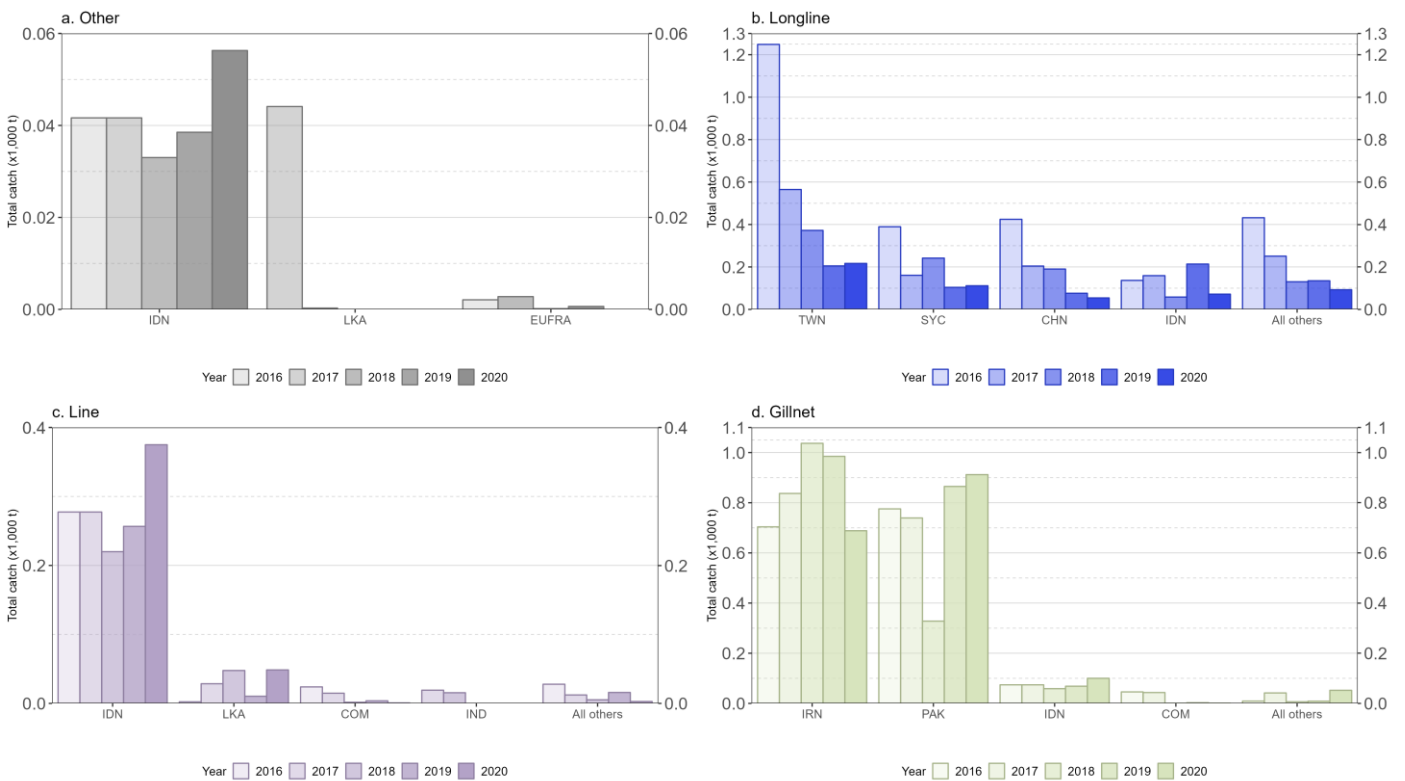


Figure 6: Annual catch (metric tons; t) trends of striped marlin by fishery group and fleet between 2016 and 2020. Data source: [best scientific estimate of nominal catches](#)

## Changes from previous Working Party

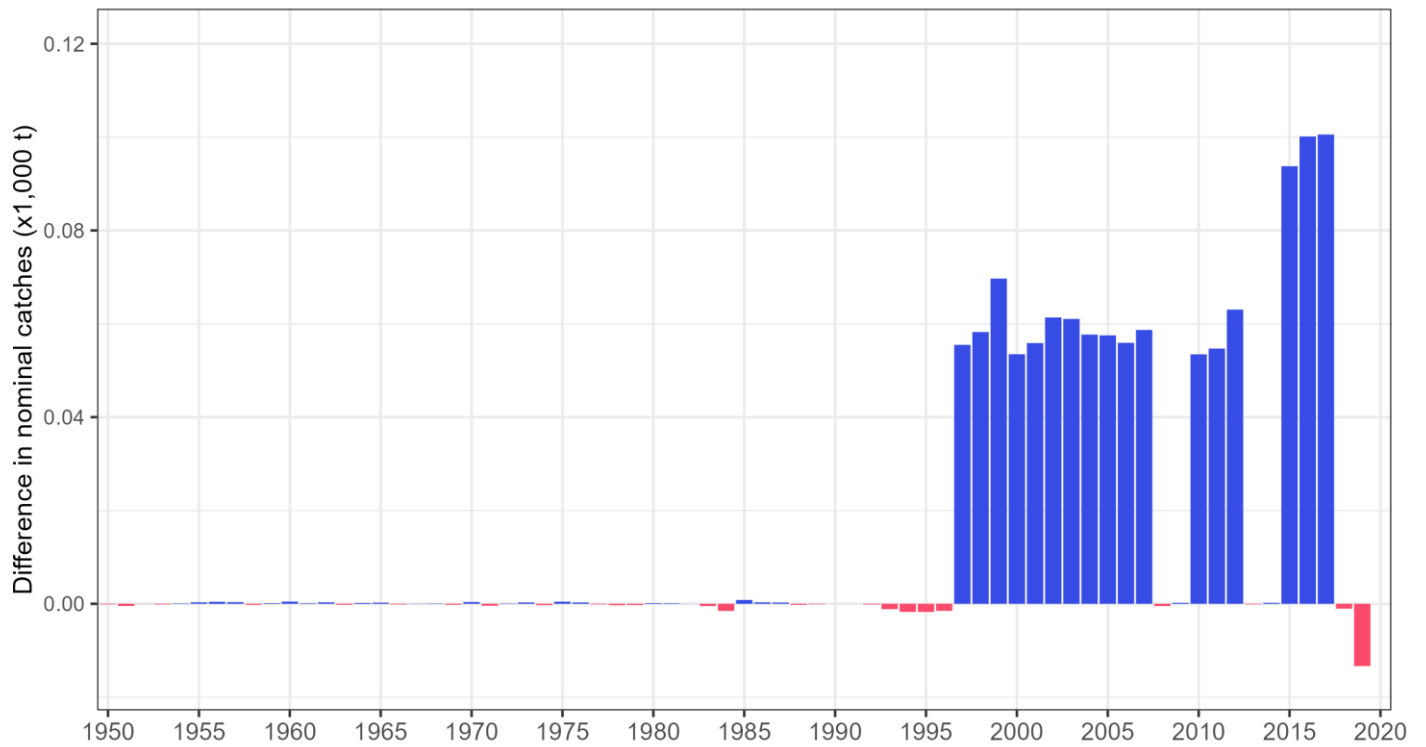


Figure 7: Differences in the available best scientific estimates of nominal catches (metric tons; t) of striped marlin between this WPB and its previous session ([WPB19](#) meeting held in September 2021)

### Uncertainties in nominal catch data

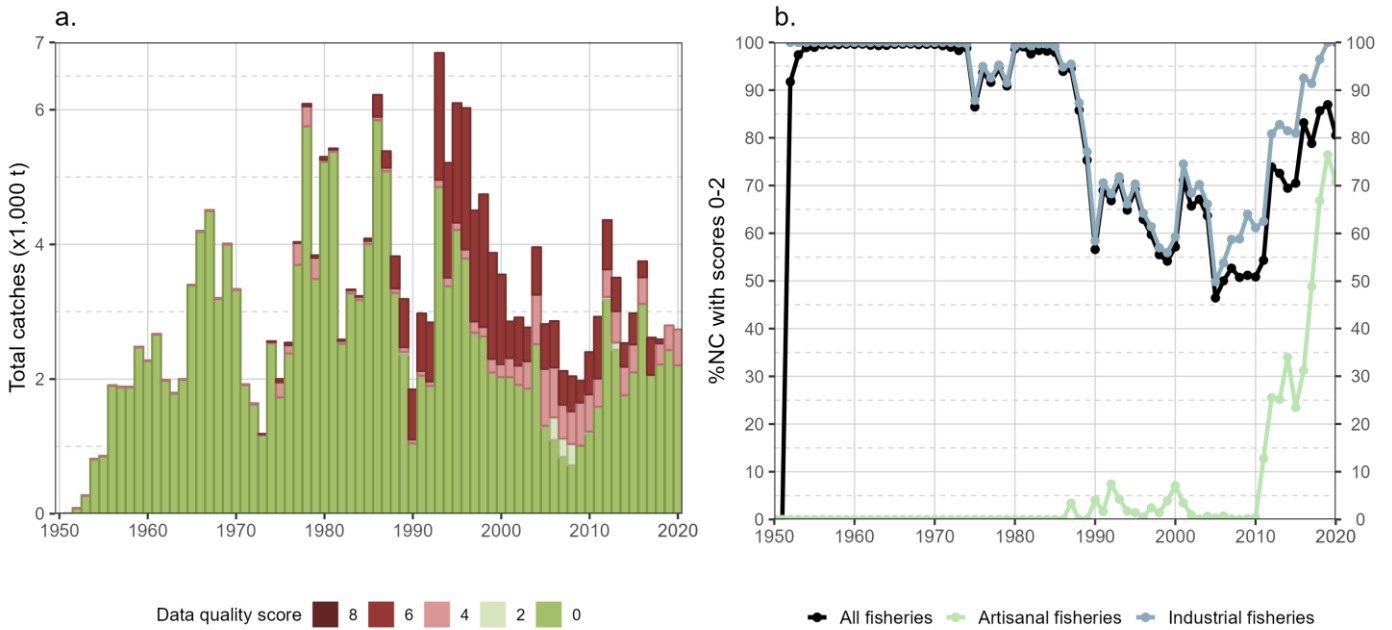


Figure 8: (a) Annual nominal catches (metric tons; t) of striped marlin estimated by quality score and (b) percentage of nominal catch fully/partially reported to the IOTC Secretariat for all fisheries and by type of fishery, in the period 1950-2020

### Discard levels

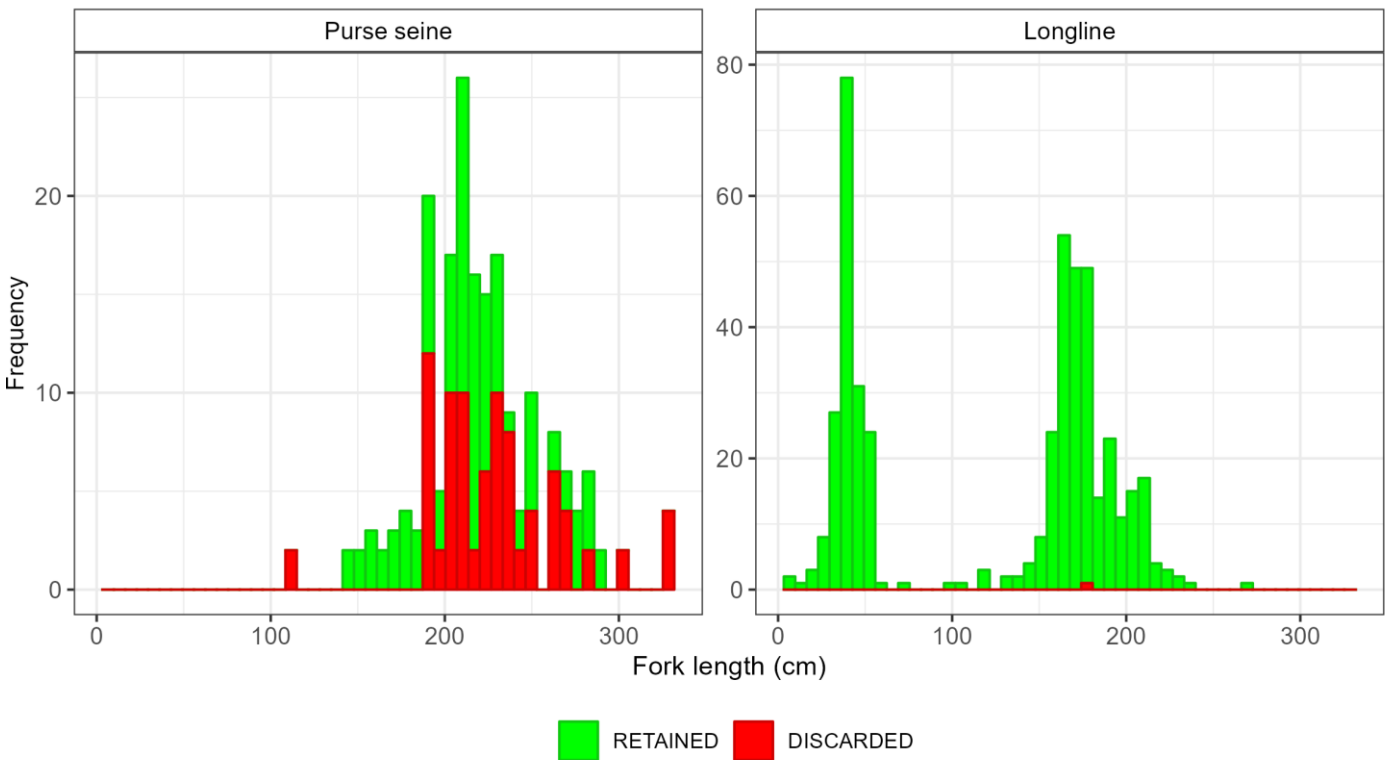


Figure 9: Size (fork length; cm) frequency distribution of striped marlin retained and discarded at sea in purse seine and longline fisheries as available in the ROS regional database



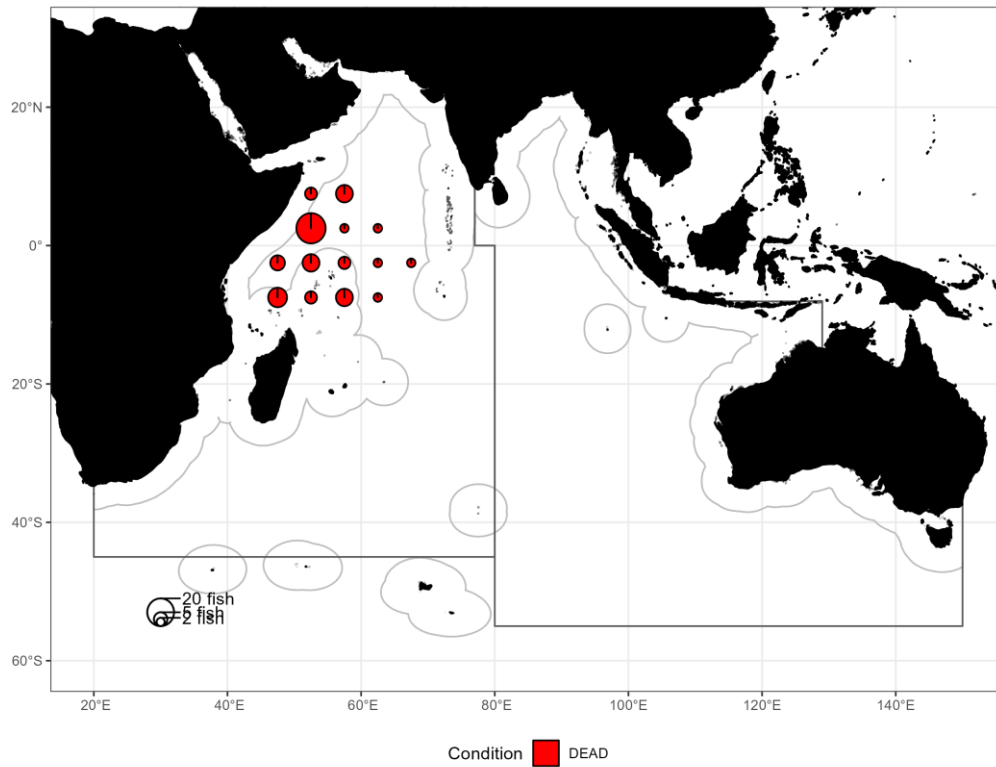


Figure 10: Distribution of striped marlins discarded at sea in the western Indian Ocean purse seine fisheries with information on condition at release as available in the ROS regional database

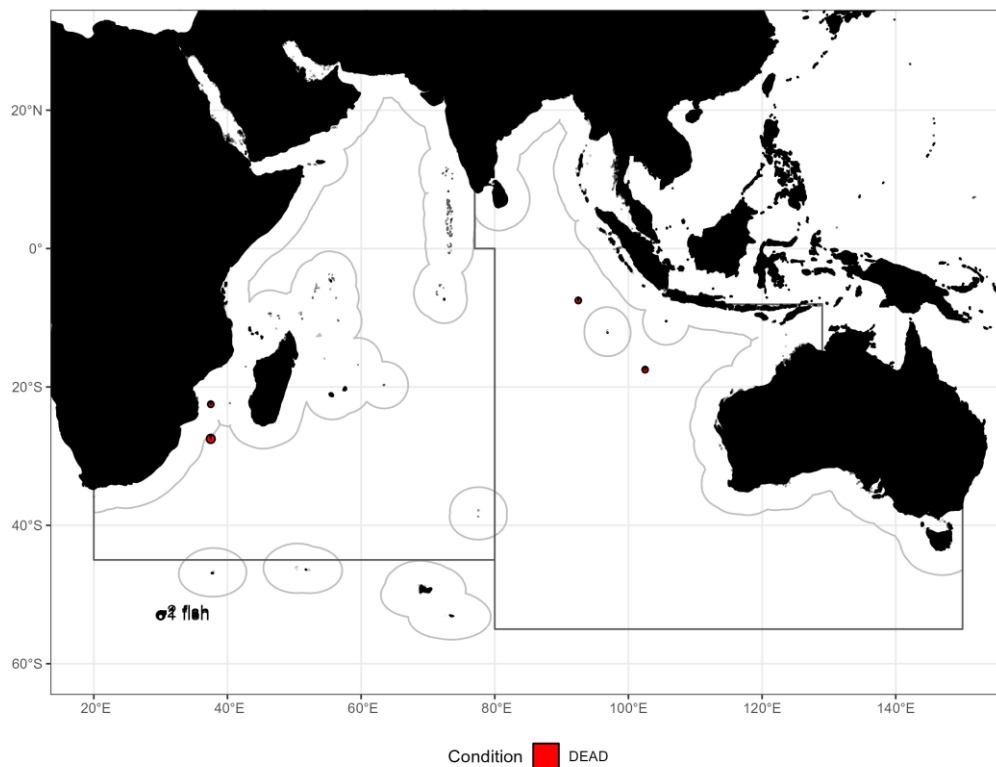


Figure 11: Distribution of striped marlins discarded at sea in the Indian Ocean longline fisheries with information on condition at release as available in the ROS regional database

# Geo-referenced catch

## Spatial distribution of catches

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

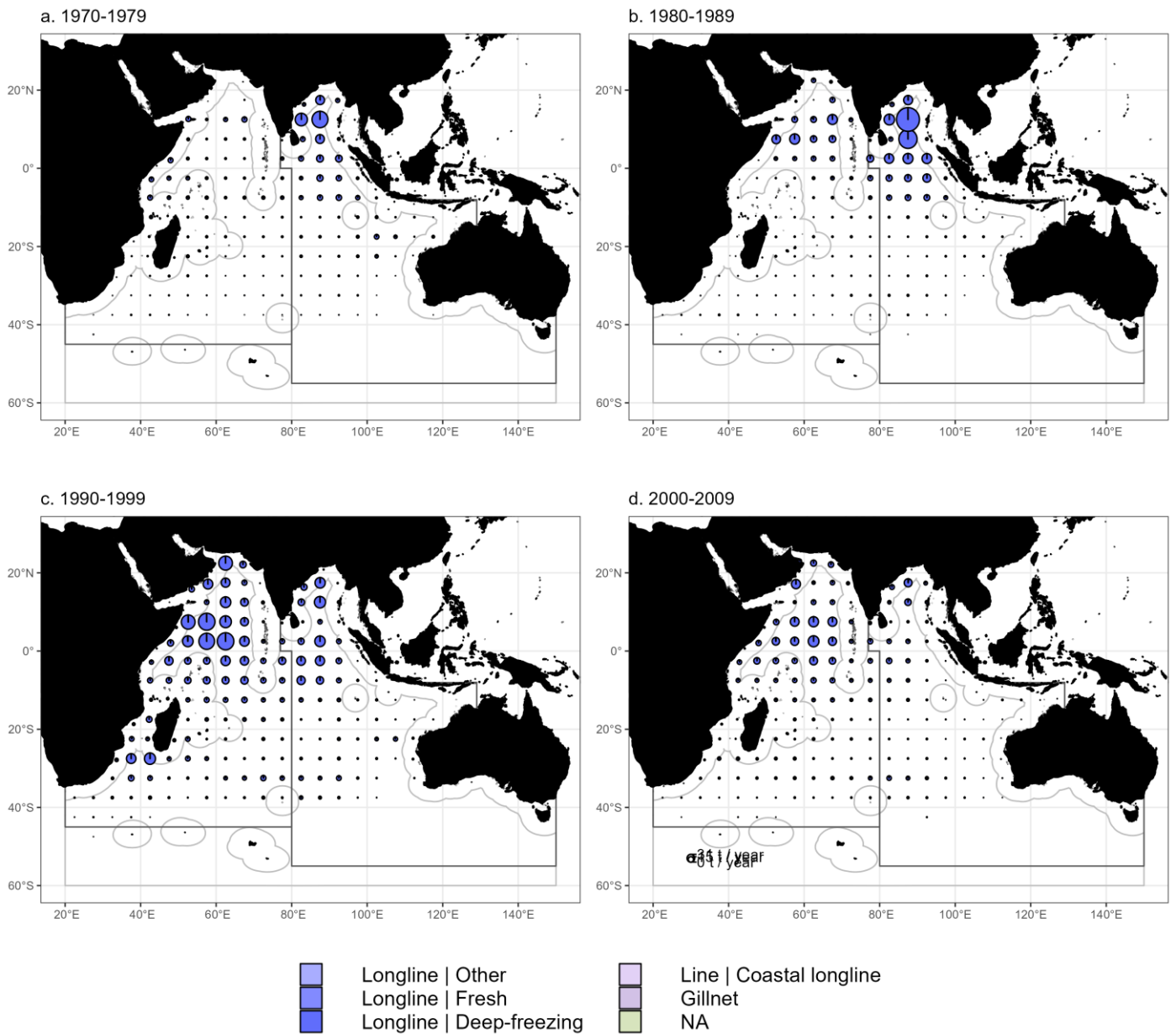


Figure 12: Mean annual time-area catches in weight (metric tons; t) of striped marlin, by decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

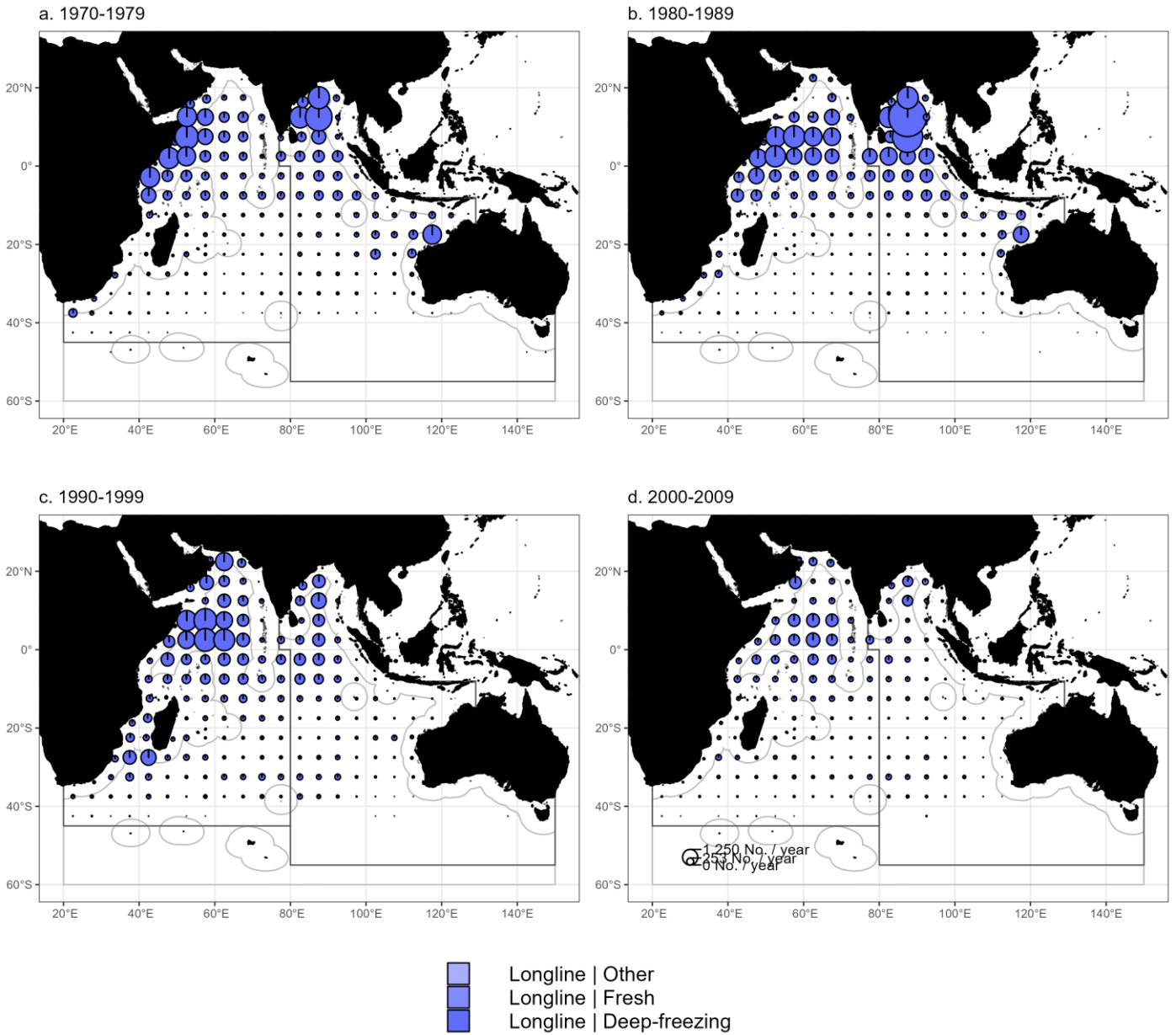


Figure 13: Mean annual time-area catches in numbers of striped marlin, by decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

Geo-referenced catches by fishery, last years (2016-2020) and decade (2010-2019)

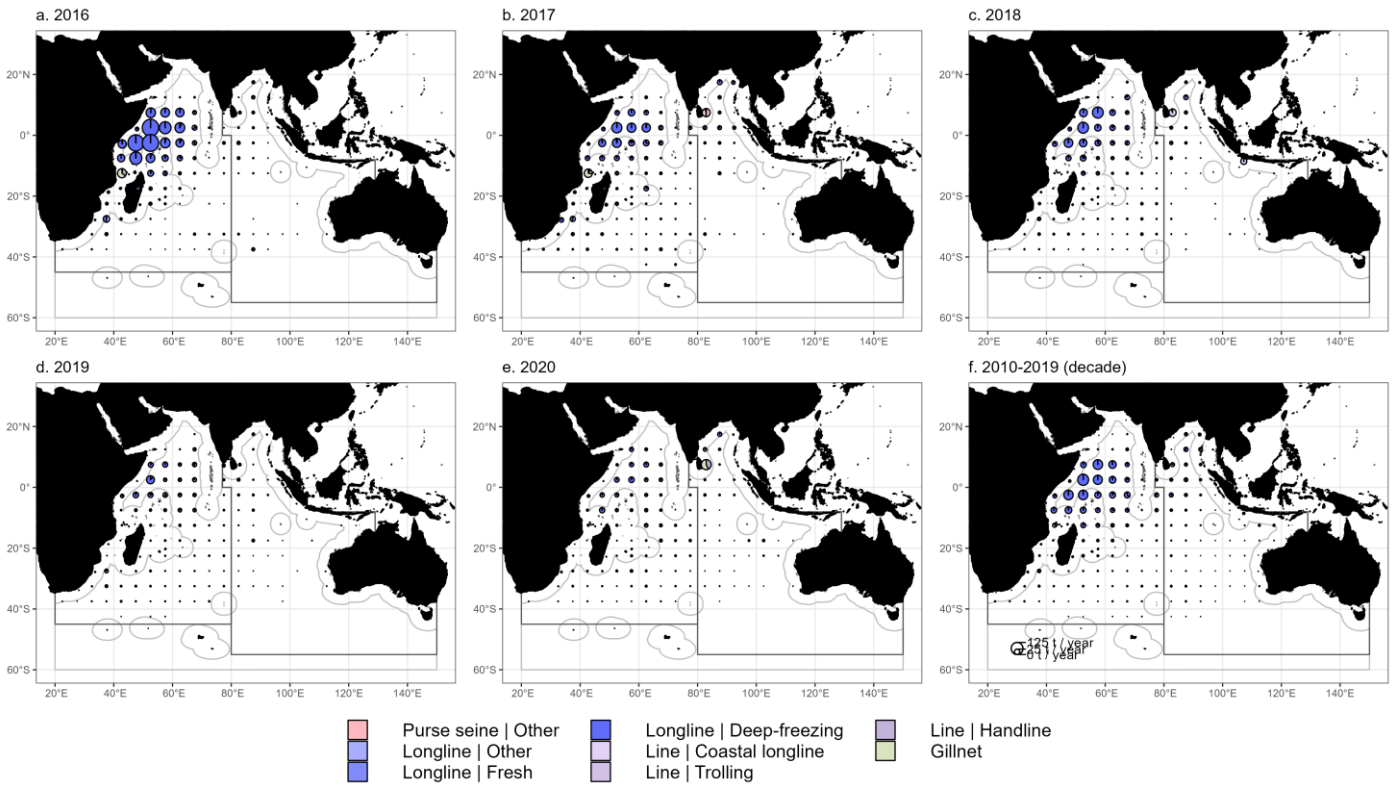


Figure 14: Mean annual time-area catches in weight (metric tons; t) of striped marlin, by year / decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

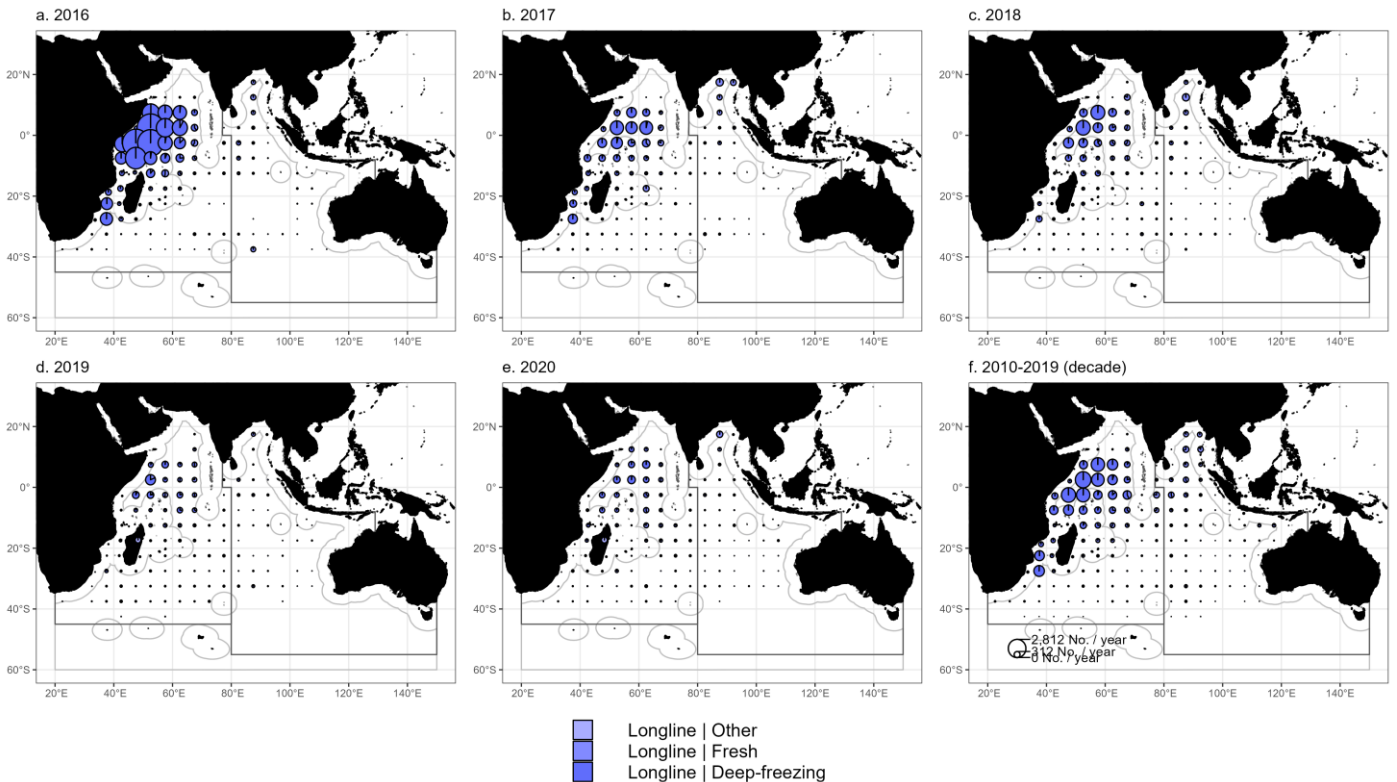


Figure 15: Mean annual time-area catches in numbers of striped marlin, by year / decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

## Uncertainties in catch and effort data

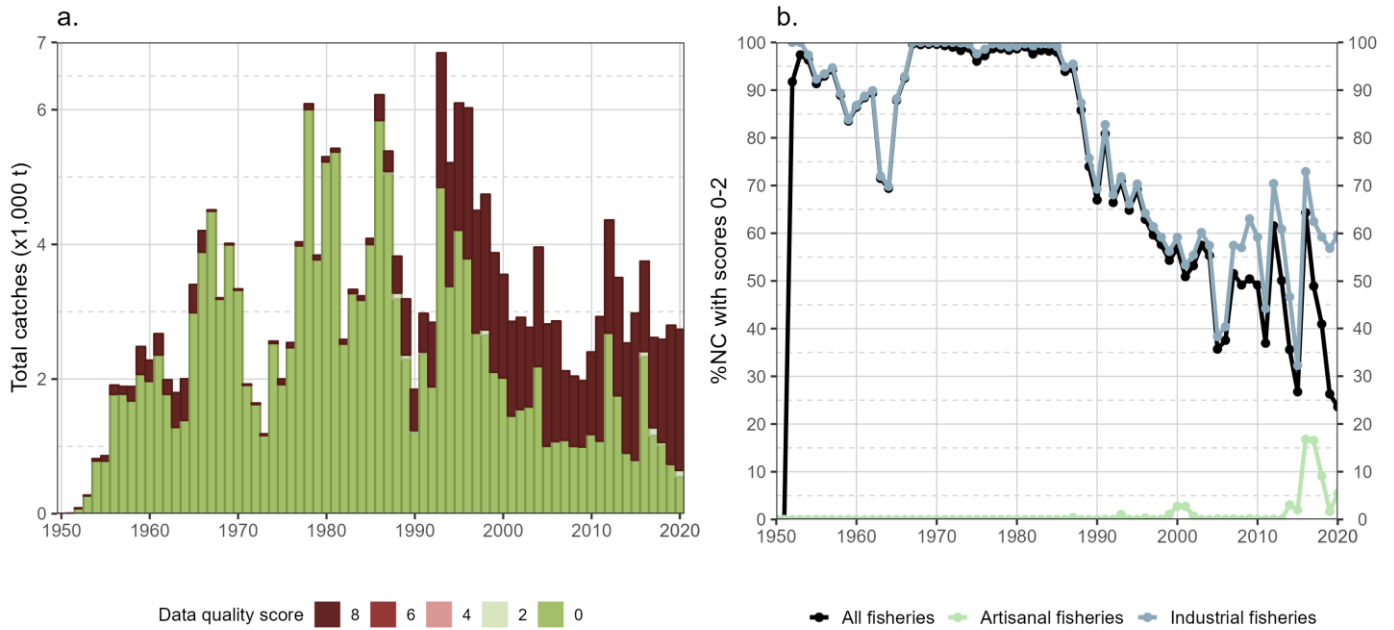


Figure 16: (a) Annual nominal catches (metric tons; t) of striped marlin estimated by quality score and (b) percentage of nominal catches for which geo-referenced catches were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950-2020

## Size composition of the catch

### Samples availability

#### By fishery group

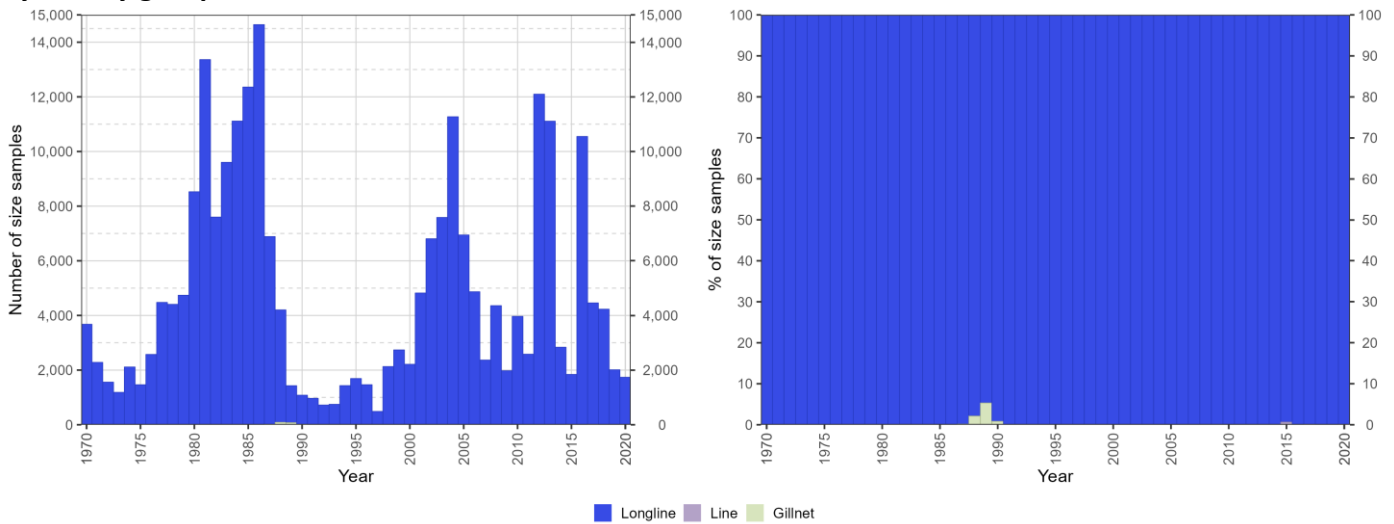


Figure 17: Availability of striped marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and fishery group. Data source: [standardized size-frequency dataset](#)

## Longline fisheries

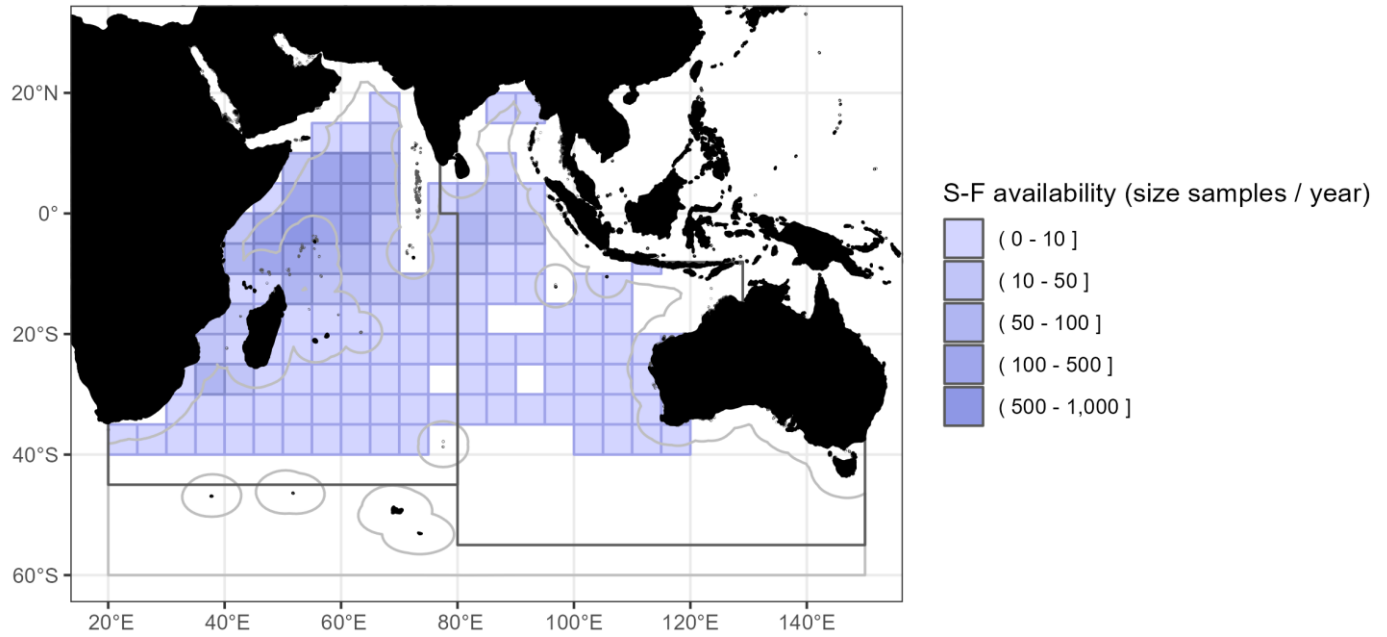


Figure 18: Spatial distribution (average number of samples per grid per year) of available striped marlin size-frequency data for longline fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

## Line fisheries

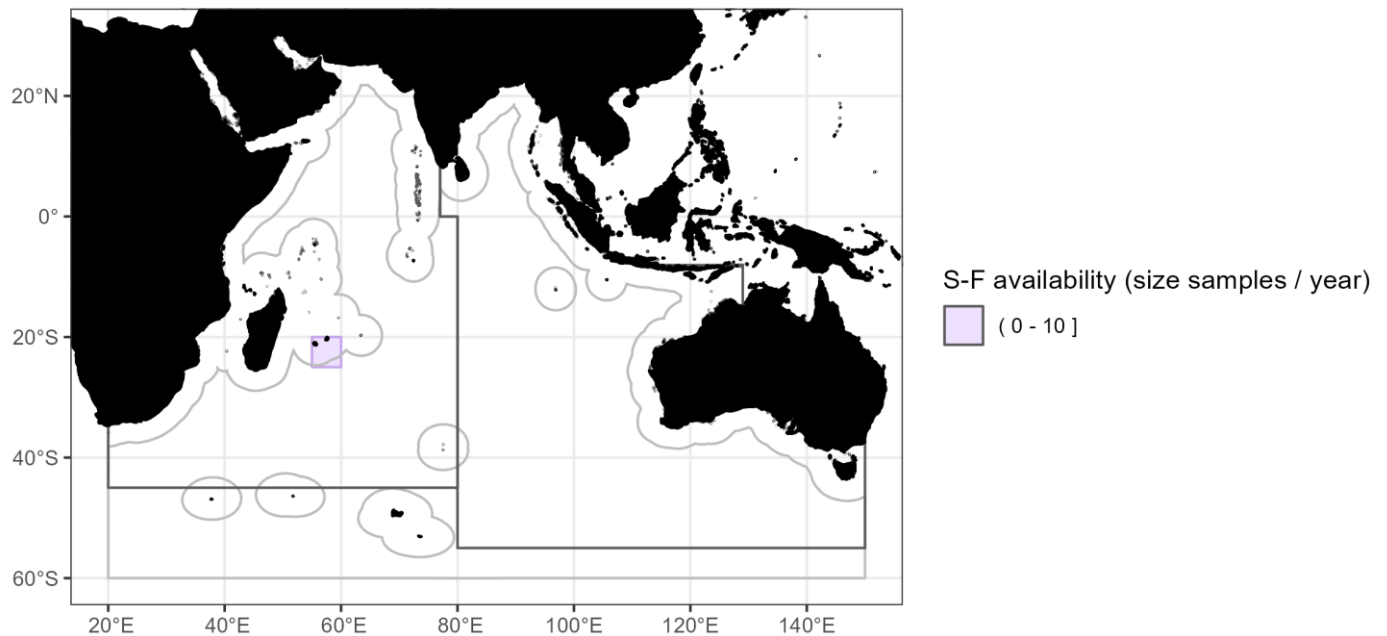


Figure 19: Spatial distribution (average number of samples per grid per year) of available striped marlin size-frequency data for line fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

By fishery

Deep-freezing longline fisheries

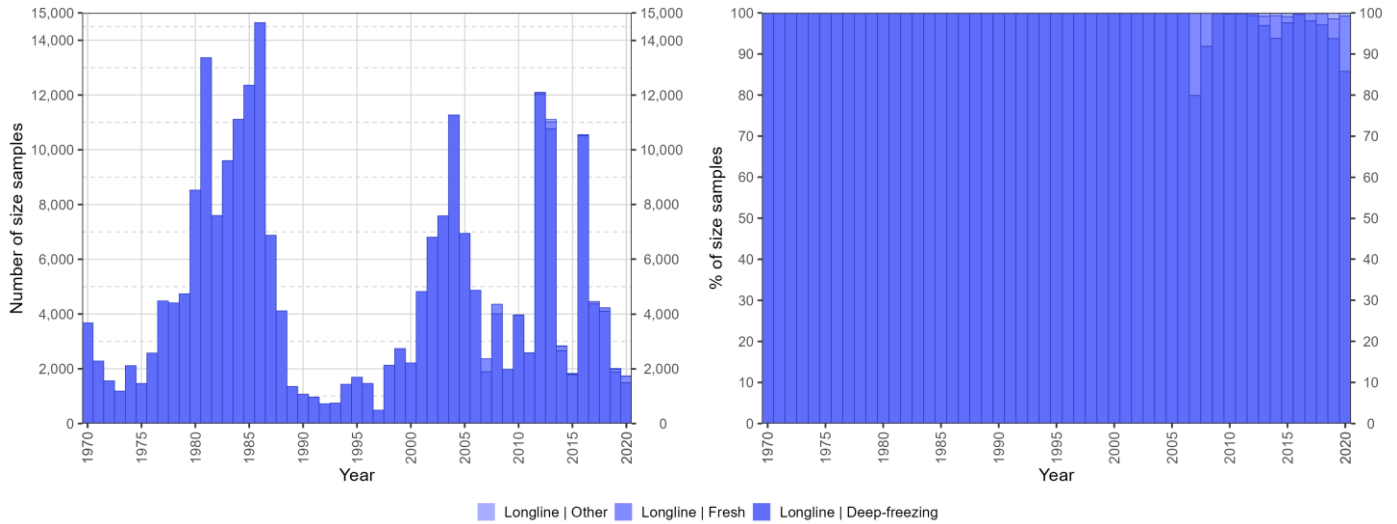


Figure 20: Availability of striped marlin size-frequency data as absolute number of samples per year and longline fishery. Data source: [standardized size-frequency dataset](#)

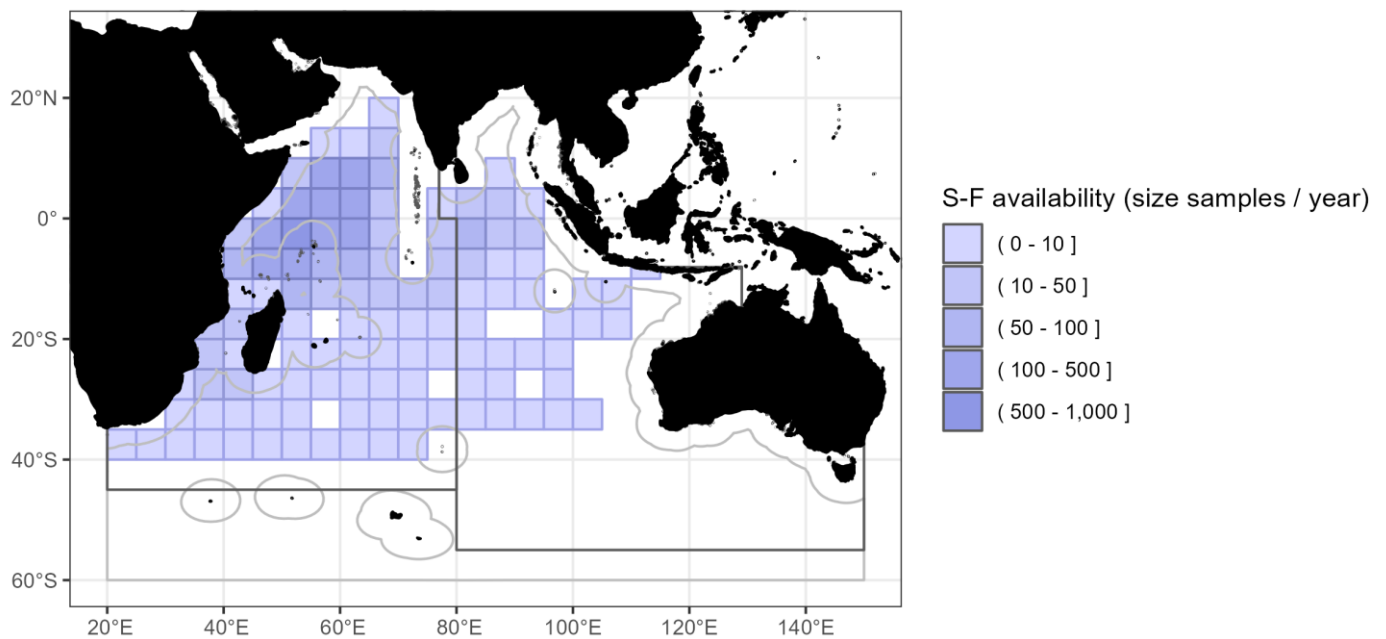


Figure 21: Spatial distribution (average number of samples per grid per year) of available striped marlin size-frequency data by deep-freezing longline fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)



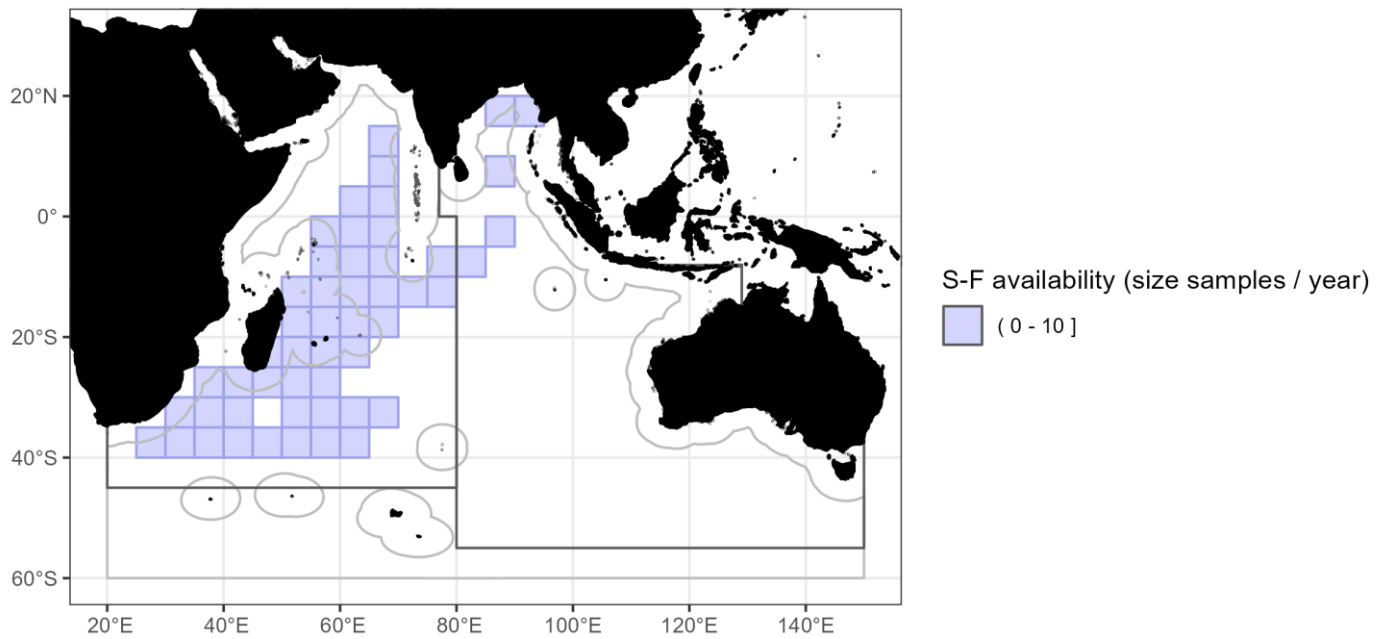


Figure 22: Spatial distribution (average number of samples per grid per year) of available striped marlin size-frequency data by fresh longline fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

### Gillnet fisheries

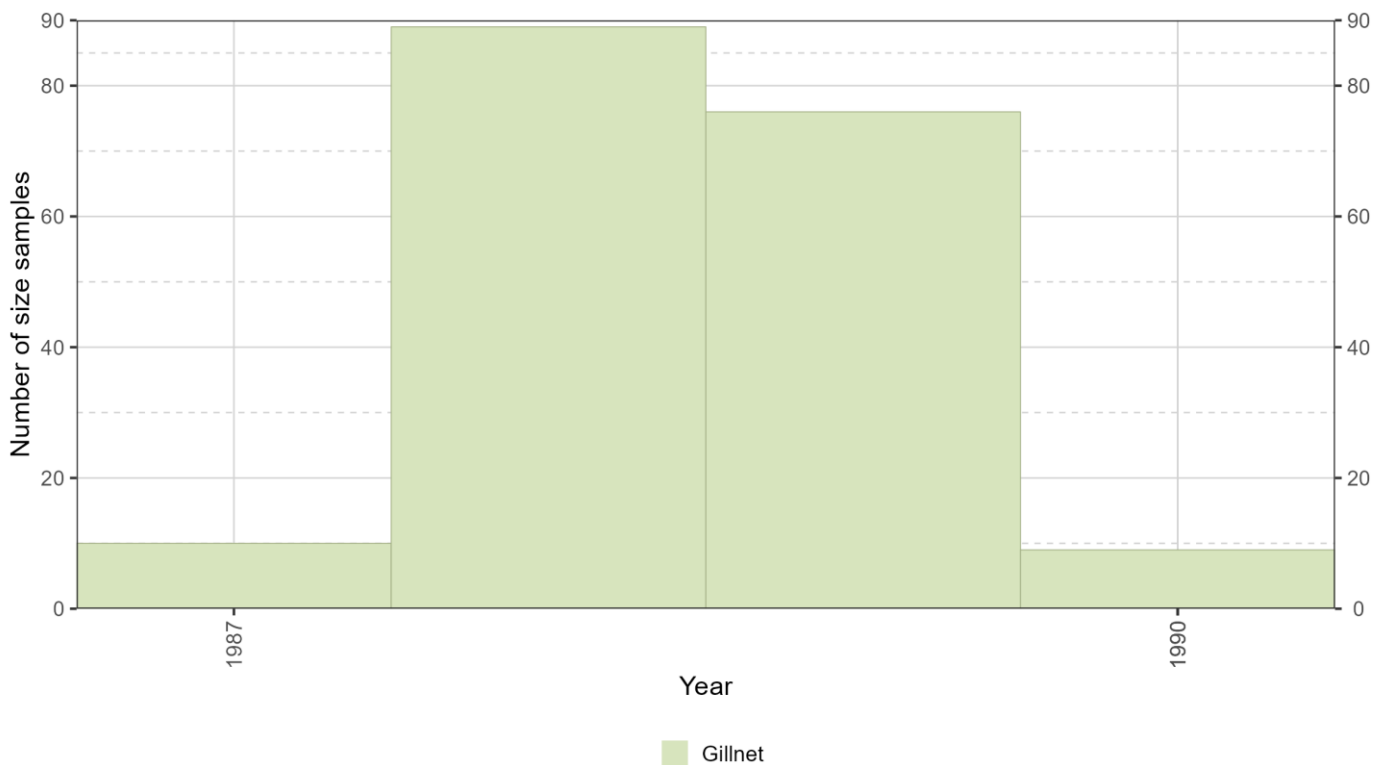


Figure 23: Availability of striped marlin size-frequency data as absolute number of samples per year in gillnet fisheries. Data source: [standardized size-frequency dataset](#)



Line fisheries

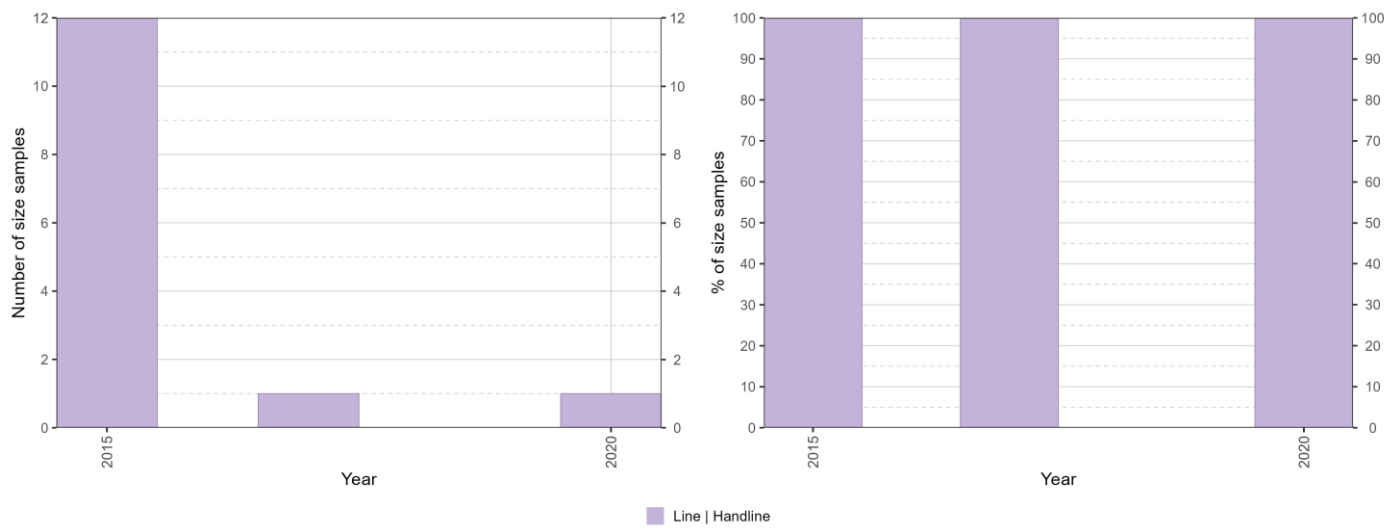


Figure 24: Availability of striped marlin size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and line fishery type. Data source: [standardized size-frequency dataset](#)

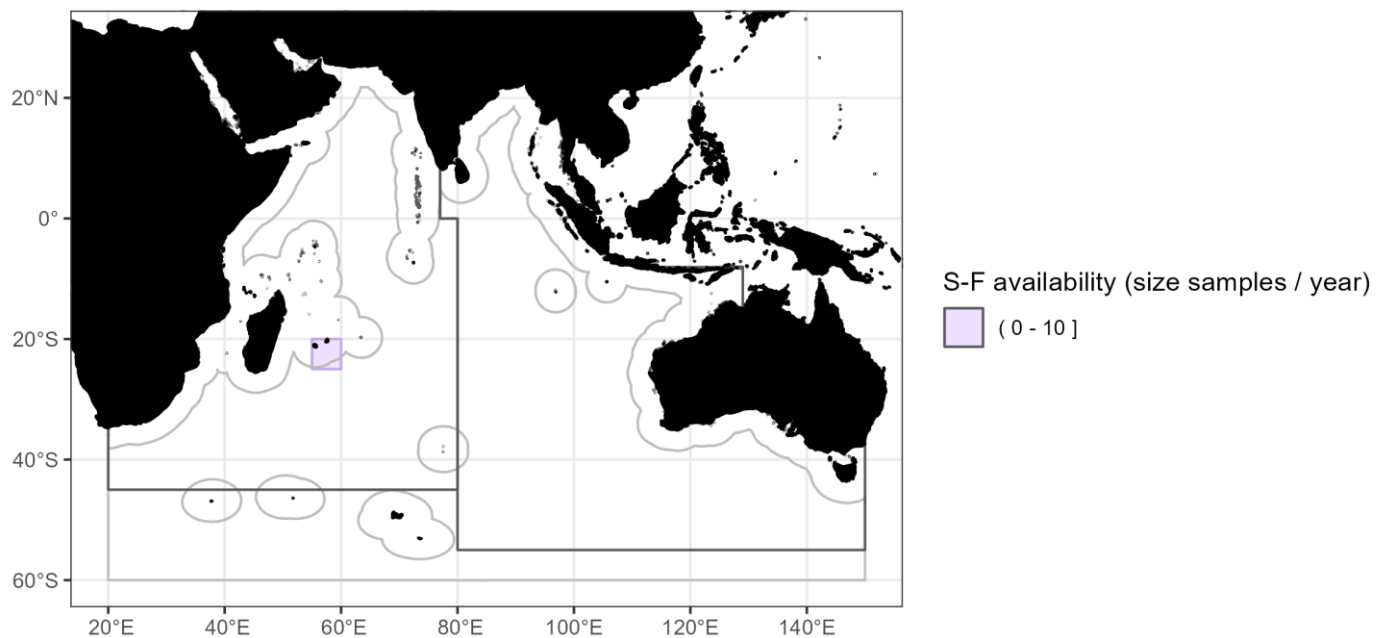


Figure 25: Spatial distribution (average number of samples per grid per year) of available striped marlin size-frequency data by line (handline) fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

### Temporal patterns and trends in size distributions

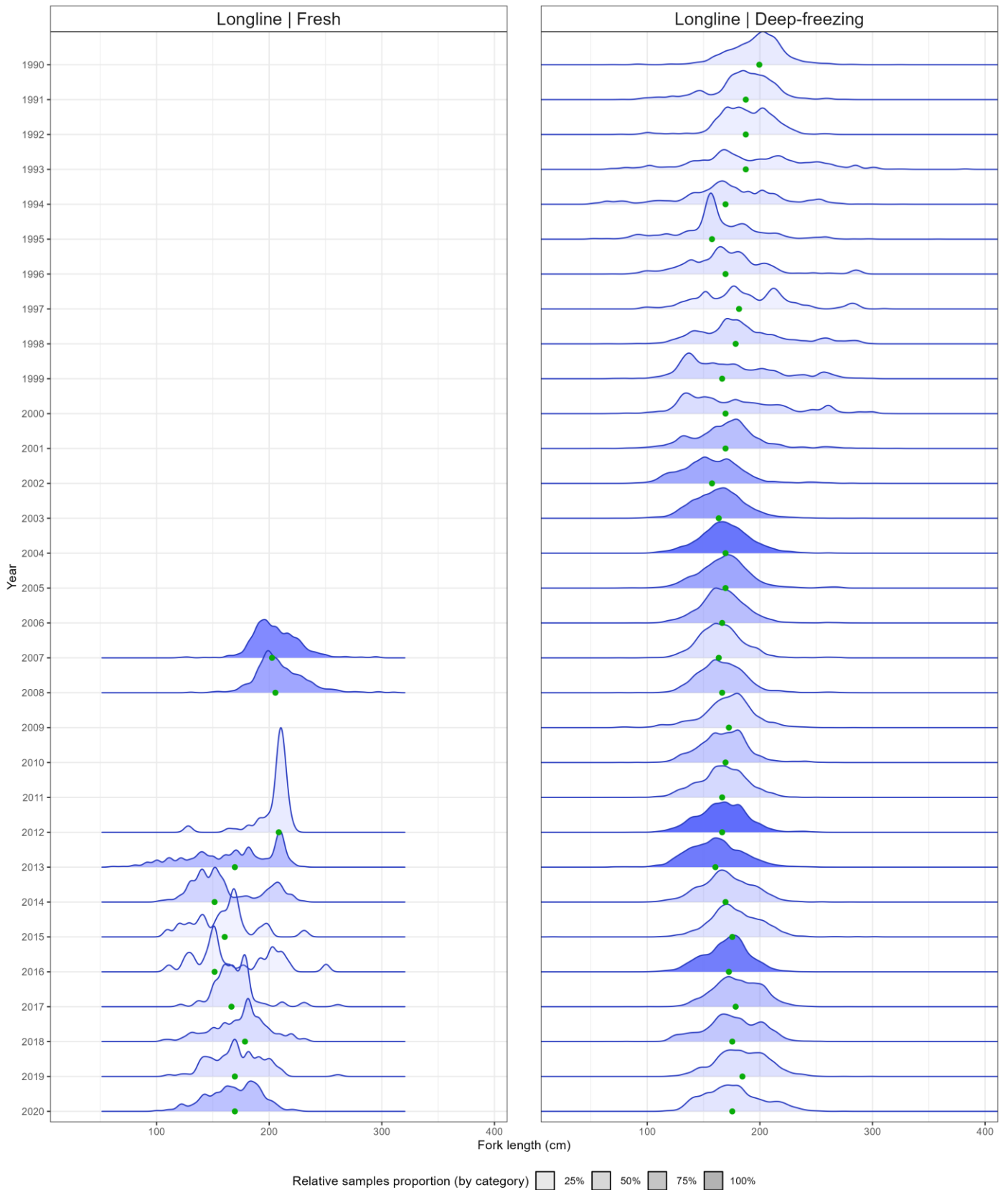


Figure 26: Relative size distribution (fork length; cm) of striped marlin caught by (left panel) fresh longline fisheries and (right panel) deep-freezing longline fisheries. Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median value. Data source: [standardized size-frequency dataset](#)

Size distribution by fishery and fleet

Deep-freezing longline fisheries

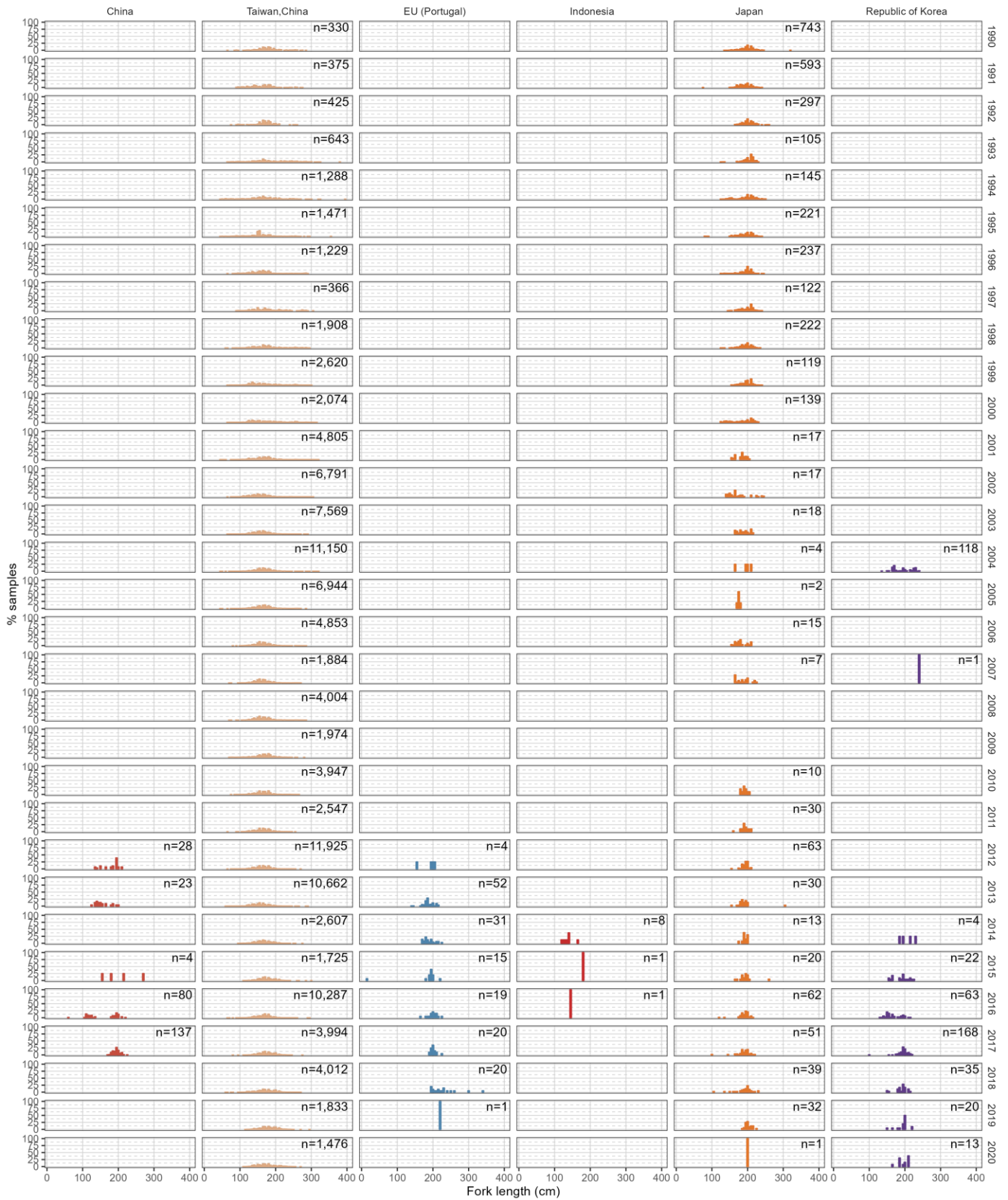


Figure 27: Relative size distribution of striped marlin (fork length; cm) recorded for deep-freezing longline fisheries by year and main fleet. Data source: [standardized size-frequency dataset](#)

Fresh longline fisheries

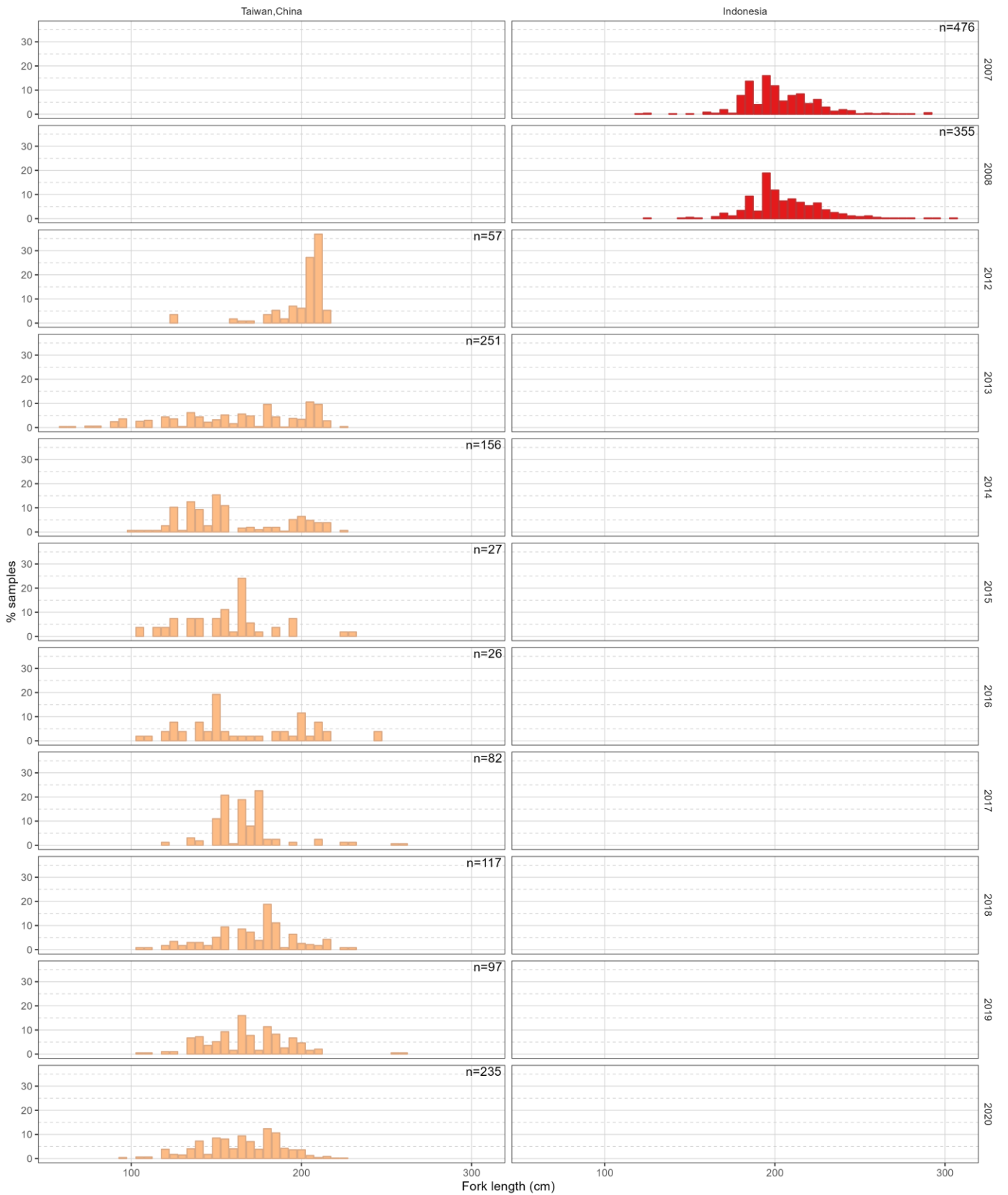


Figure 28: Relative size distribution of striped marlin (fork length; cm) recorded for fresh longline fisheries by year and main fleet. Data source: [standardized size-frequency dataset](#)

### Uncertainties in size-frequency data

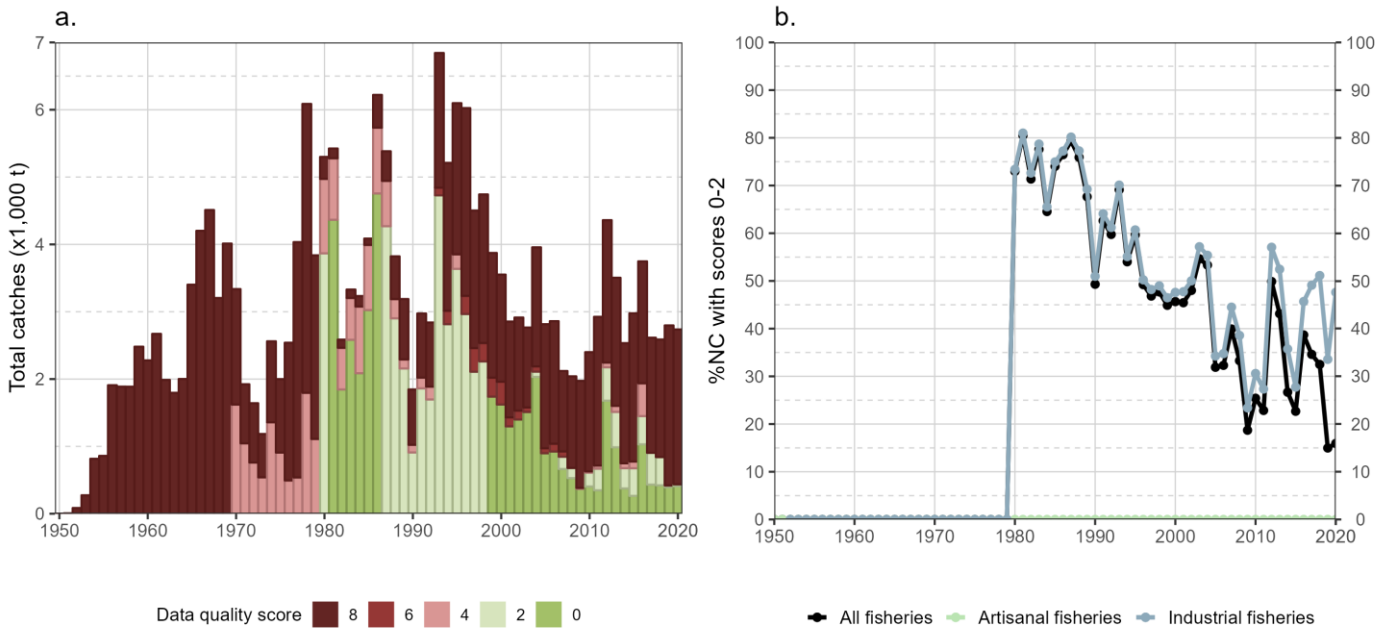


Figure 29: (a) Annual nominal catches (t) of striped marlin estimated by quality score and (b) percentage of nominal catches for which geo-referenced size-frequency data were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950–2020

## References

IOTC (2022) [Review of the statistical data available for Indian Ocean billfish](#). IOTC, Virtual meeting, 12-15 September 2022

## Appendix

### Appendix I: Changes in best scientific estimates of nominal catches from previous WPB

Some minor improvements were made to the best scientific estimates of nominal catches of striped marlin since the 19<sup>th</sup> session of the IOTC Working Party on Billfish ([WPB19](#)), with overall small modifications in the time series of annual catches (**Fig. 7**). The changes covering the period 2016-2019 were due to: (i) some revision of the Seychelles (SYC) longline and line catches and (ii) changes in the Indian Ocean major areas for gillnet fisheries from Pakistan (PAK) (**Table 4**).

Table 4: Changes in best scientific estimates of average annual nominal catches (metric tons; t) of striped 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)
2019	SYC	Line	Western Indian Ocean	12	0	12
		Longline	Western Indian Ocean	104	127	-23
2017	PAK	Gillnet	Western Indian Ocean	739	644	96
2016		Gillnet	Western Indian Ocean	775	675	100