



REVIEW OF THE STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN SWORDFISH (1950-2020)

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Abstract

The document provides an overview of the consolidated knowledge about fisheries catching swordfish (*Xiphias gladius*) 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 quality of the nominal catches of swordfish is considered to be good and overall the best among the five billfish species under IOTC mandate. The available fisheries statistics show that swordfish are mostly caught in both large-scale and coastal longline fisheries although gillnet fisheries have increased their catches over the last decade. Catches of large-scale longline fisheries have shown a steady decrease since 2004 while longline catches from the areas of national jurisdiction of Sri Lanka and India to a lesser extent have sharply increased since 2010. Information available on discarding practices collected through the IOTC Regional Observer Program shows that discarding in longline fisheries is mostly driven by size in some fleets. 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, particularly for coastal fisheries. Consolidated data show that swordfish are caught across all the Indian Ocean although the main fishing grounds appear to be located in the western Indian Ocean and around the coasts of Sri Lanka and India. The reporting of size-frequency data has improved in recent years, particularly thanks to the data reported for the coastal longline fishery of Sri Lanka.

Keywords: billfish | swordfish | Indian Ocean | tuna fisheries

Introduction

The overarching objective of this paper is to provide participants in the data preparatory meeting of the 20th Session of the IOTC Working Party on Billfish ([WPB20](#)) with a review of the status of the information available on swordfish (*Xiphias gladius*), 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)

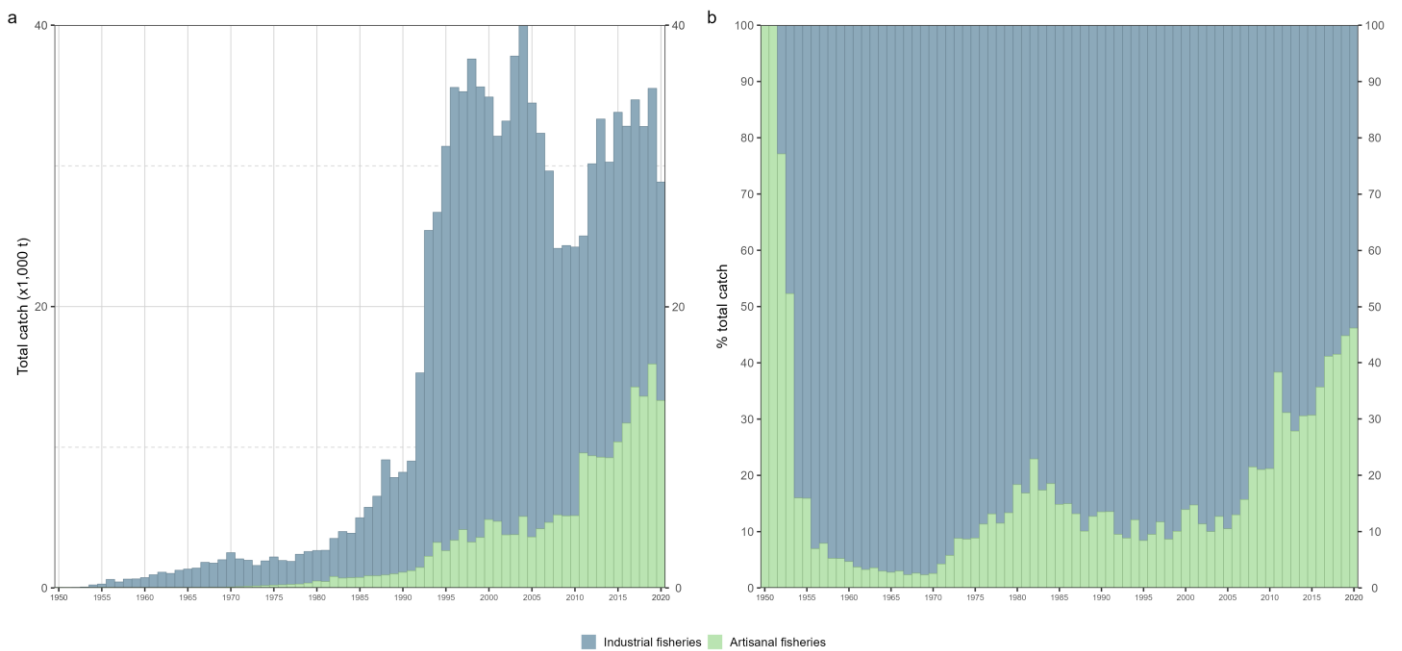


Figure 1: Annual time series of cumulative nominal absolute (a) and relative (b) catches (metric tons; t) of swordfish by type of fishery for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

Table 1: Best scientific estimates of average annual nominal catches (metric tons; t) of swordfish 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	1	11	19	39	199
Longline Other	0	0	0	44	2,861	11,896	7,595
Longline Fresh	0	0	15	151	1,895	2,759	5,483
Longline Deep-freezing	260	1,301	1,905	4,128	19,686	15,017	7,580
Line Coastal longline	10	10	16	151	363	696	4,599
Line Trolling	2	2	8	21	34	44	233
Line Handline	10	9	135	417	604	411	1,032
Baitboat	0	0	0	0	0	0	0
Gillnet	16	18	25	168	547	1,424	4,534
Other	0	0	0	1	2	4	9
Total	297	1,340	2,106	5,093	26,011	32,292	31,265

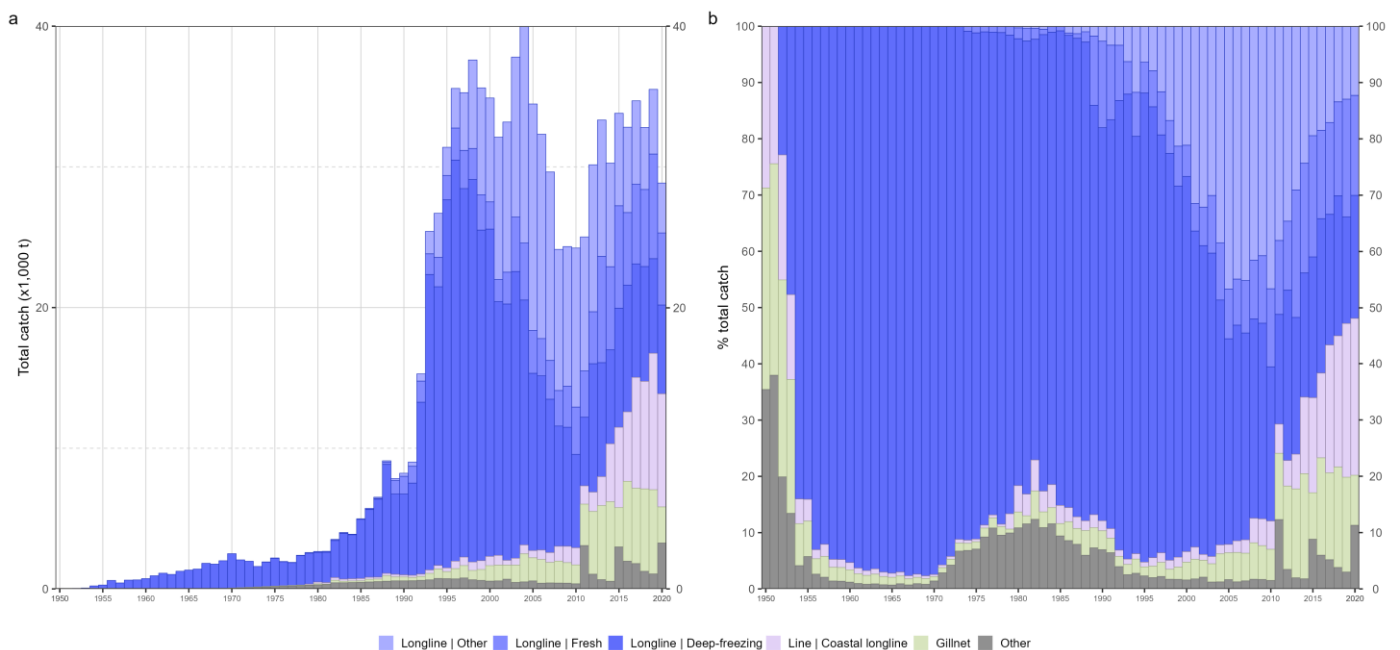


Figure 2: Annual time series of cumulative nominal absolute (a) and relative (b) catches (metric tons; t) of swordfish by fishery for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

Table 2: Best scientific estimates of annual nominal catches (metric tons; t) of swordfish 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	85	84	96	94	96	106	787	482	78	111
Longline Other	9,529	10,448	9,695	7,370	6,579	6,073	5,936	4,412	4,603	3,550
Longline Fresh	3,287	3,694	7,557	5,904	7,283	5,152	5,666	5,478	7,439	5,127
Longline Deep-freezing	4,875	9,123	8,096	6,677	8,458	9,008	8,056	8,158	6,716	6,306
Line Coastal longline	1,302	1,377	2,065	4,123	5,714	4,946	7,887	7,651	9,706	8,046
Line Trolling	152	183	192	115	88	962	334	119	141	84
Line Handline	2,835	766	356	322	2,788	888	668	639	834	3,053
Baitboat	0	0	0	0	0	0	0	0	0	0
Gillnet	2,943	4,463	5,264	5,655	2,796	5,678	5,356	5,859	5,987	2,566
Other	10	9	11	10	10	9	9	8	9	12
Total	25,020	30,149	33,331	30,270	33,812	32,823	34,698	32,804	35,512	28,855

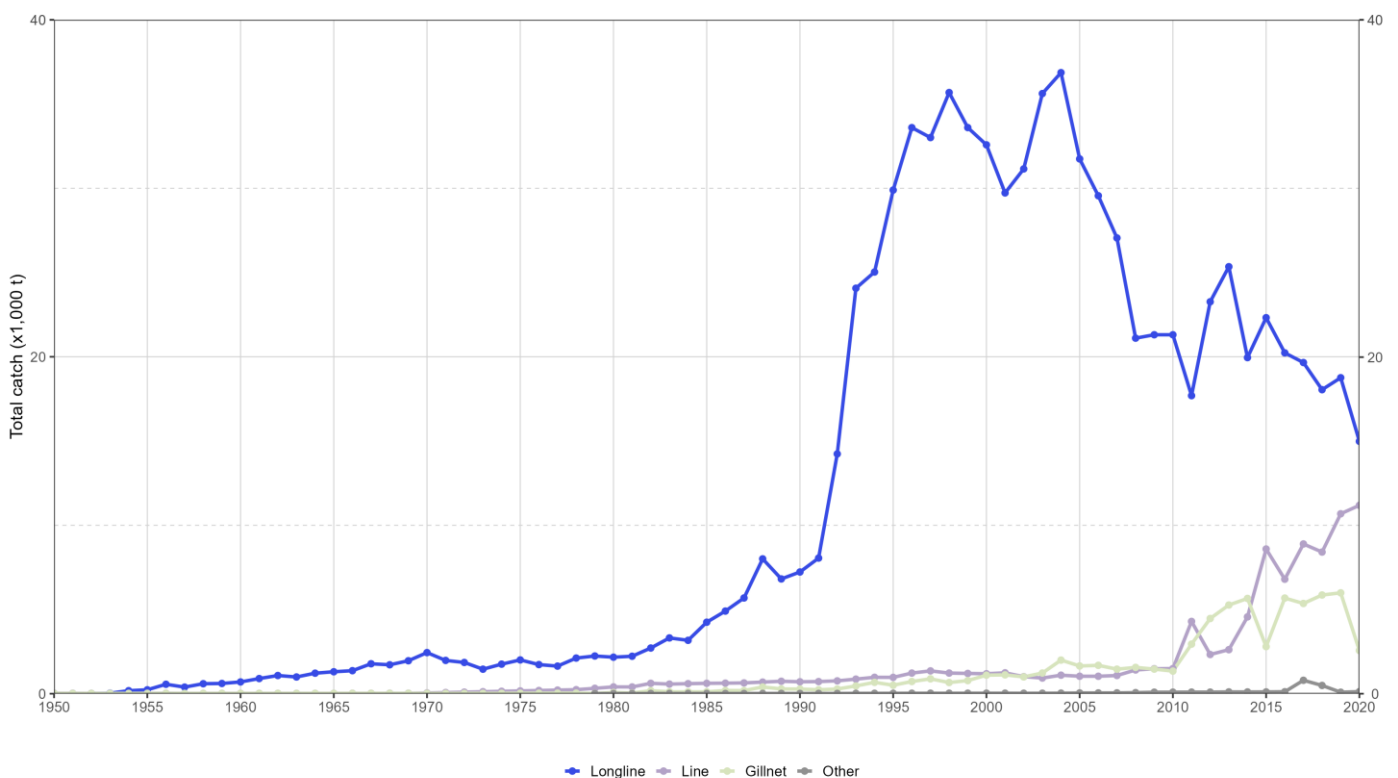


Figure 3: Annual time series of nominal catches (metric tons; t) of swordfish by fishery group for the period 1950-2020. Data source: [best scientific estimate of nominal catches](#)

Main fishery features (2016-2020)

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

Fishery	Fishery code	Catch	Percentage
Longline Deep-freezing	LLD	7,649	23.2
Line Coastal longline	LIC	7,647	23.2
Longline Fresh	LLF	5,772	17.5
Gillnet	GN	5,089	15.5
Longline Other	LLO	4,915	14.9
Other	OT	1,866	5.7

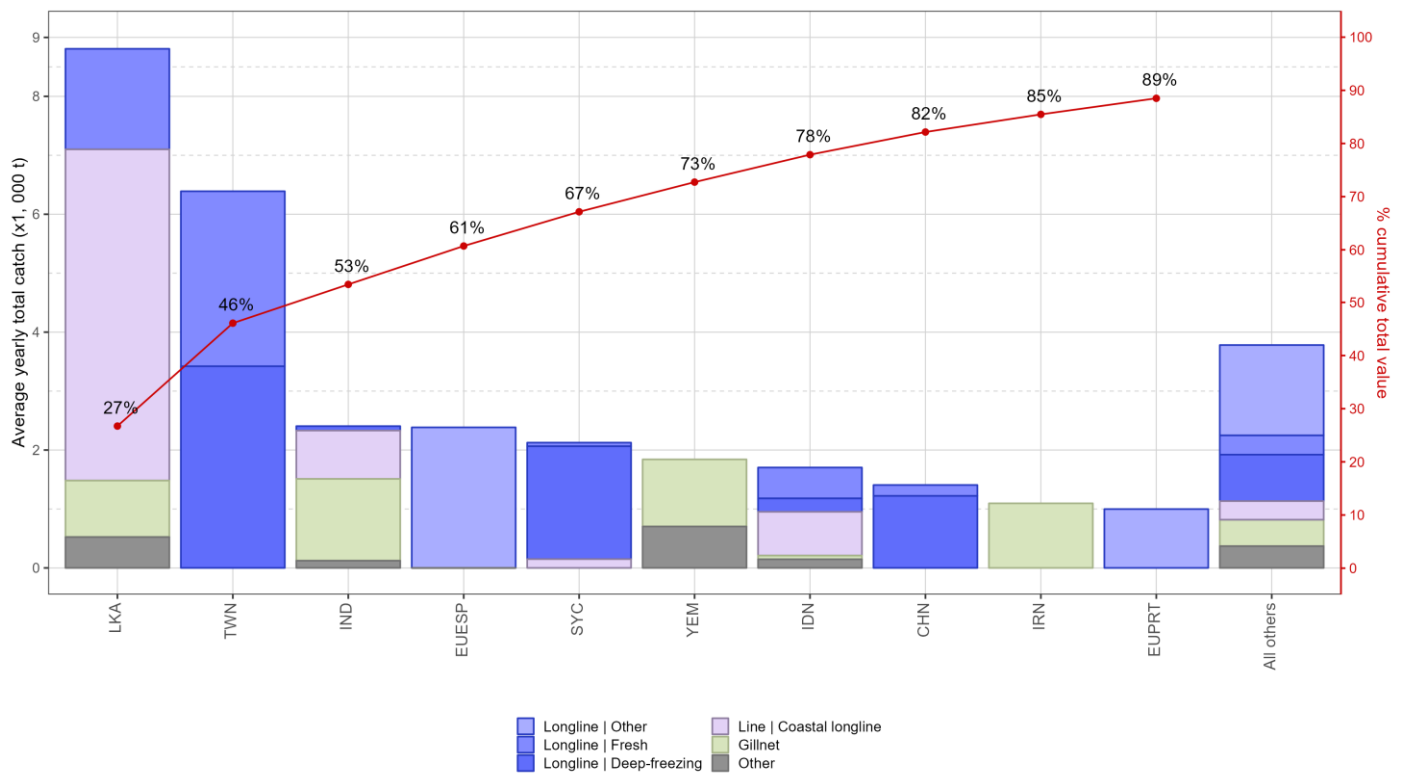


Figure 4: Mean annual catches (metric tons; t) of swordfish by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet. Data source: [best scientific estimate of nominal catches](#)

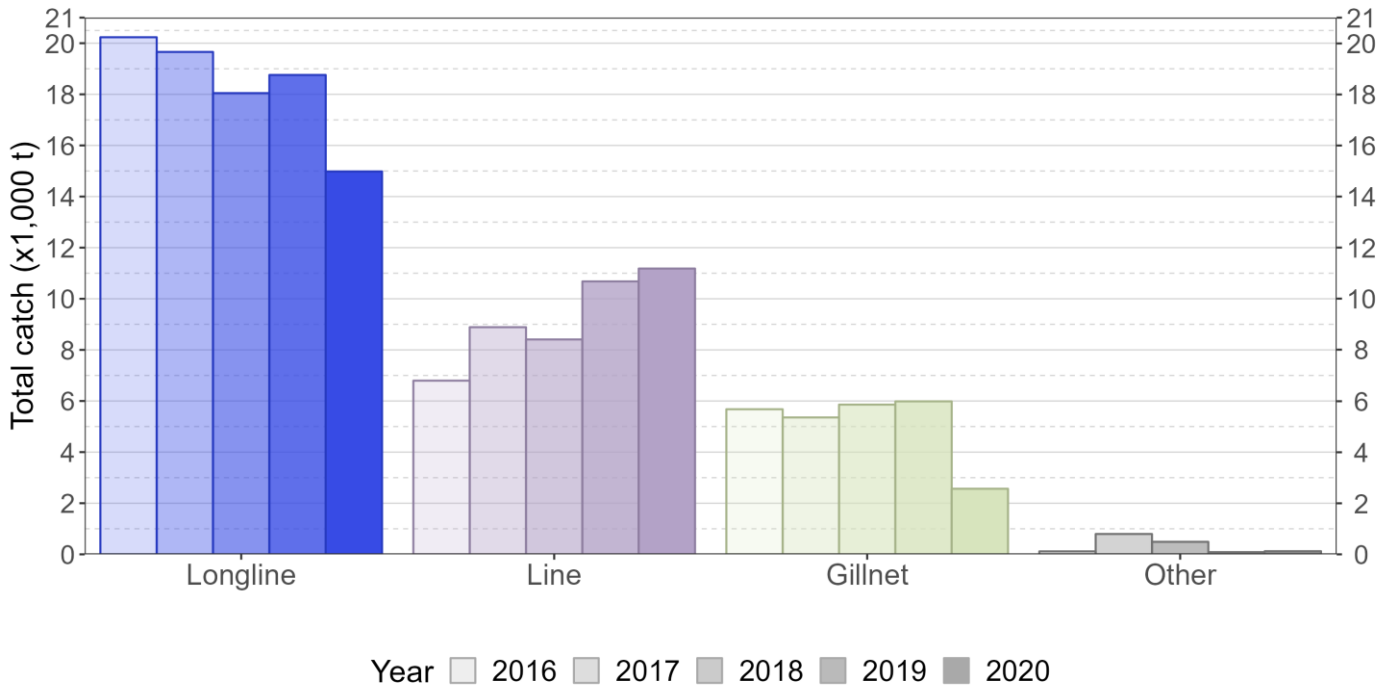


Figure 5: Annual catch (metric tons; t) trends of swordfish by fishery group between 2016 and 2020. Data source: [best scientific estimate of nominal catches](#)

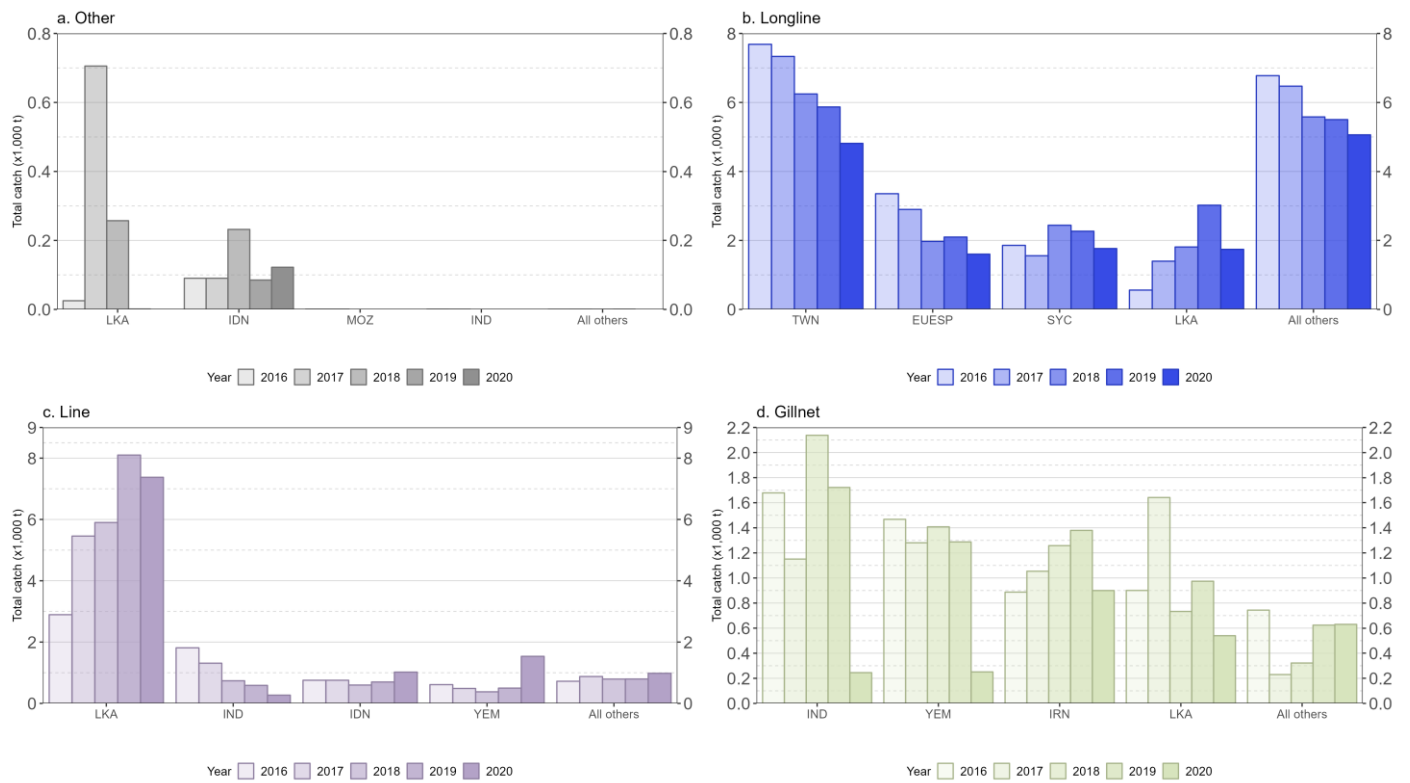


Figure 6: Annual catch (metric tons; t) trends of swordfish by fishery group and fleet between 2016 and 2020. Data source: [best scientific estimate of nominal catches](#)

Changes from previous Working Party



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

Uncertainties in nominal catch data

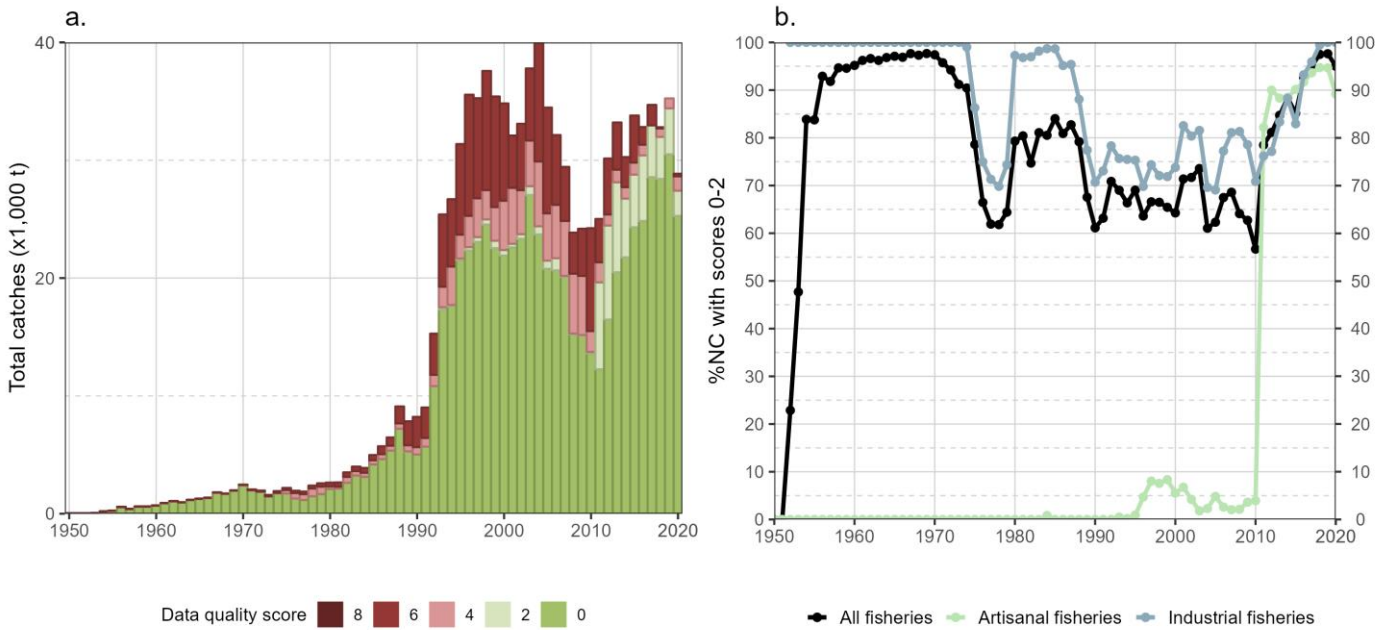


Figure 8: (a) Annual nominal catches (metric tons; t) of swordfish estimated by quality score and (b) percentage of nominal catches fully or partially reported to the IOTC Secretariat for all fisheries and by type of fishery, in the period 1950-2020

Discard levels

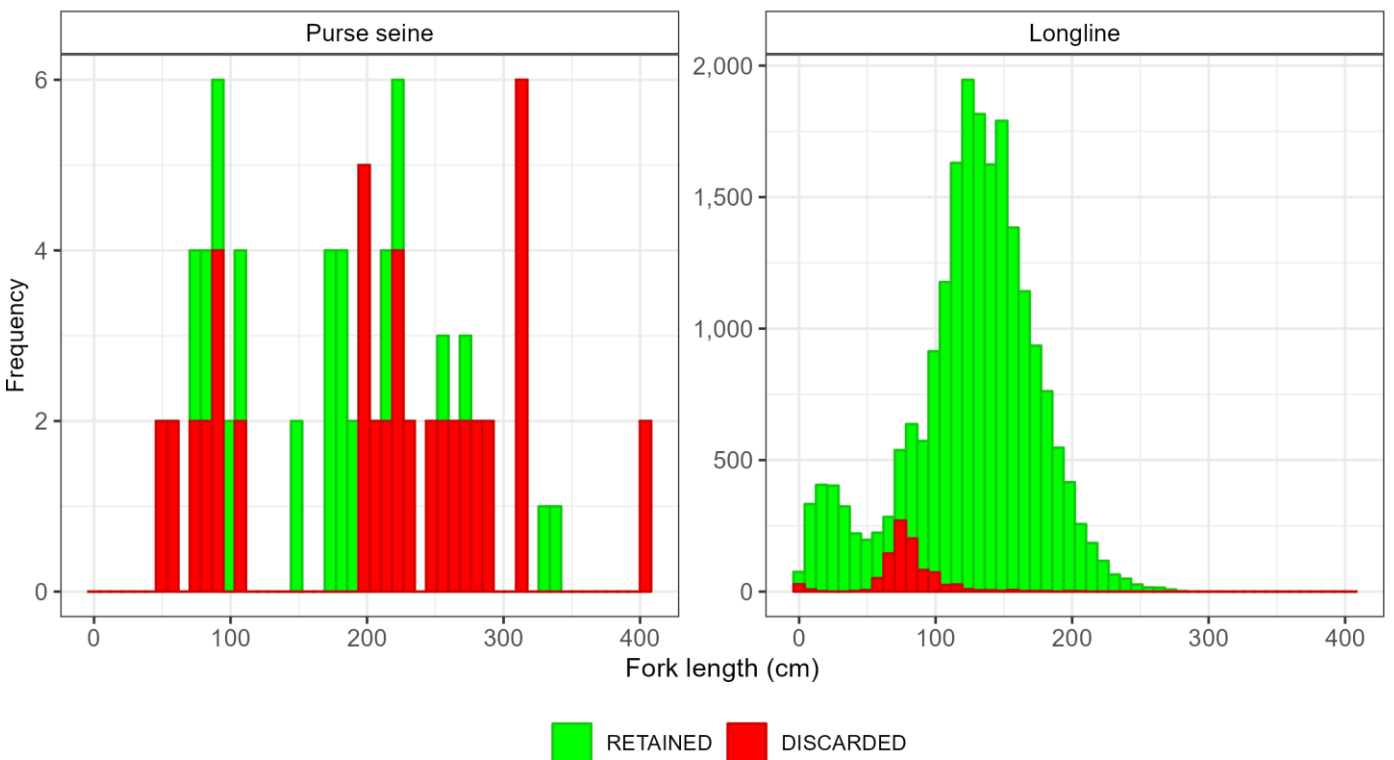


Figure 9: Size (fork length; cm) frequency distribution of swordfish retained and discarded at sea in purse seine and longline fisheries as available in the ROS regional database

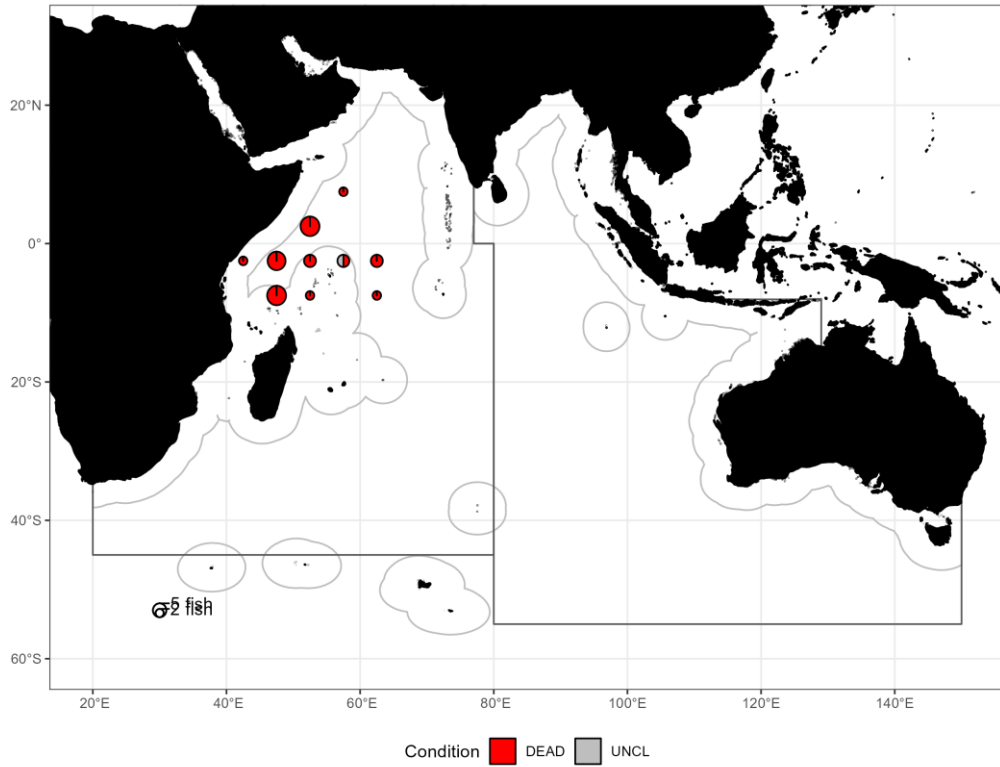


Figure 10: Distribution of swordfish discarded at sea in the western Indian Ocean purse seine fisheries with information on condition at release as available in the ROS regional database

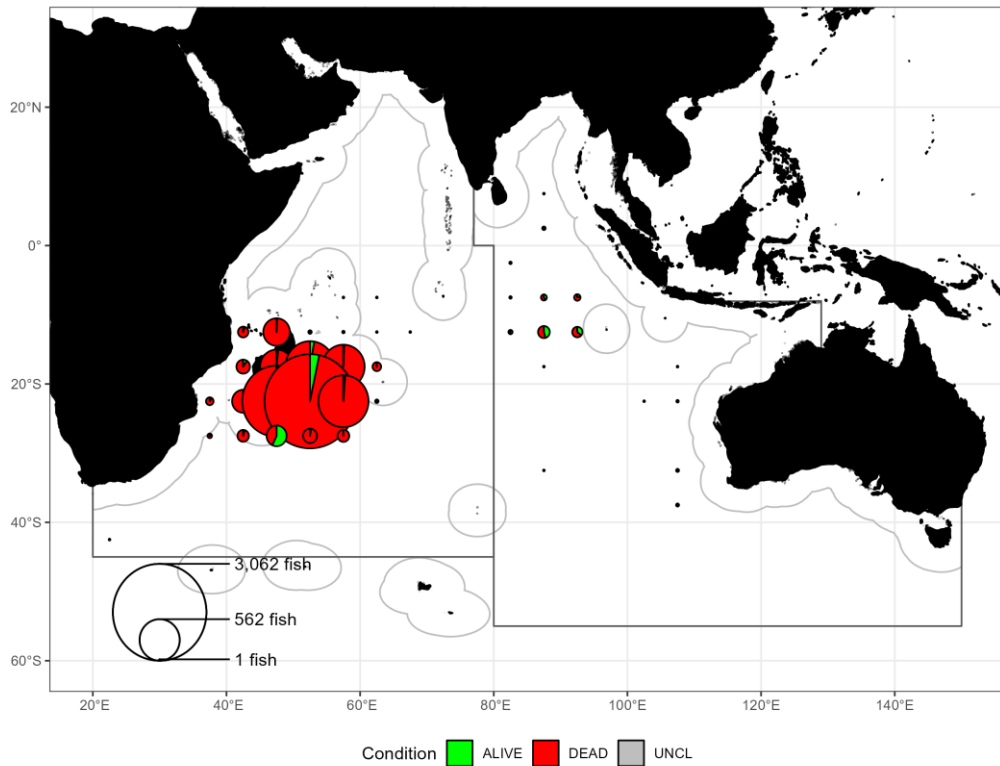


Figure 11: Distribution of swordfish discarded at sea in the Indian Ocean longline fisheries with information on condition at release as available in the ROS regional database

Geo-referenced catch

Spatial distribution of catches

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

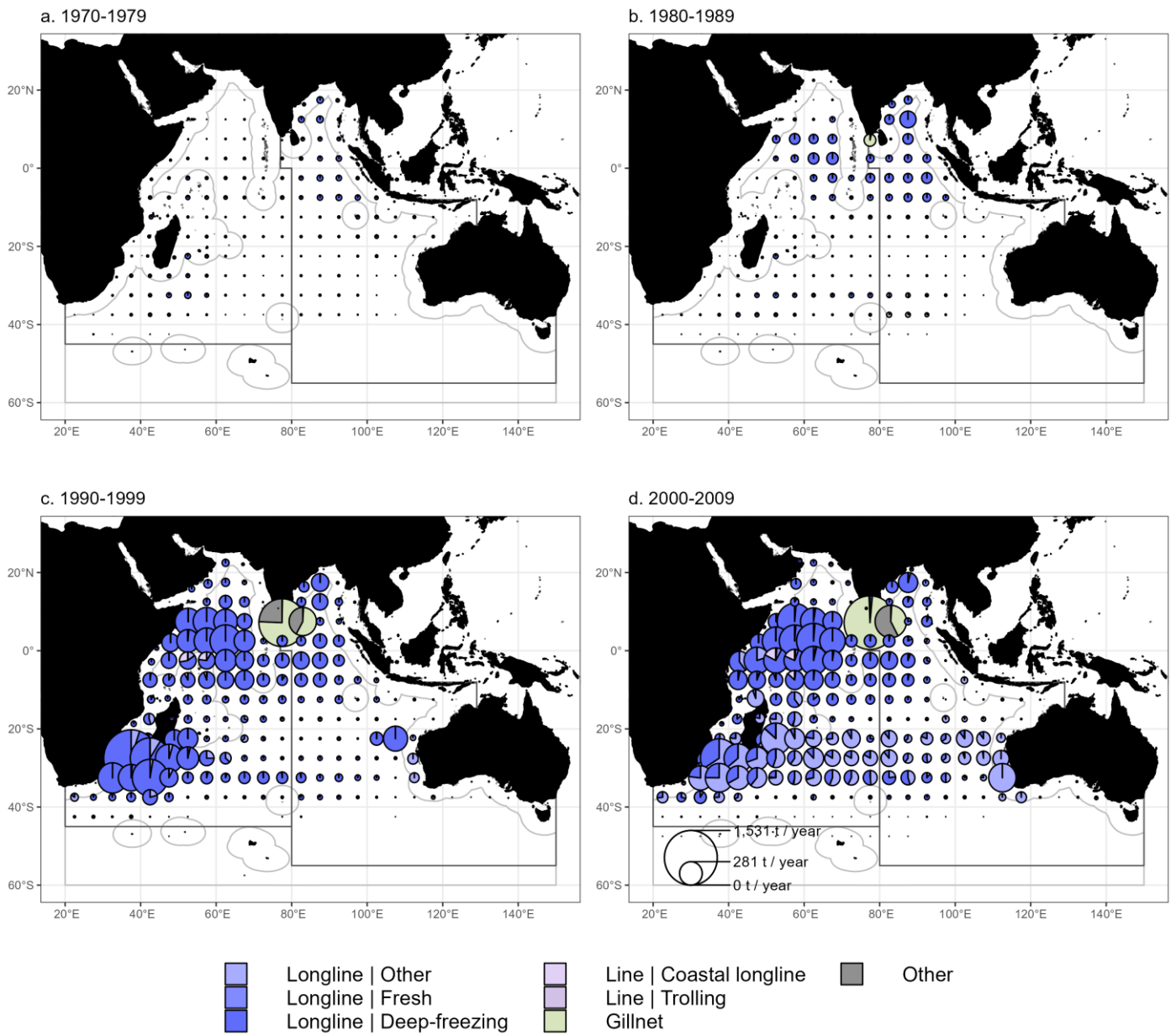


Figure 12: Mean annual time-area catches in weight (metric tons; t) of swordfish, by decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

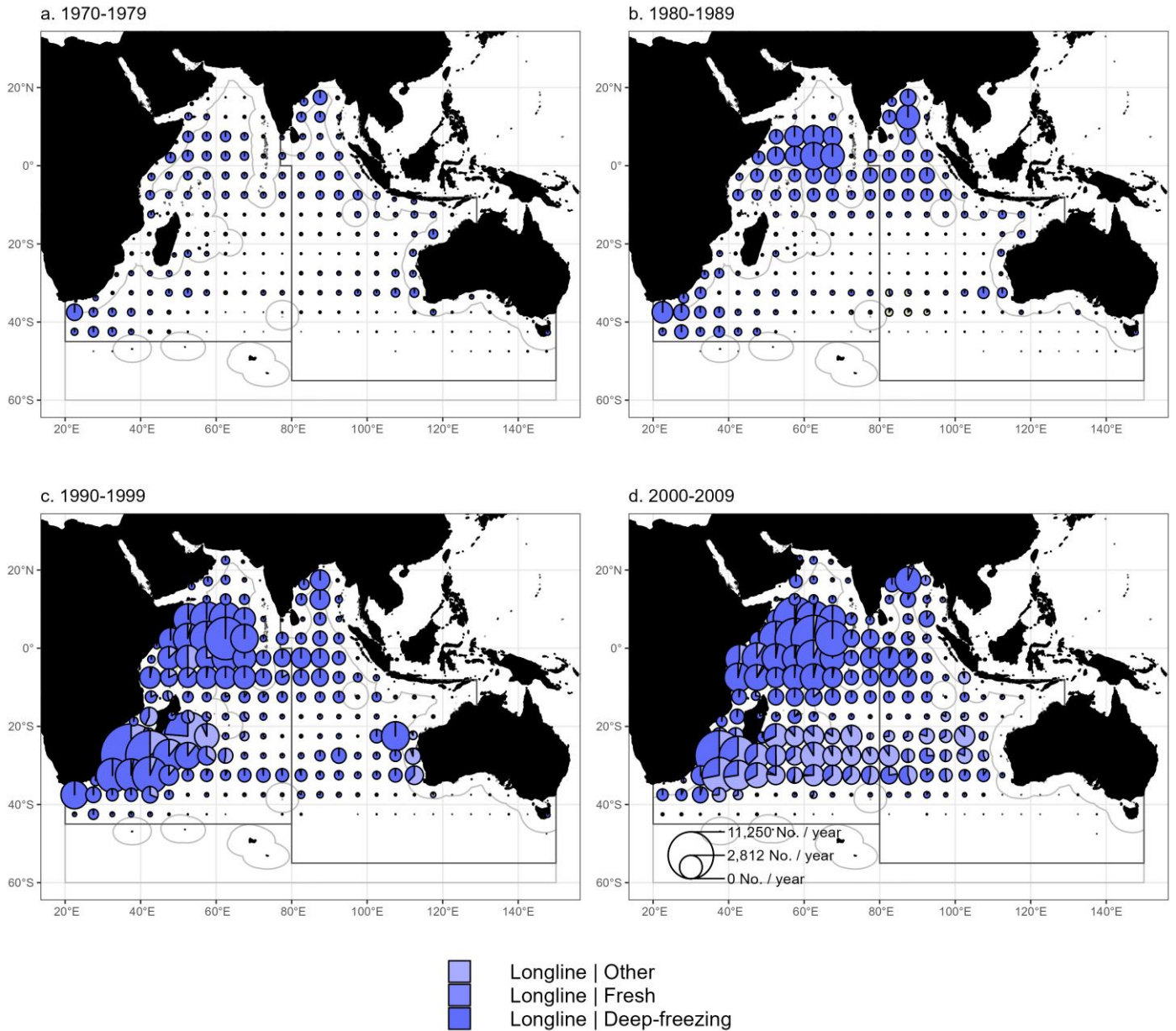


Figure 13: Mean annual time-area catches in numbers of swordfish, by decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

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

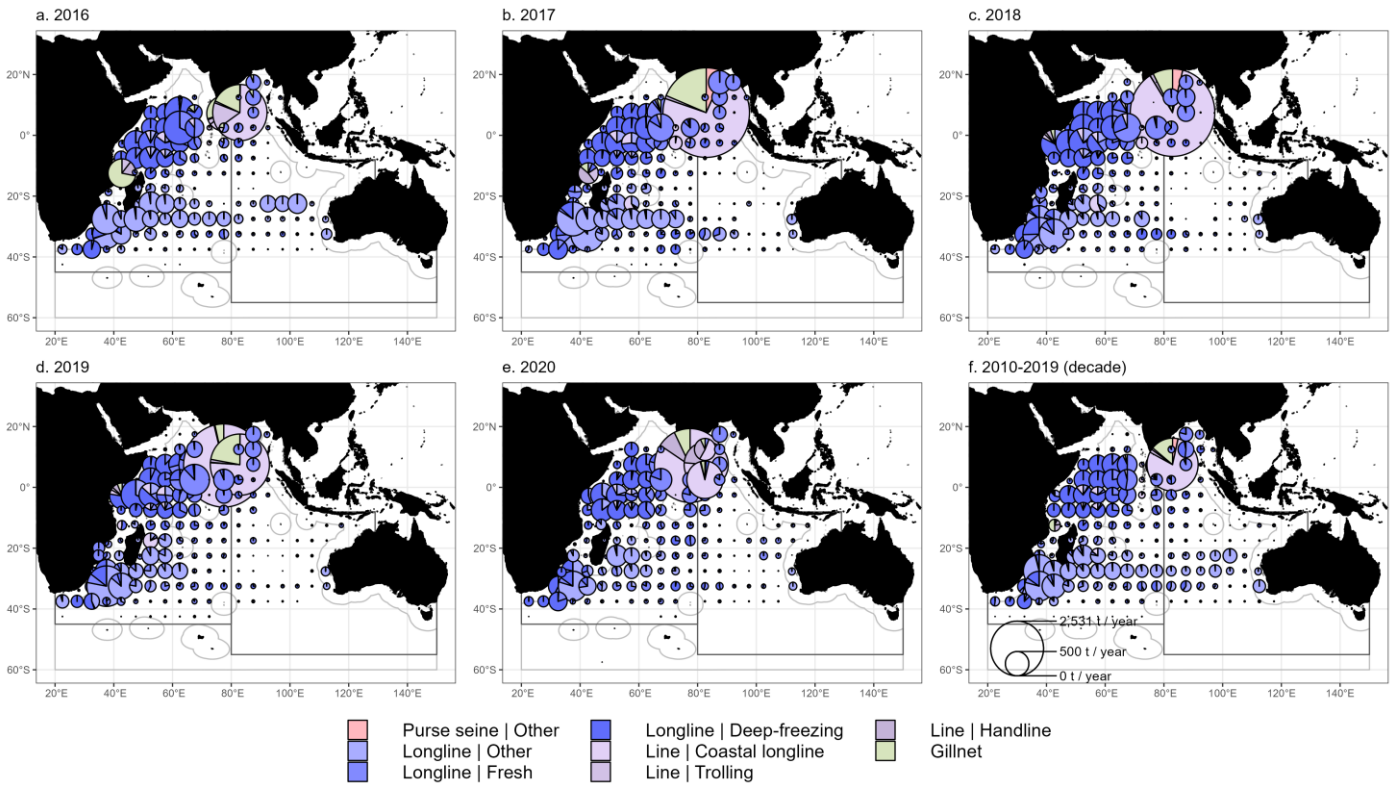


Figure 14: Mean annual time-area catches in weight (metric tons; t) of swordfish, by year / decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

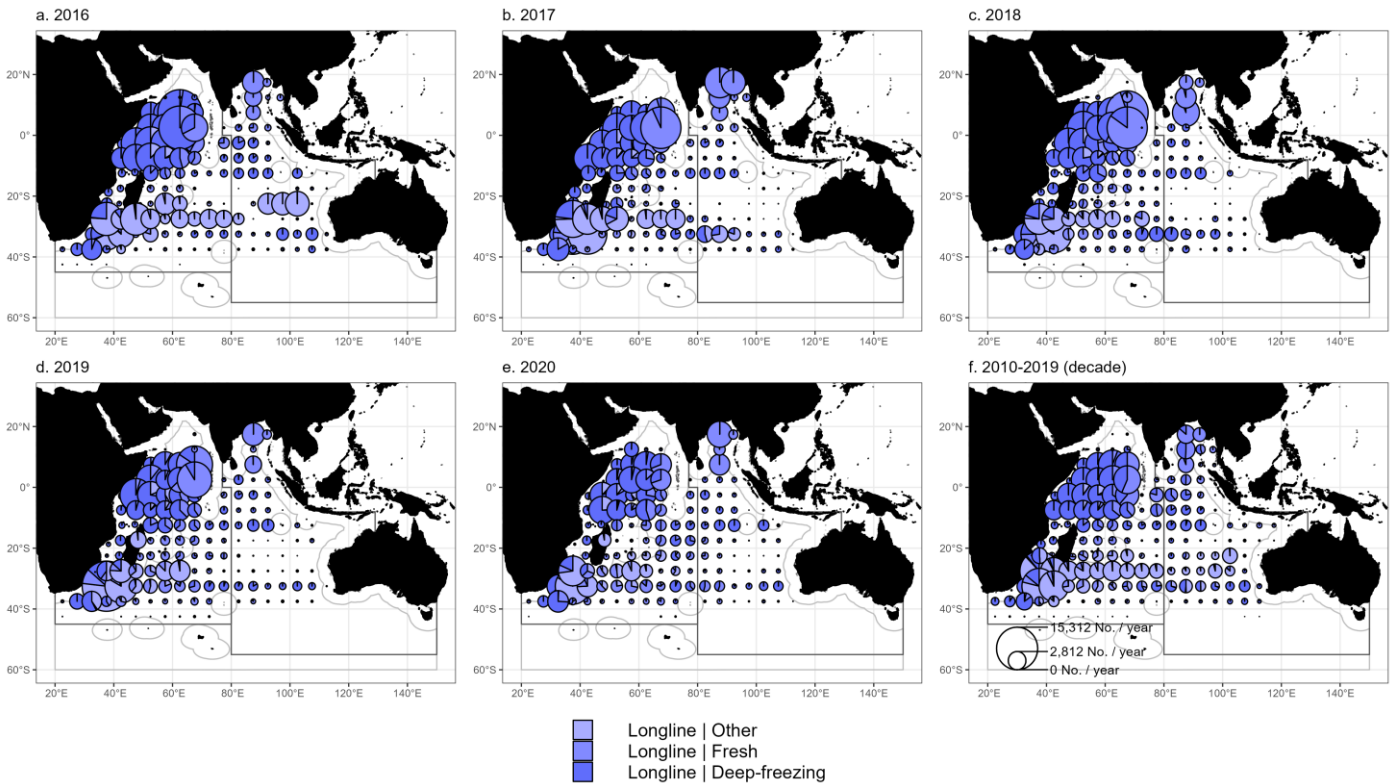


Figure 15: Mean annual time-area catches in numbers of swordfish, by year / decade, 5x5 grid, and fishery. Data source: [time-area catches](#)

Uncertainties in catch and effort data

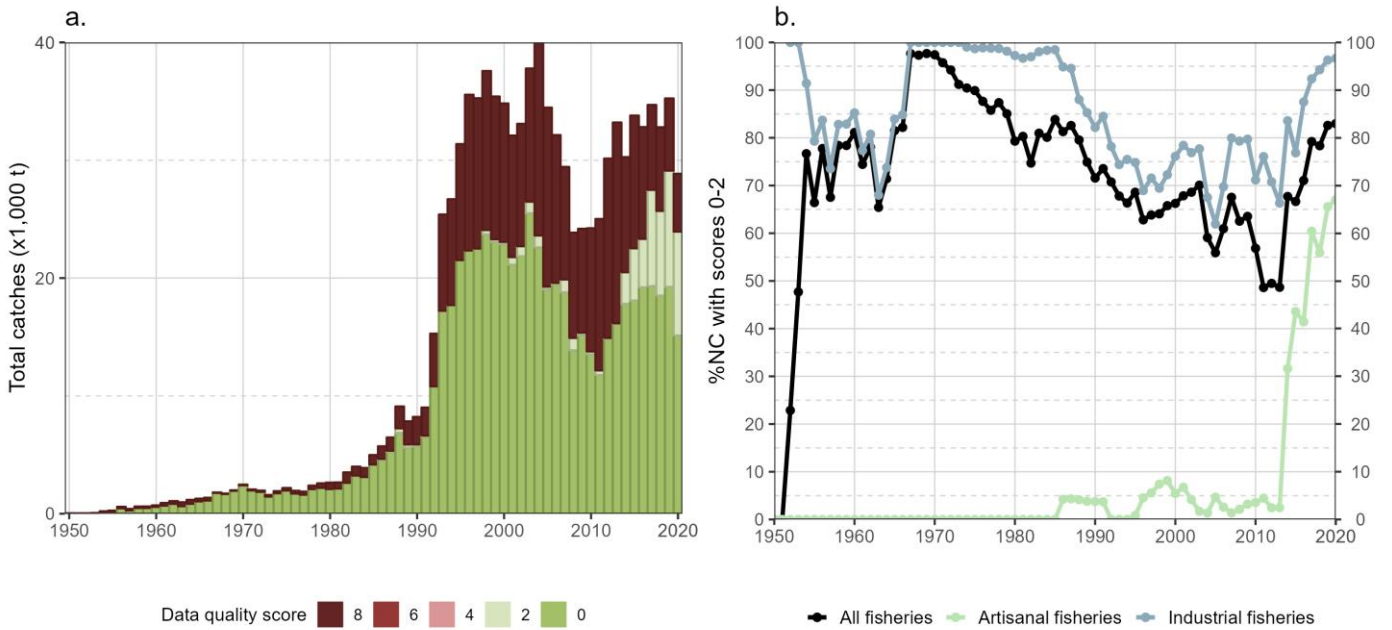


Figure 16: (a) Annual nominal catches (metric tons; t) of swordfish estimated by quality score and (b) percentage of nominal catches for which geo-referenced catches were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the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

Size composition of the catch

Samples availability

By fishery group

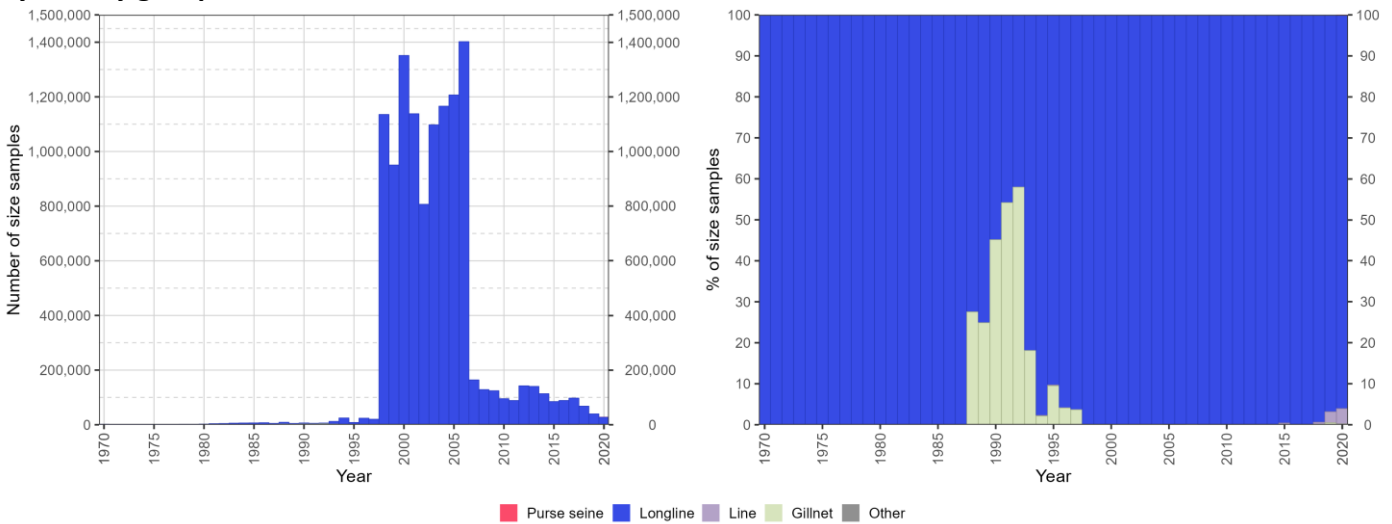


Figure 17: Availability of swordfish size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and fishery group. Data source: [standardized size-frequency dataset](#)

Longline fisheries

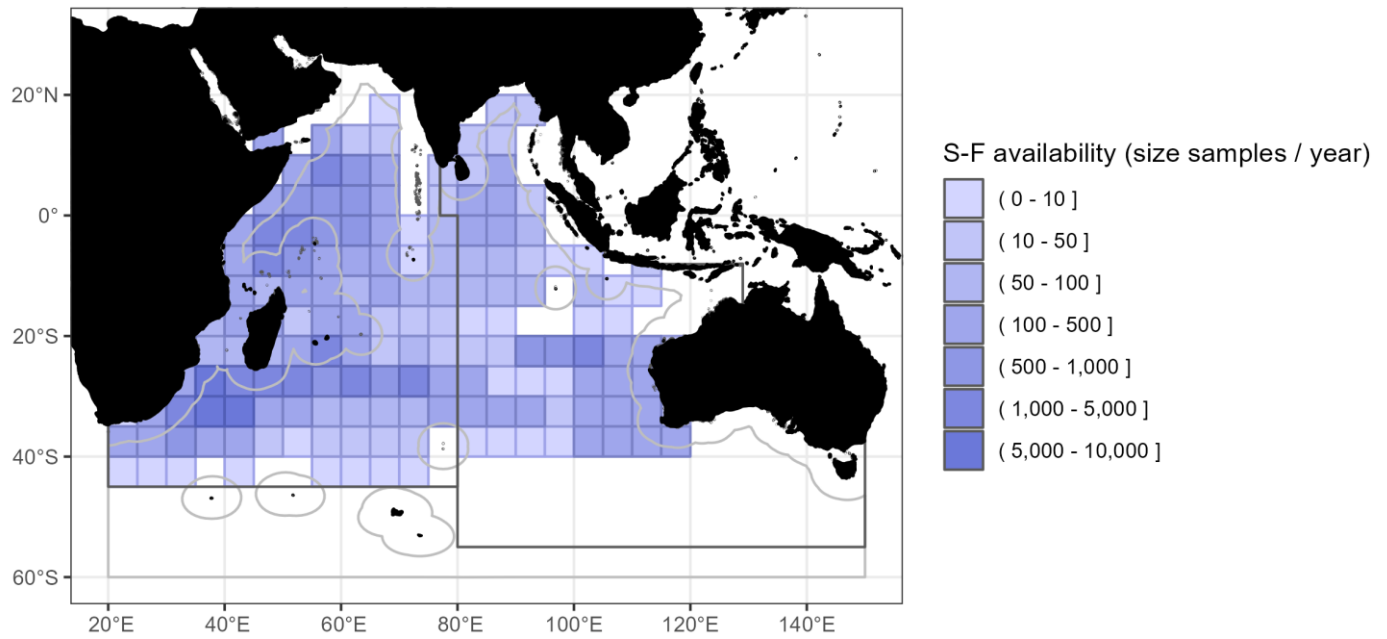


Figure 18: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for longline fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

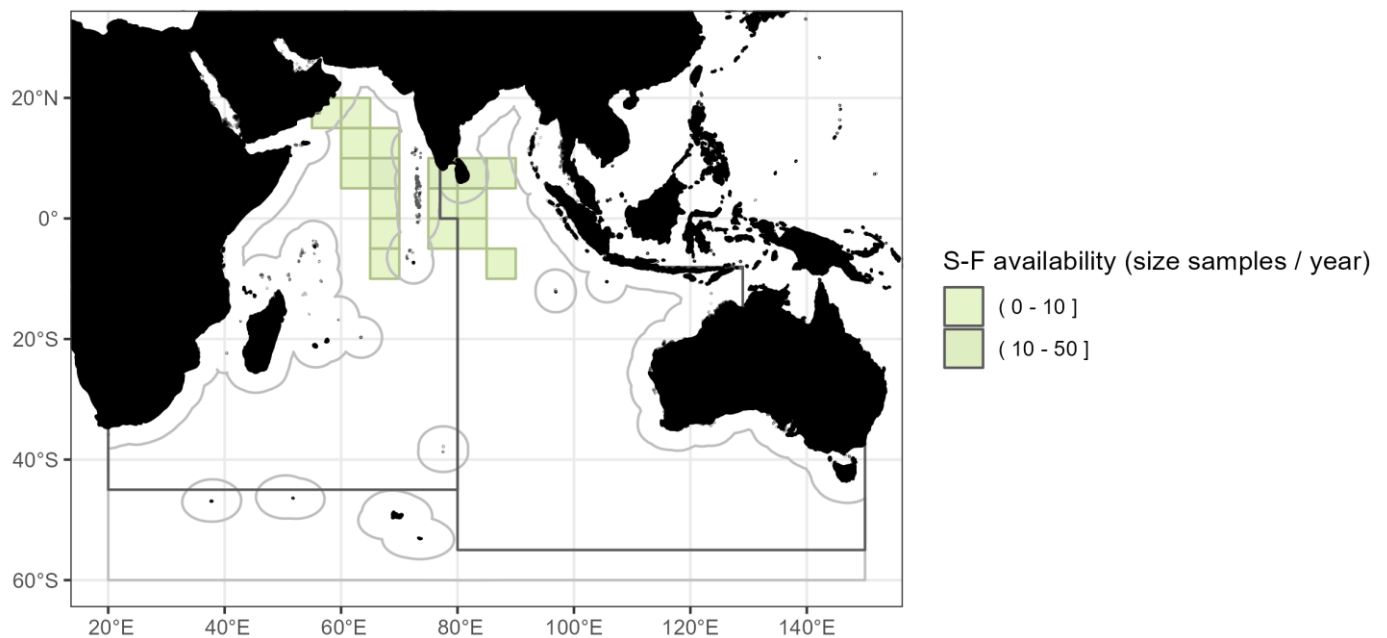


Figure 19: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for gillnet fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Line fisheries

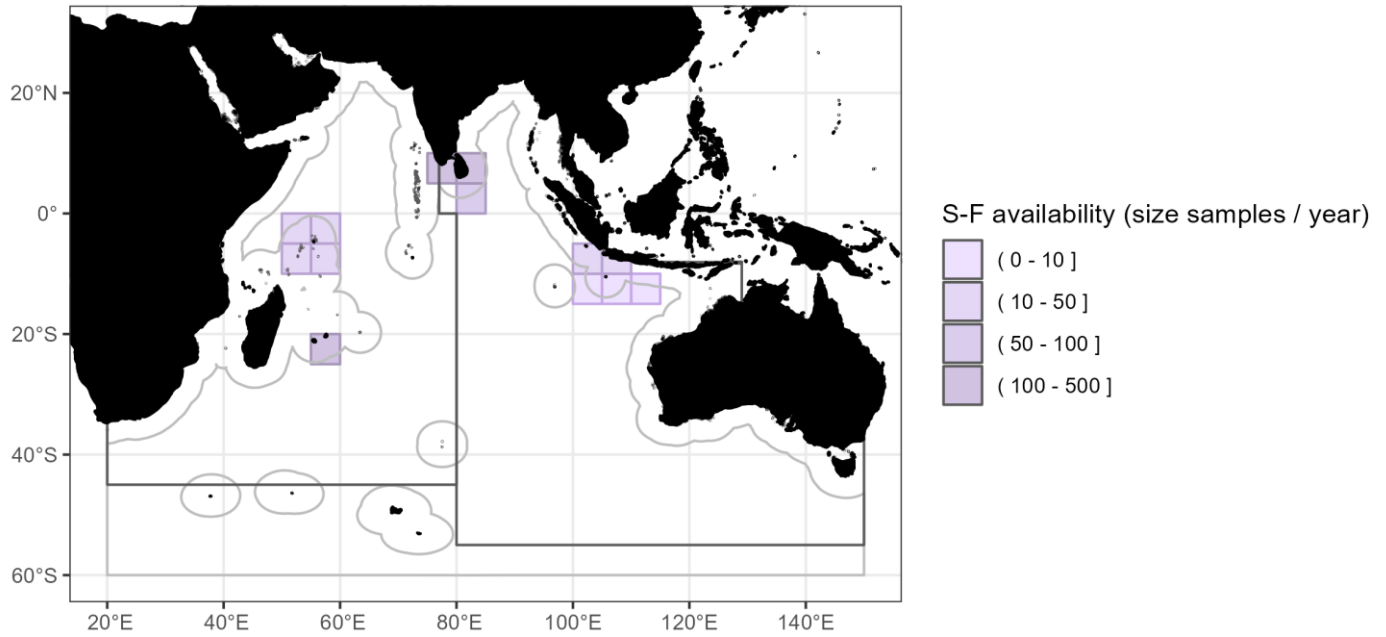


Figure 20: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for line fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Purse seine fisheries

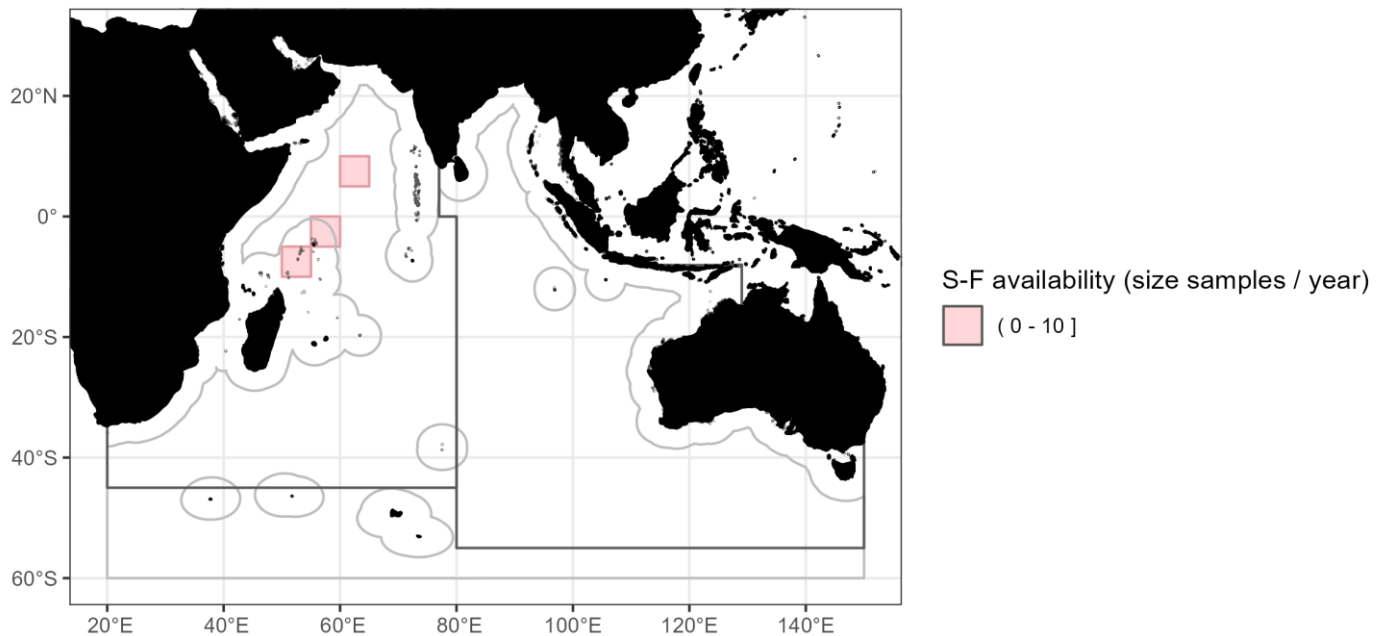


Figure 21: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for purse seine fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

By fishery

Gillnet fisheries

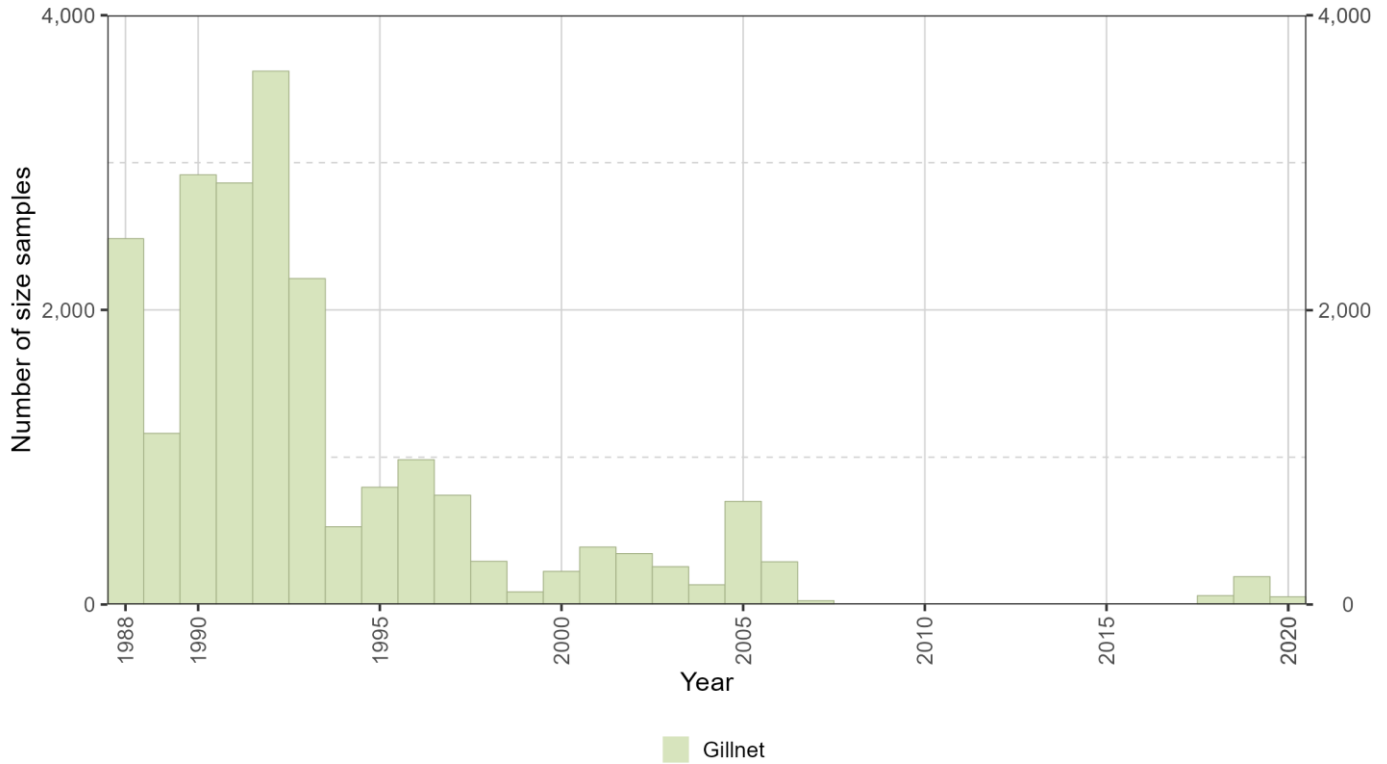


Figure 22: Availability of swordfish size-frequency data as absolute number of samples per year in gillnet fisheries. Data source: [standardized size-frequency dataset](#)

Longline fisheries

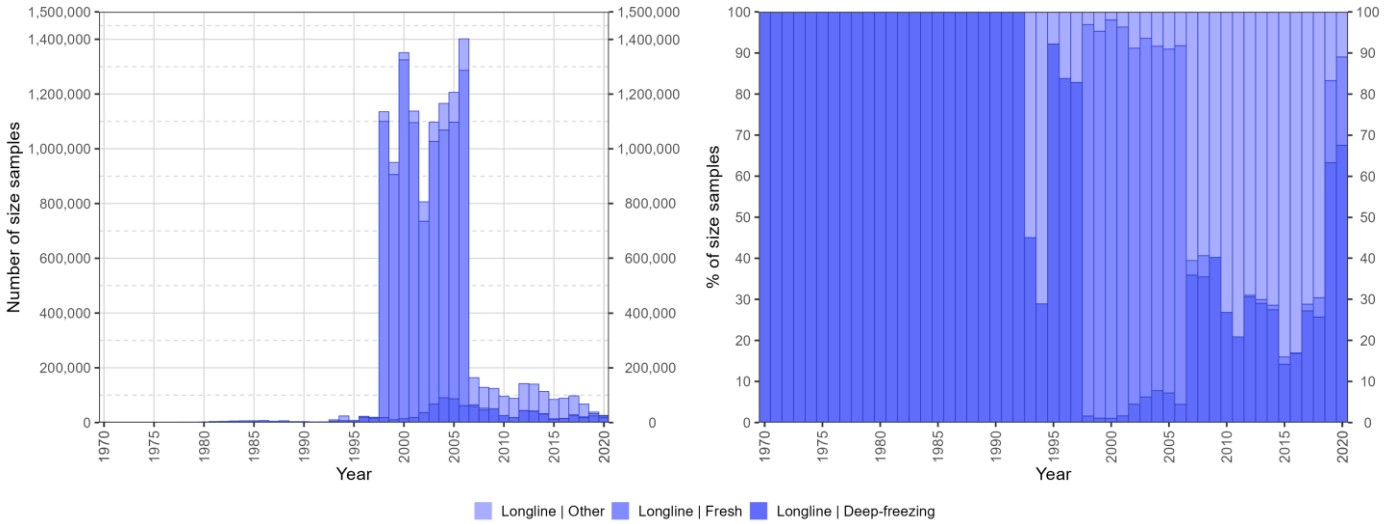


Figure 23: Availability of swordfish size-frequency data as absolute number of samples per year and longline fishery. Data source: [standardized size-frequency dataset](#)

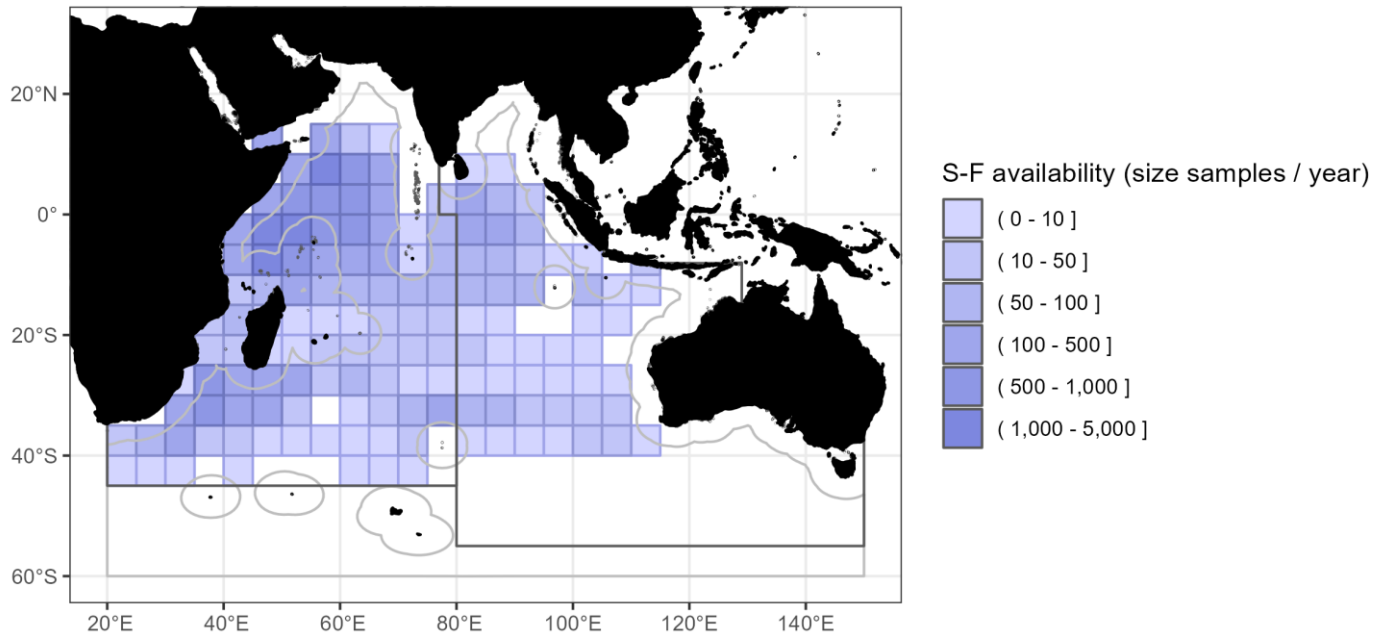


Figure 24: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for deep-freezing longline fisheries (LLD) in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

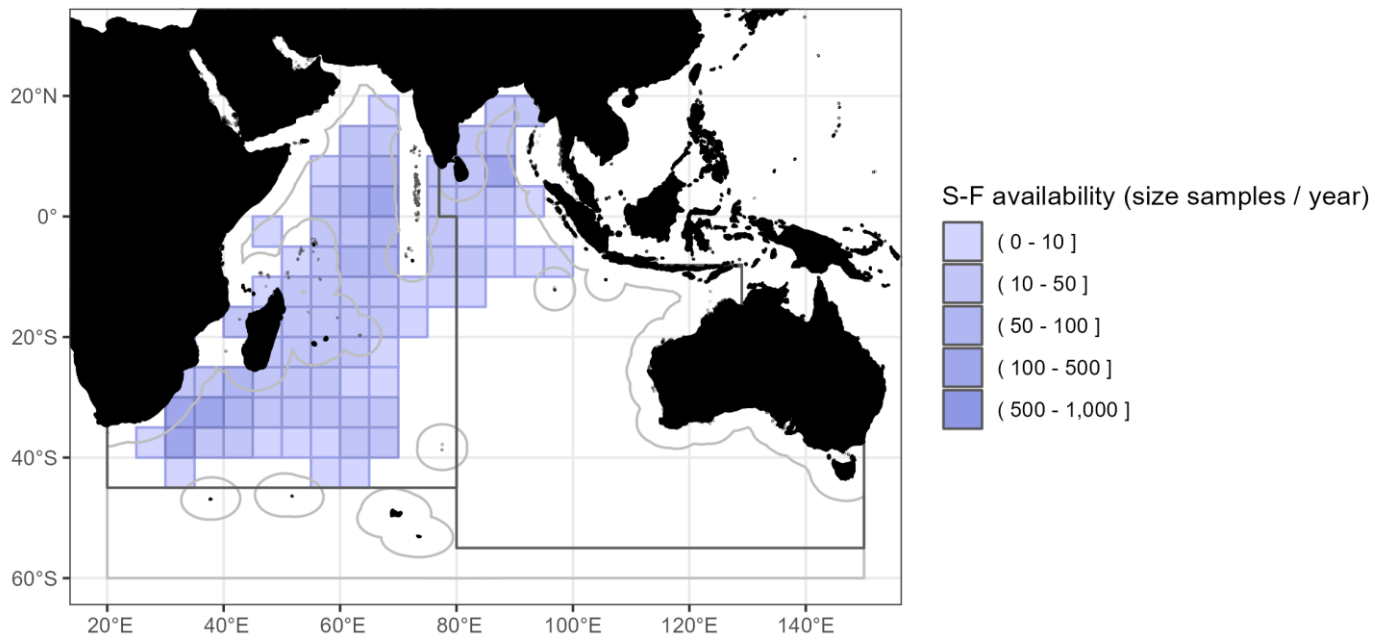


Figure 25: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for fresh longline fisheries (LLF) in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

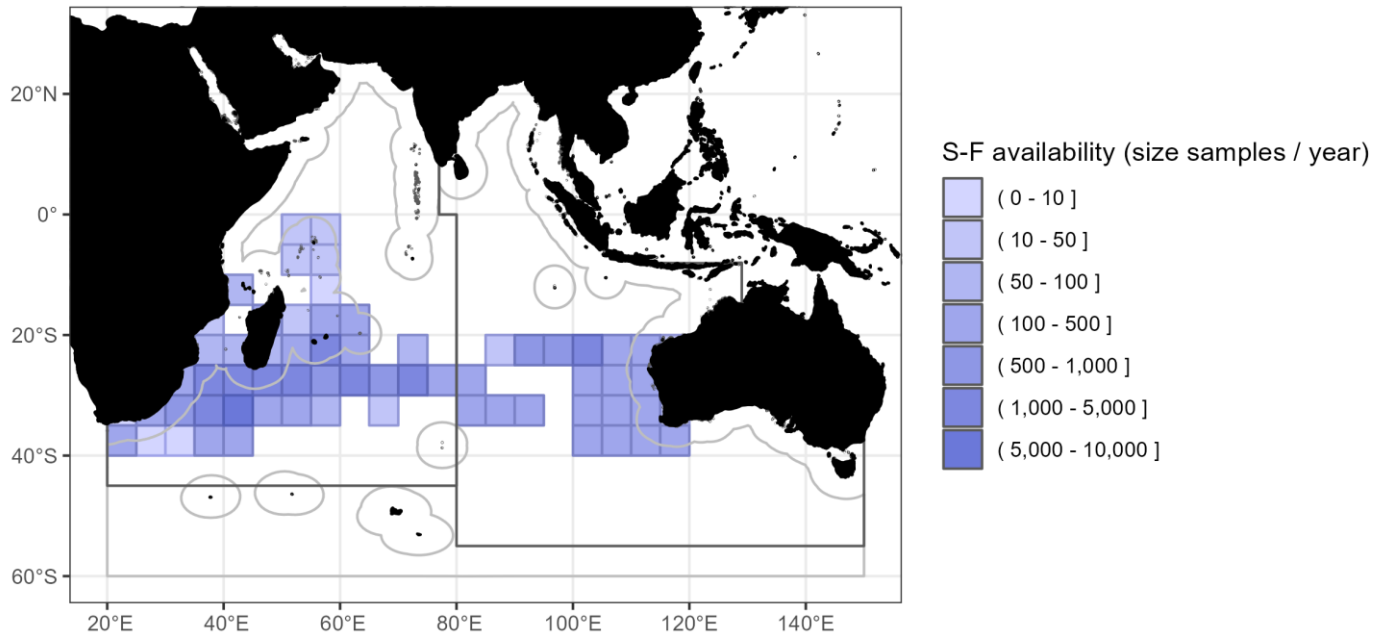


Figure 26: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data for swordfish and shark-targeted longline fisheries (LLO) in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Purse seine fisheries

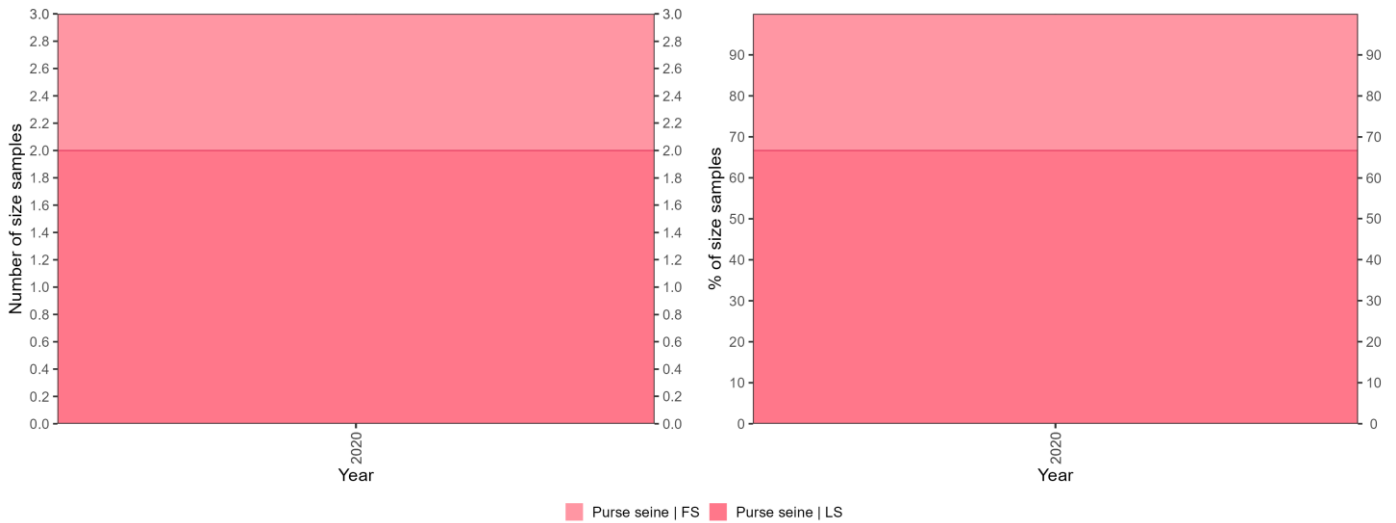


Figure 27: Availability of swordfish size-frequency data as absolute number of samples per year and purse seine fishery. FS = free-school; LS = school associated with drifting floating object. Data source: [standardized size-frequency dataset](#)

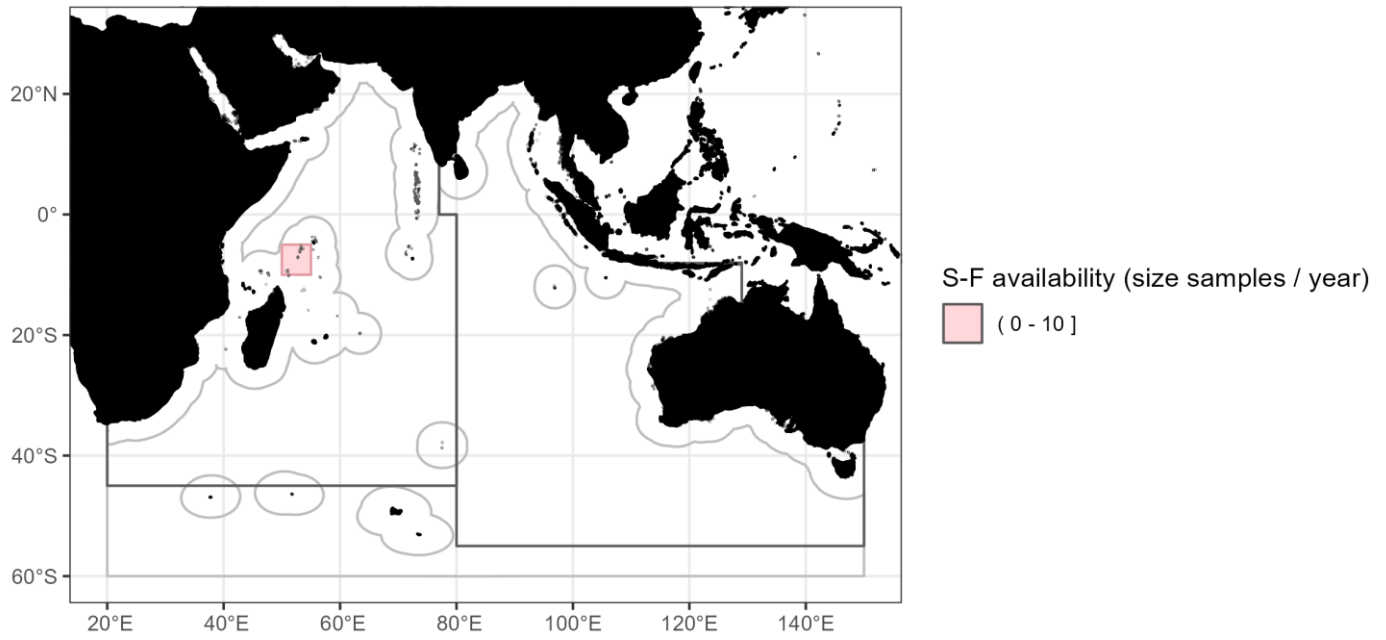


Figure 28: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data by purse seine fisheries on free-swimming schools (PSFS) in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

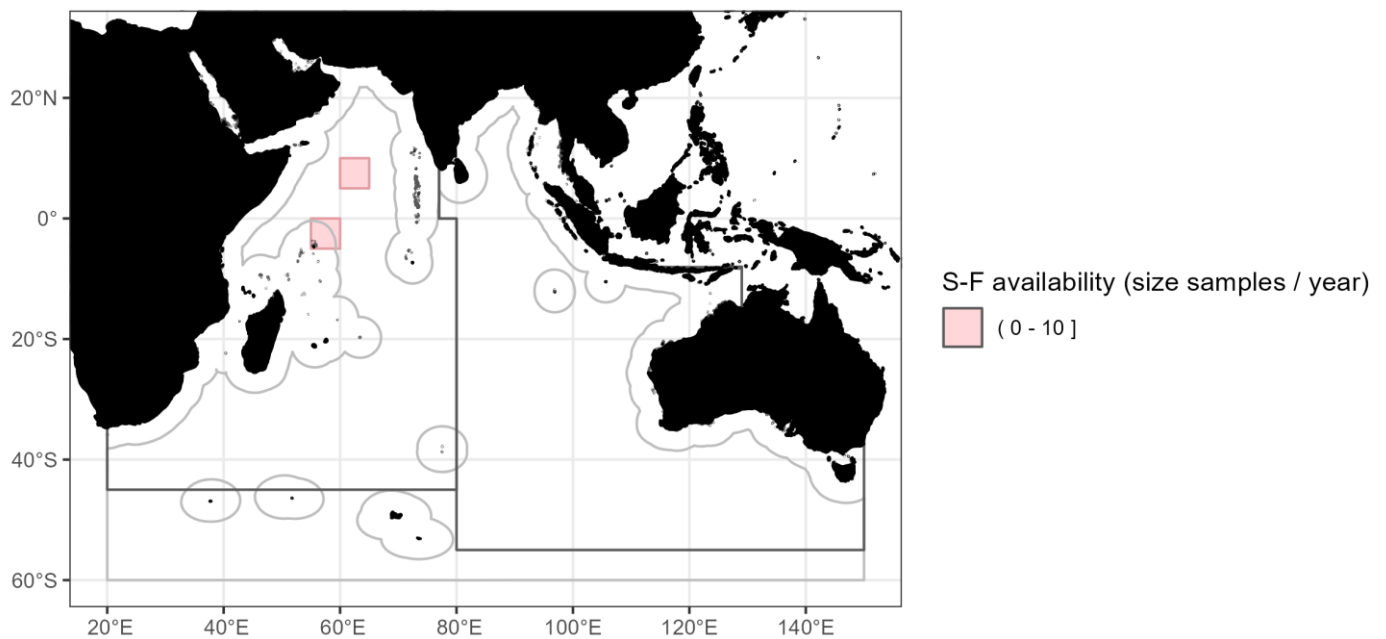


Figure 29: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data by purse seine fisheries on schools associated with drifting floating objects (PSLS) in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Line fisheries

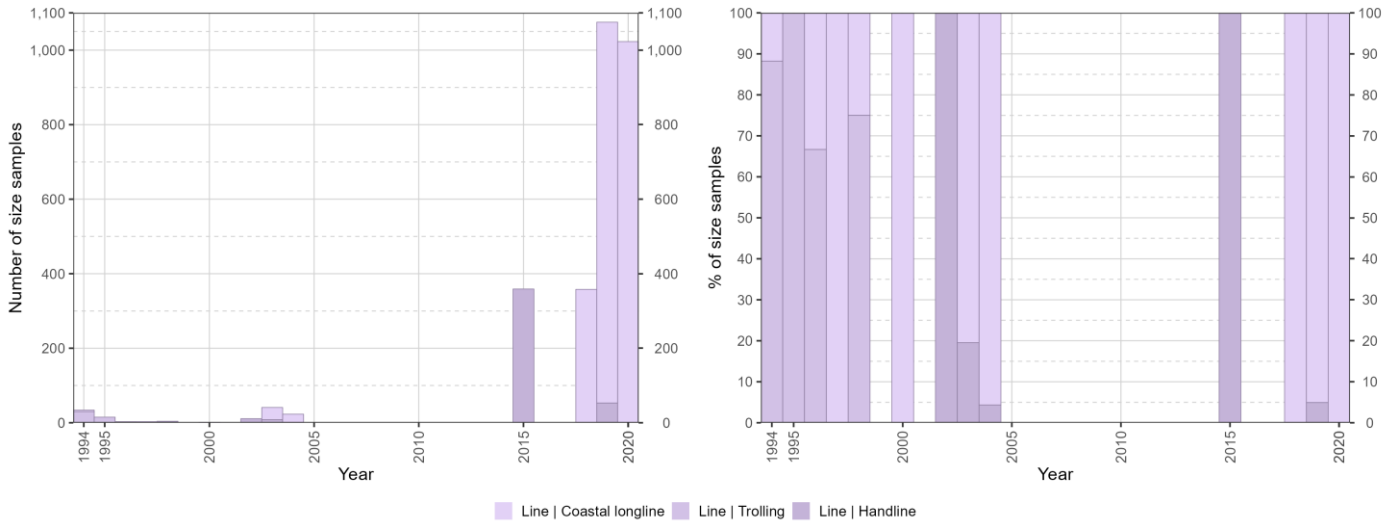


Figure 30: Availability of swordfish size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and type of line fishery. Data source: [standardized size-frequency dataset](#)

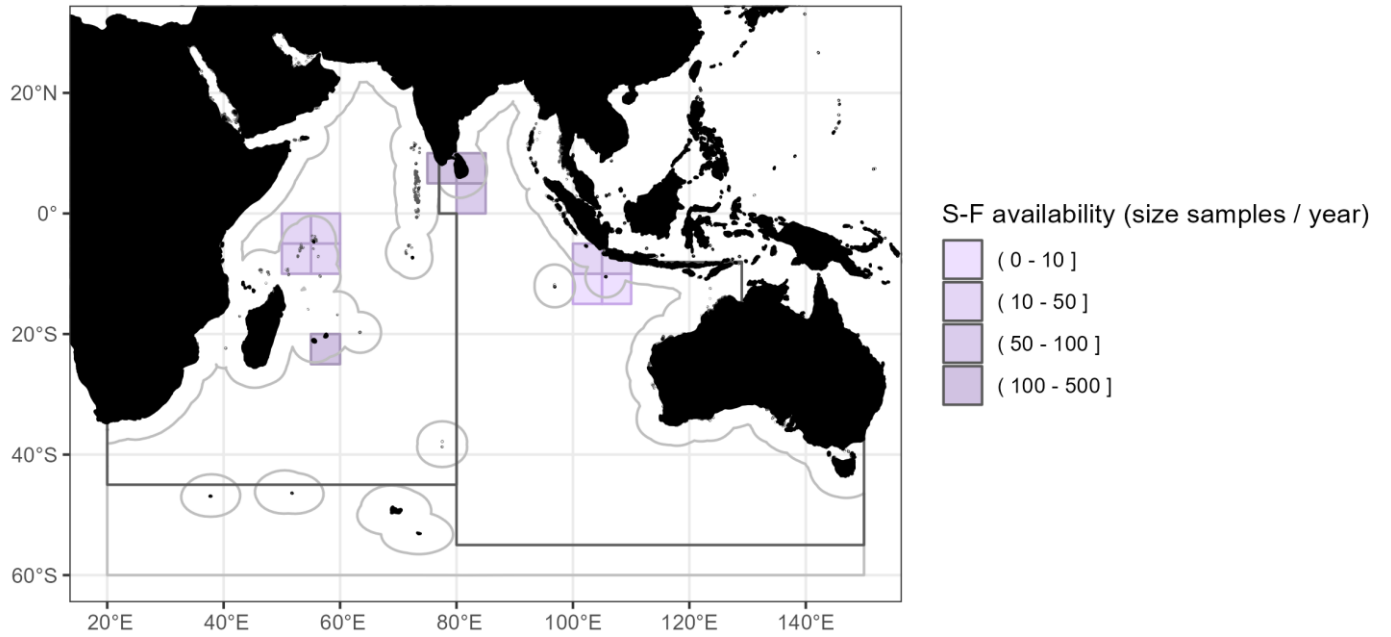


Figure 31: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data by line (coastal longline) fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

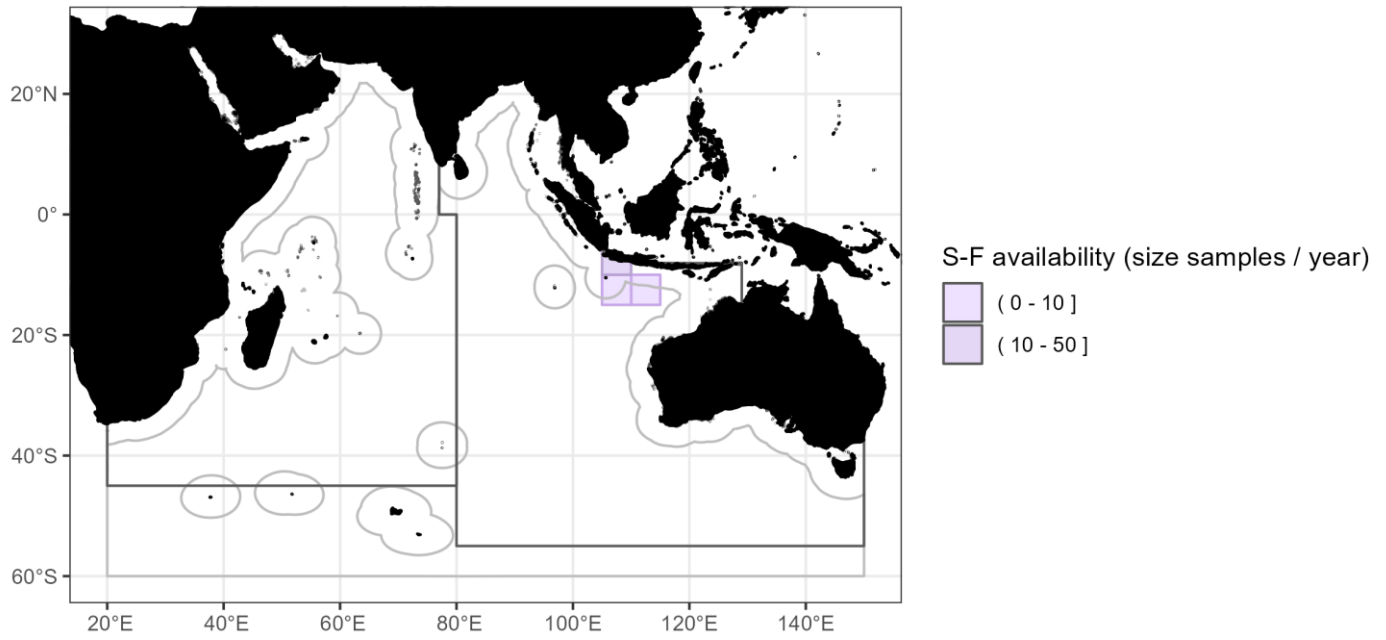


Figure 32: Spatial distribution (average number of samples per grid per year) of available swordfish size-frequency data by line (handline) fisheries in the period 2016-2020. Data source: [standardized size-frequency dataset](#)

Other fisheries

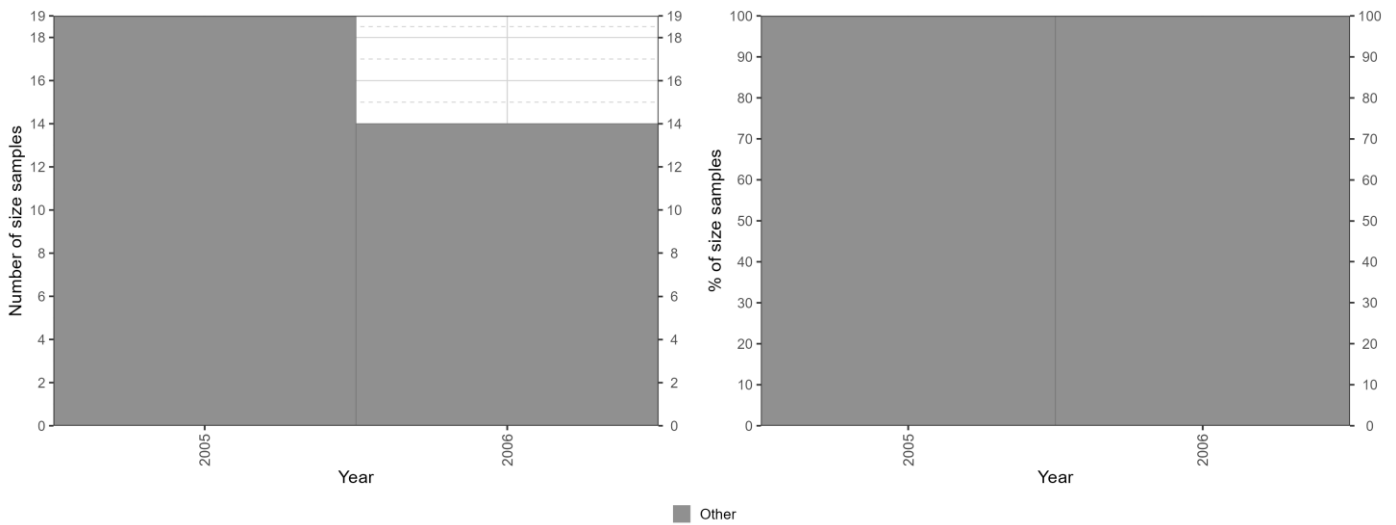


Figure 33: Availability of swordfish size-frequency data as absolute number of samples (left) and relative number of samples (right) per year and 'other' fishery type. Data source: [standardized size-frequency dataset](#)

Temporal patterns and trends in size distributions

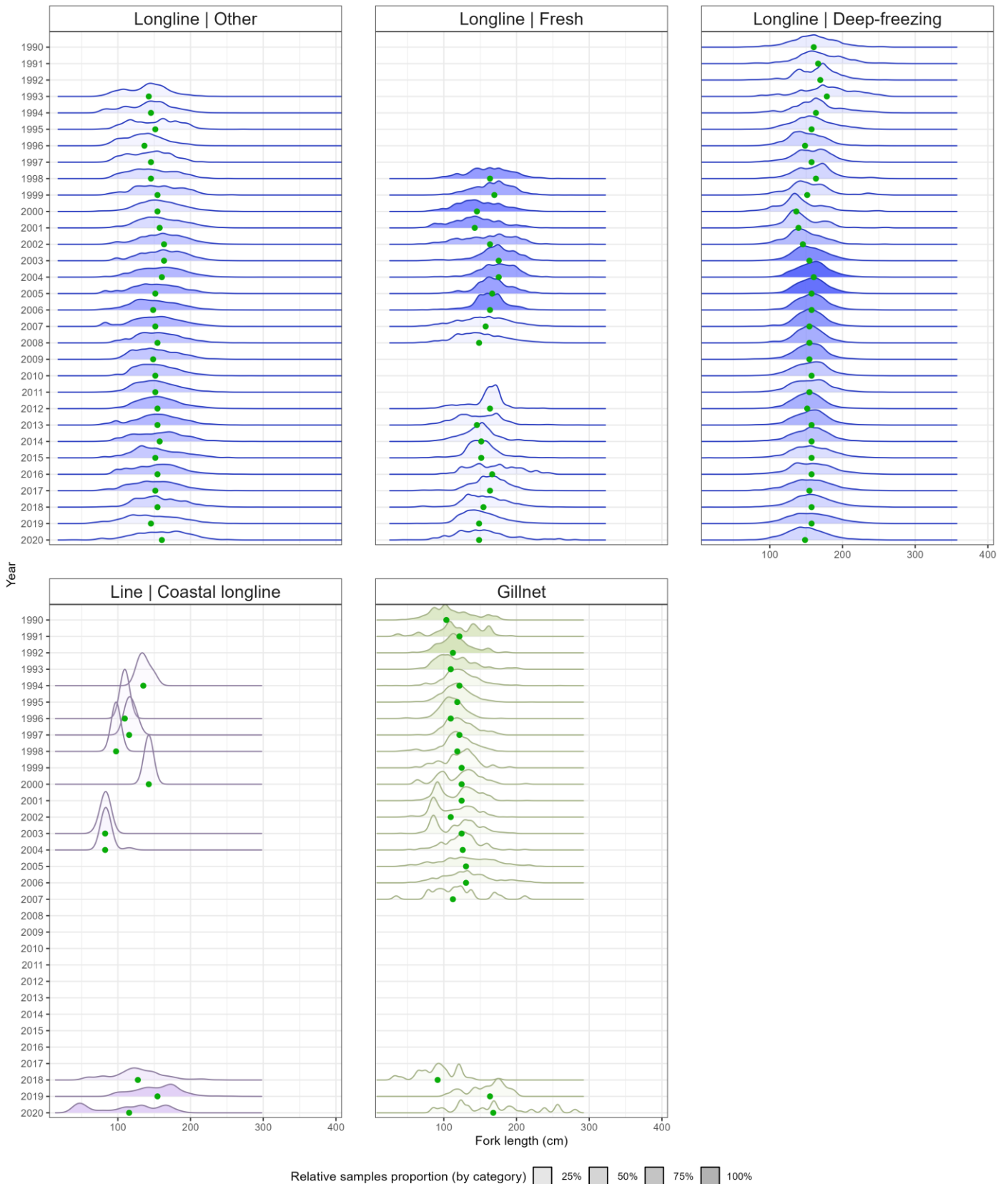


Figure 34: Relative size distribution (fork length; cm) of swordfish caught by longline and gillnet fisheries. Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median value. Data source: [standardized size-frequency dataset](#)

Size distribution by fishery and fleet

Deep-freezing longline fisheries

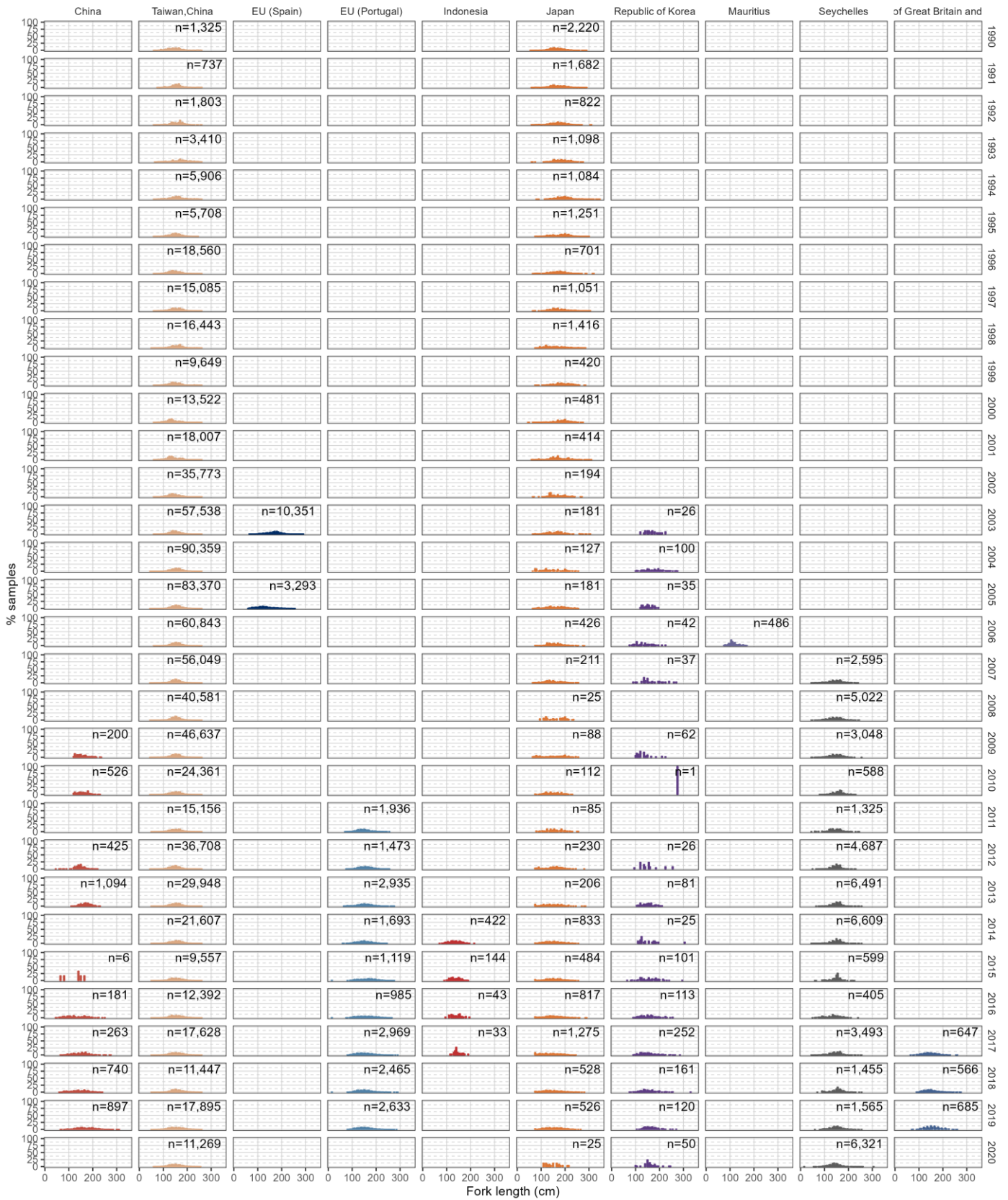


Figure 35: Relative size distribution of swordfish (fork length; cm) recorded for deep-freezing longline fisheries (LLD) by year and main fleet. Data source: [standardized size-frequency dataset](#)

Fresh longline fisheries

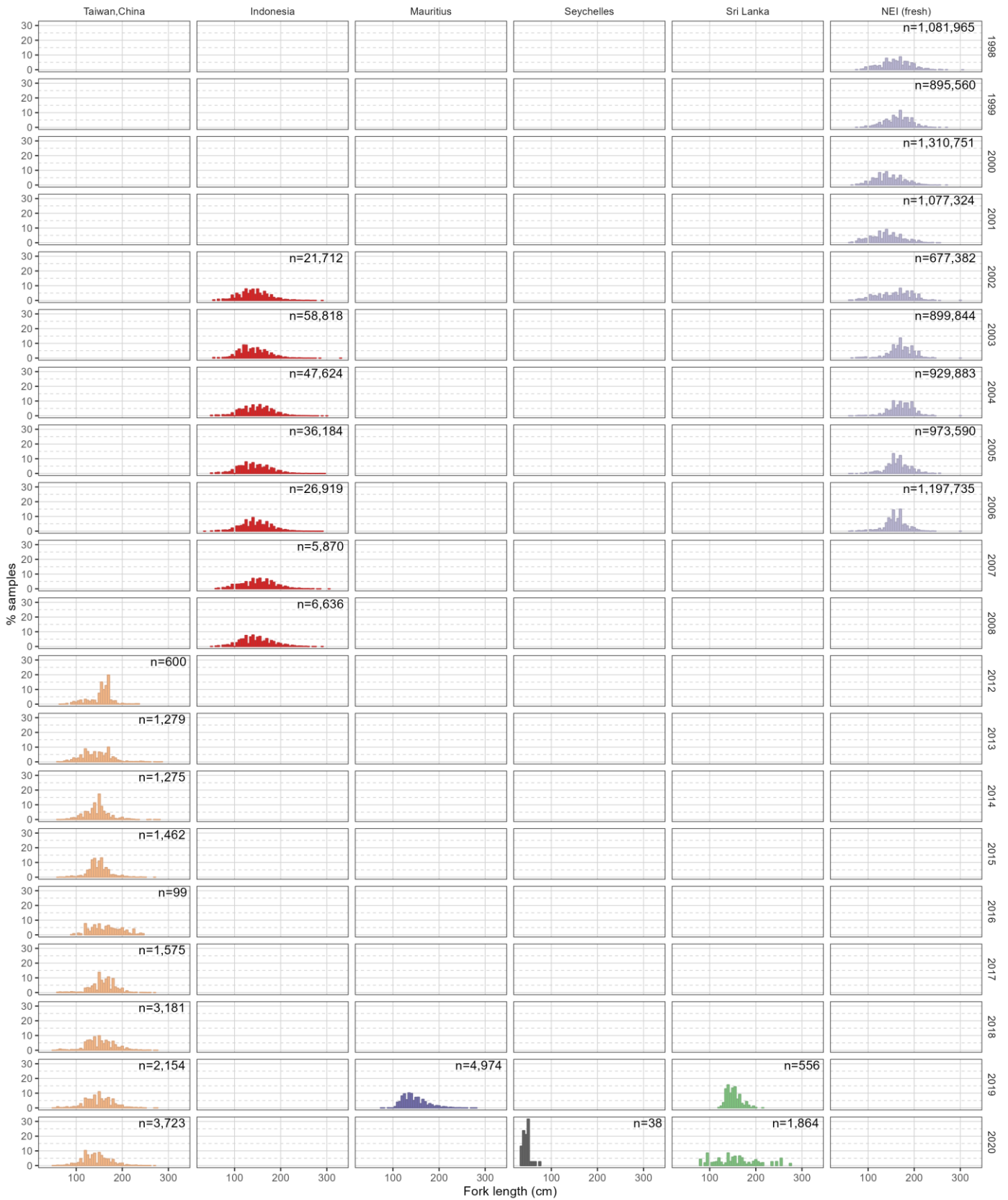


Figure 36: Relative size distribution of swordfish (fork length; cm) recorded for fresh longline fisheries (LLF) by year and main fleet. Data source: [standardized size-frequency dataset](#)

Swordfish and sharks-targeted longline fisheries

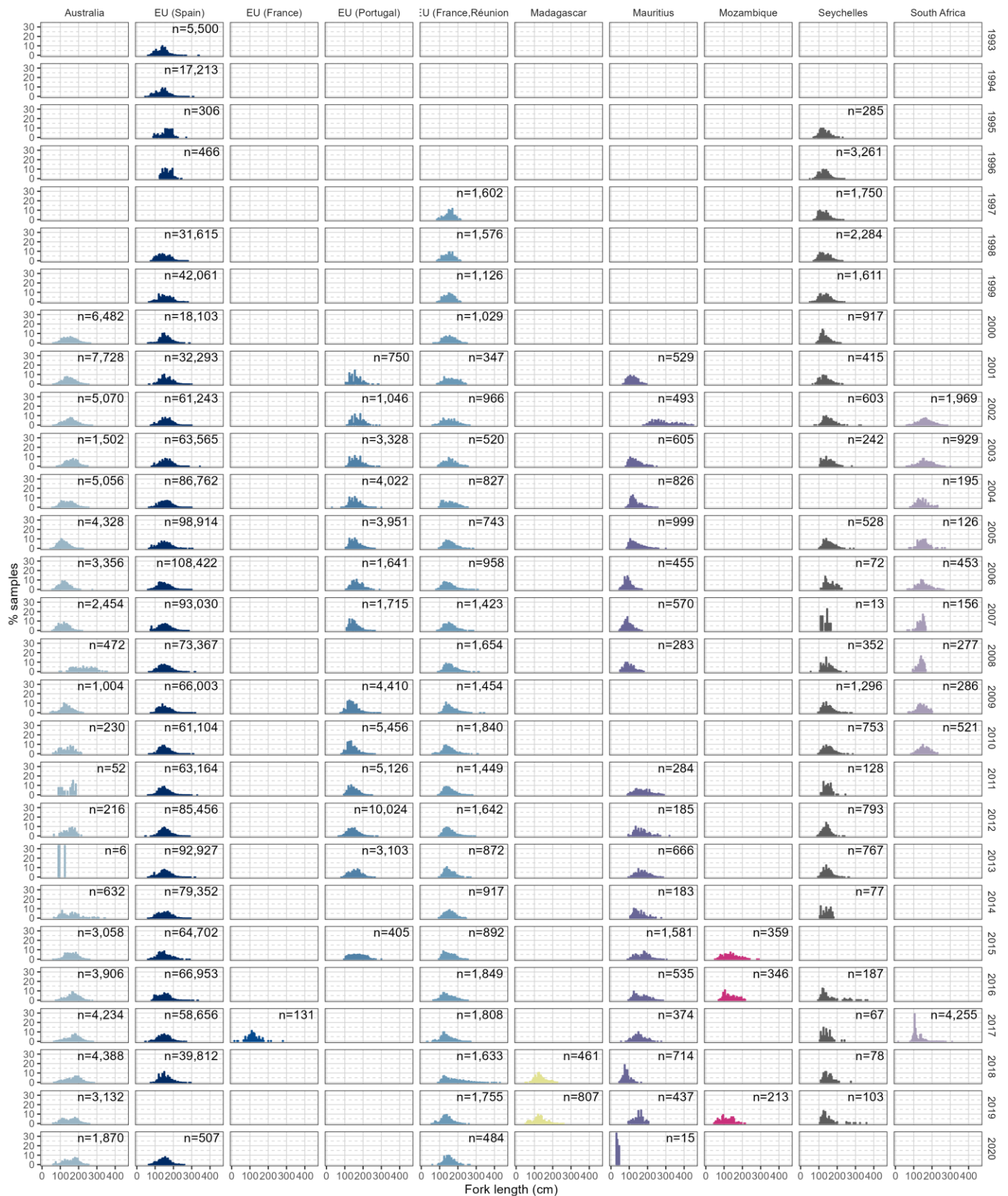


Figure 37: Relative size distribution of swordfish (fork length; cm) recorded for swordfish and shark-targeted longline fisheries (LLO) by year and main fleet. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

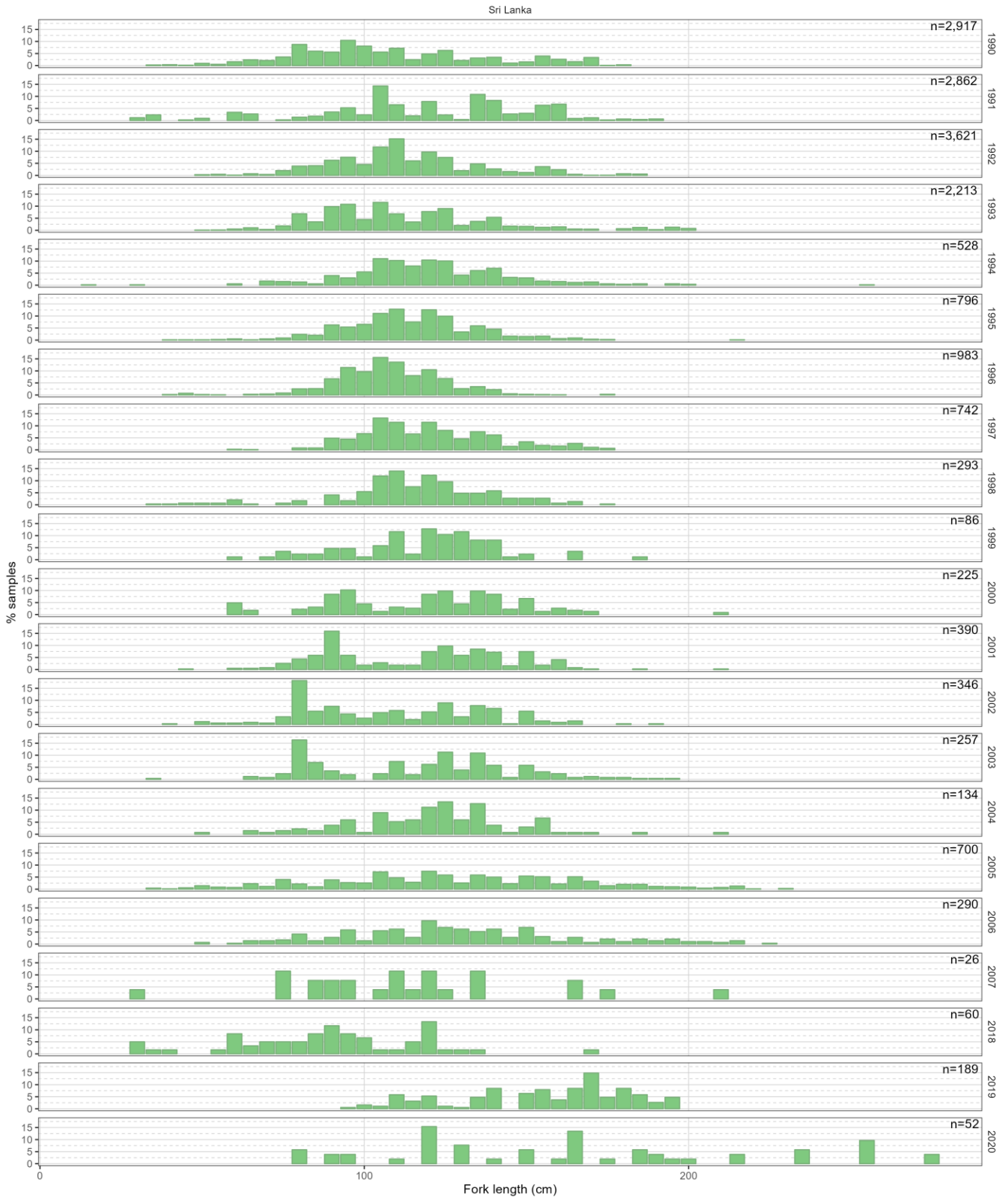


Figure 38: Relative size distribution of swordfish (fork length; cm) recorded for gillnet fisheries by year and main fleet. Data source: [standardized size-frequency dataset](#)

Uncertainties in size-frequency data

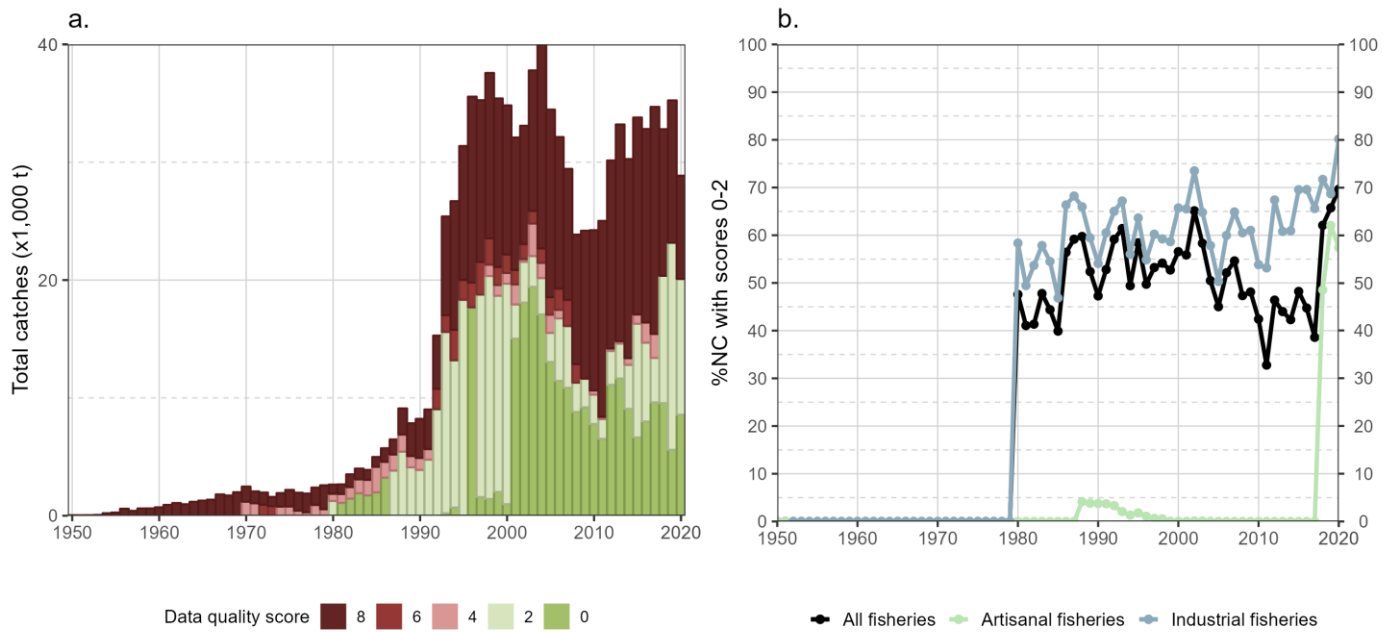


Figure 39: (a) Annual nominal catches (metric tons; t) of swordfish estimated by quality score and (b) percentage of nominal catches for which geo-referenced size-frequency data were reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, 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 improvements were made to the best scientific estimates of nominal catches of swordfish since the 19th 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 catch revision for the Seychelles (SYC) longline and line fisheries, (ii) updates of billfish catches by Yemen (YEM) as available in the [FAO global capture production database](#), (iii) changes in the Indian Ocean major areas for most fisheries from Sri Lanka (LKA), (iv) re-assignment of line catches from the fleet EU,France (EUFRA) to EU,Mayotte (EUMYT), and (v) assignment of catches from EU,United Kingdom (EUGBR) to the new CPC *United Kingdom of Great Britain and Northern Ireland* (GBR) following the withdrawal of the United Kingdom from the European Union (**Table 4**).

Table 4: Changes in best scientific estimates of average annual nominal catches (metric tons; t) of swordfish 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	CHN	Longline	Eastern Indian Ocean	14	1	13	
		Longline	Western Indian Ocean	991	1,004	-13	
	EUFRA	Line	Western Indian Ocean	0	44	-44	
	EUGBR	Longline	Western Indian Ocean	0	383	-383	
	EUMYT	Line	Western Indian Ocean	44	0	44	
	GBR	Longline	Western Indian Ocean	383	0	383	
	LKA	Gillnet	Eastern Indian Ocean	921	711	210	
		Gillnet	Western Indian Ocean	53	263	-210	
		Line	Eastern Indian Ocean	8,100	2,463	5,637	
		Line	Western Indian Ocean	0	5,637	-5,637	
		Longline	Eastern Indian Ocean	858	508	350	
		Longline	Western Indian Ocean	2,163	2,513	-350	
	SYC	Line	Western Indian Ocean	180	0	180	
		Longline	Eastern Indian Ocean	0	17	-17	
		Longline	Western Indian Ocean	2,267	2,293	-26	
	YEM	Gillnet	Western Indian Ocean	1,287	0	1,287	
		Line	Western Indian Ocean	499	0	499	
	2018	EUFRA	Longline	Western Indian Ocean	0	27	-27
		EUGBR	Longline	Western Indian Ocean	0	485	-485
		EUMYT	Longline	Western Indian Ocean	27	0	27
GBR		Longline	Western Indian Ocean	485	0	485	
LKA		Gillnet	Eastern Indian Ocean	700	508	192	
		Gillnet	Western Indian Ocean	33	225	-192	
		Line	Eastern Indian Ocean	5,900	5,735	165	
		Line	Western Indian Ocean	0	165	-165	
		Longline	Eastern Indian Ocean	1,132	701	431	
		Longline	Western Indian Ocean	677	1,108	-431	
SYC		Line	Western Indian Ocean	130	0	130	
		Longline	Eastern Indian Ocean	0	48	-48	
	Longline	Western Indian Ocean	2,440	2,521	-81		

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
	YEM	Gillnet	Western Indian Ocean	1,408	0	1,408
		Line	Western Indian Ocean	378	0	378
2017	EUFRA	Longline	Western Indian Ocean	0	23	-23
	EUGBR	Longline	Western Indian Ocean	0	272	-272
	EUMYT	Longline	Western Indian Ocean	23	0	23
	GBR	Longline	Western Indian Ocean	272	0	272
	SYC	Line	Western Indian Ocean	182	0	182
		Longline	Eastern Indian Ocean	0	22	-22
		Longline	Western Indian Ocean	1,555	1,722	-166
	YEM	Gillnet	Western Indian Ocean	1,280	0	1,280
		Line	Western Indian Ocean	488	0	488
2016	EUFRA	Longline	Western Indian Ocean	0	22	-22
	EUGBR	Longline	Eastern Indian Ocean	0	62	-62
		Longline	Western Indian Ocean	0	142	-142
	EUMYT	Longline	Western Indian Ocean	22	0	22
	GBR	Longline	Eastern Indian Ocean	62	0	62
		Longline	Western Indian Ocean	142	0	142
	SYC	Line	Western Indian Ocean	160	0	160
		Longline	Western Indian Ocean	1,841	2,002	-160
	YEM	Gillnet	Western Indian Ocean	1,468	0	1,468
		Line	Western Indian Ocean	612	0	612