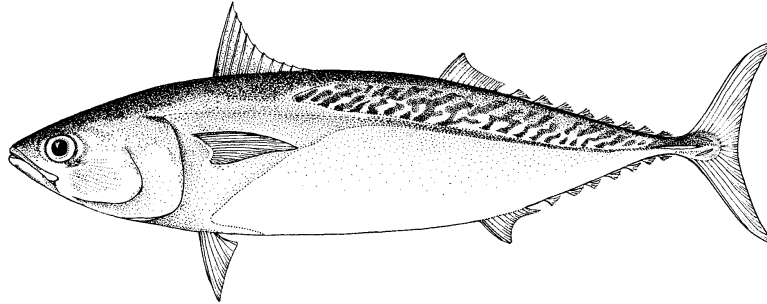


REVIEW OF FISHERIES STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN FRIGATE TUNA

Author: [IOTC Secretariat](#)



Introduction

The overarching objective of the paper is to provide participants at the 13th Session of the IOTC Working Party on Neritic Tunas ([WPNT13](#)) with a review of the status of fisheries information available on frigate tuna (*Auxis thazard*) ([Cantor 1849](#)) occurring in the Indian Ocean. The document describes the temporal and spatial trends in retained catches at global and ocean-basin scale and the main characteristics of the fisheries catching frigate tuna in the Indian Ocean, as well as providing an assessment of the reporting quality of the data sets available at the IOTC Secretariat. A full description of the data sources, processing steps to generate the data sets, and key for reporting quality scores is available in IOTC ([2023](#)).

Global catches

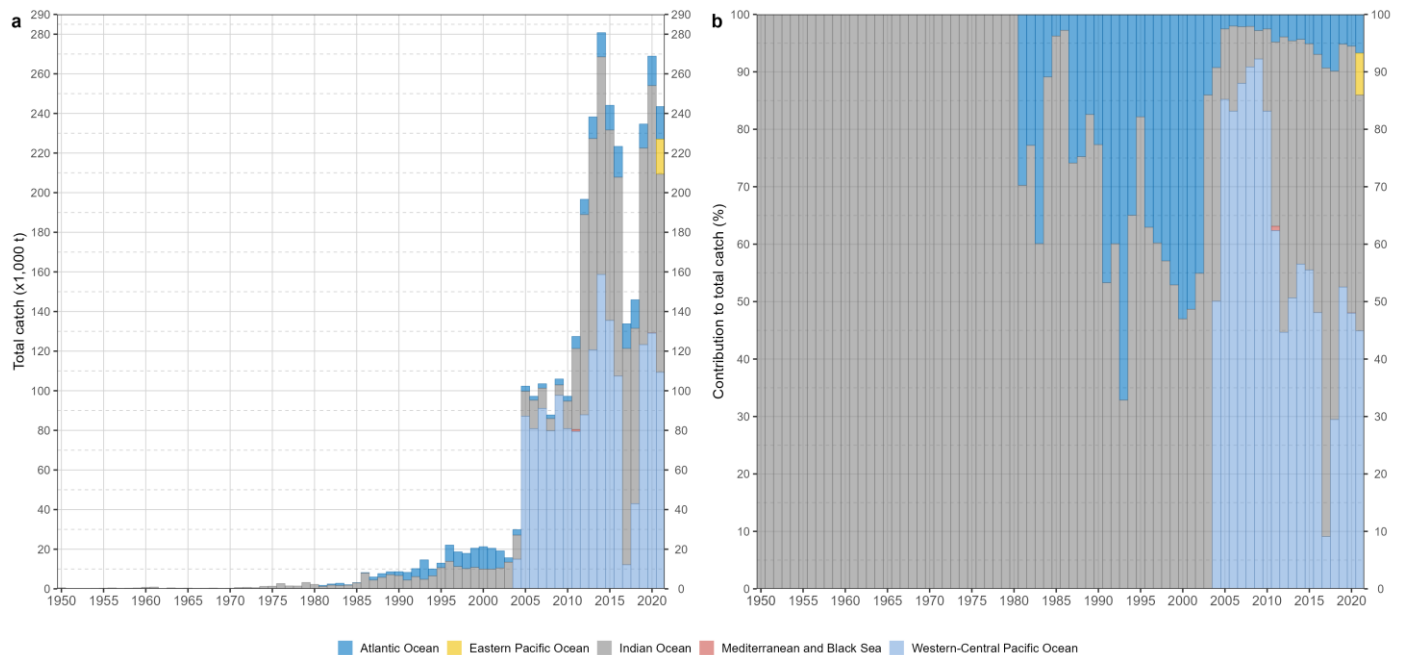


Figure 1: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) contribution to the total retained catches (percentage; %) of frigate tuna by ocean basin for the period 1950-2021. Source: [FAO global capture production database](#)

Indian Ocean catches & discards

Historical trends (1950-2021)

Table 1: Mean annual retained catches (metric tonnes; t) of frigate tuna by decade and fishery for the period 1950-2019. The background intensity colour of each cell is directly proportional to the catch level. Data source: [best scientific estimates of retained catches](#)

Fishery	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Purse seine Other	0	15	824	4,666	7,552	10,021	12,414
Longline Other	0	0	0	26	1,228	858	1,307
Longline Fresh	0	0	0	0	0	0	19
Longline Deep-freezing	0	0	0	0	0	0	3
Line Coastal longline	11	249	962	2,577	5,232	17,936	24,798
Line Trolling	1,209	2,098	3,264	4,653	8,048	8,429	9,686
Line Handline	43	59	193	200	449	693	1,443
Baitboat	1,429	1,989	2,018	1,333	3,662	3,897	939
Gillnet	493	1,247	2,837	6,633	14,147	25,688	39,520
Other	13	19	330	2,323	4,390	8,929	13,677
Total	3,196	5,675	10,428	22,411	44,709	76,451	103,807

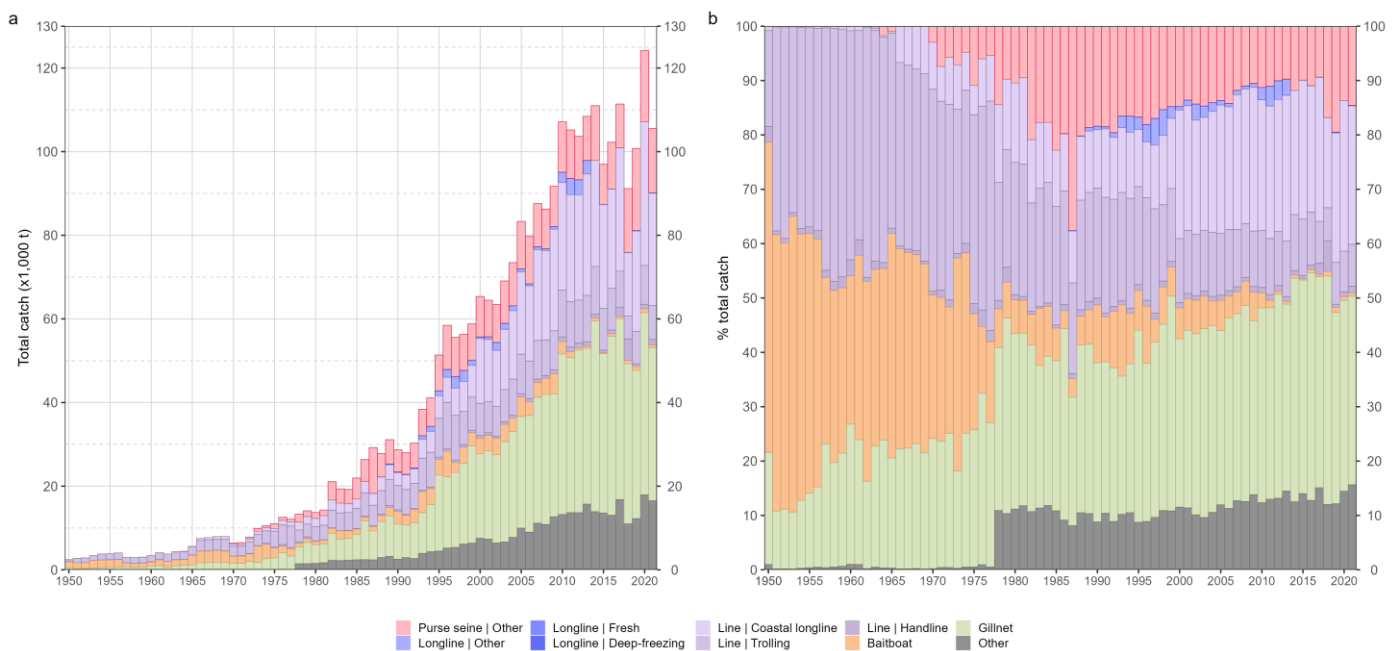


Figure 2: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of frigate tuna by fishery for the period 1950-2021. Data source: [best scientific estimates of retained catches](#)

Table 2: Annual retained catches (metric tonnes; t) of frigate tuna by fishery for the period 2012-2021. The background intensity colour of each cell is directly proportional to the catch level. Data source: [best scientific estimates of retained catches](#)

Fishery	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Purse seine Other	10,415	10,572	13,143	9,638	11,199	10,478	15,316	19,671	16,974	15,391
Longline Other	3,559	3,233	0	0	0	0	0	0	0	0
Longline Fresh	0	0	0	27	21	20	17	107	13	91
Longline Deep-freezing	0	0	0	2	9	1	4	14	2	2
Line Coastal longline	25,184	29,036	25,341	24,765	23,716	29,482	15,121	23,997	34,407	26,874
Line Trolling	10,309	11,120	11,453	10,024	9,976	8,593	5,526	7,754	9,302	8,119
Line Handline	1,096	909	825	615	855	2,270	5,112	605	1,065	1,312
Baitboat	572	572	717	228	653	493	823	931	911	649
Gillnet	38,893	37,301	45,647	38,107	42,779	43,252	38,294	35,465	43,563	36,601
Other	13,646	15,707	13,890	13,579	13,048	16,805	10,967	12,243	17,934	16,507
Total	103,672	108,450	111,016	96,983	102,258	111,394	91,179	100,786	124,171	105,547

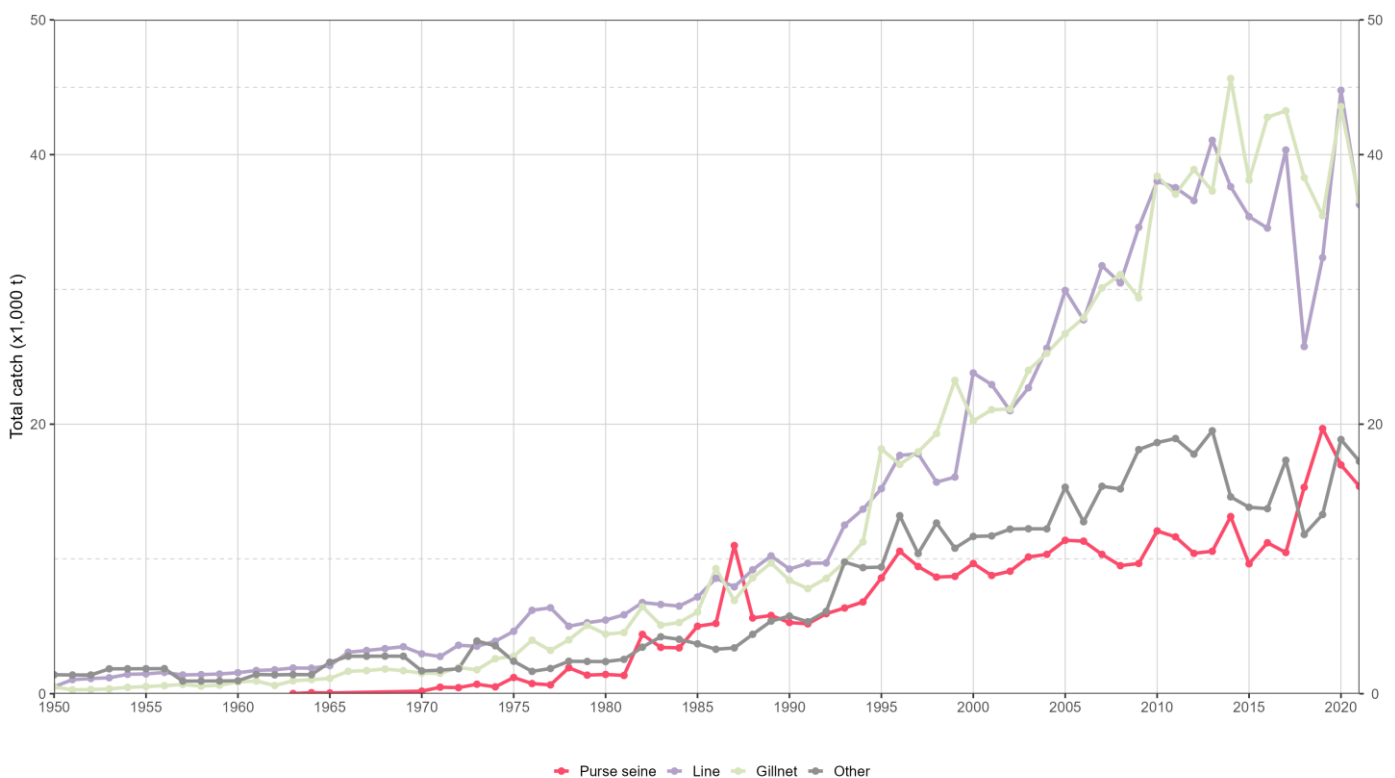


Figure 3: Annual time series of retained catches (metric tonnes; t) of frigate tuna by fishery group for the period 1950-2021. Data source: [best scientific estimates of retained catches](#)

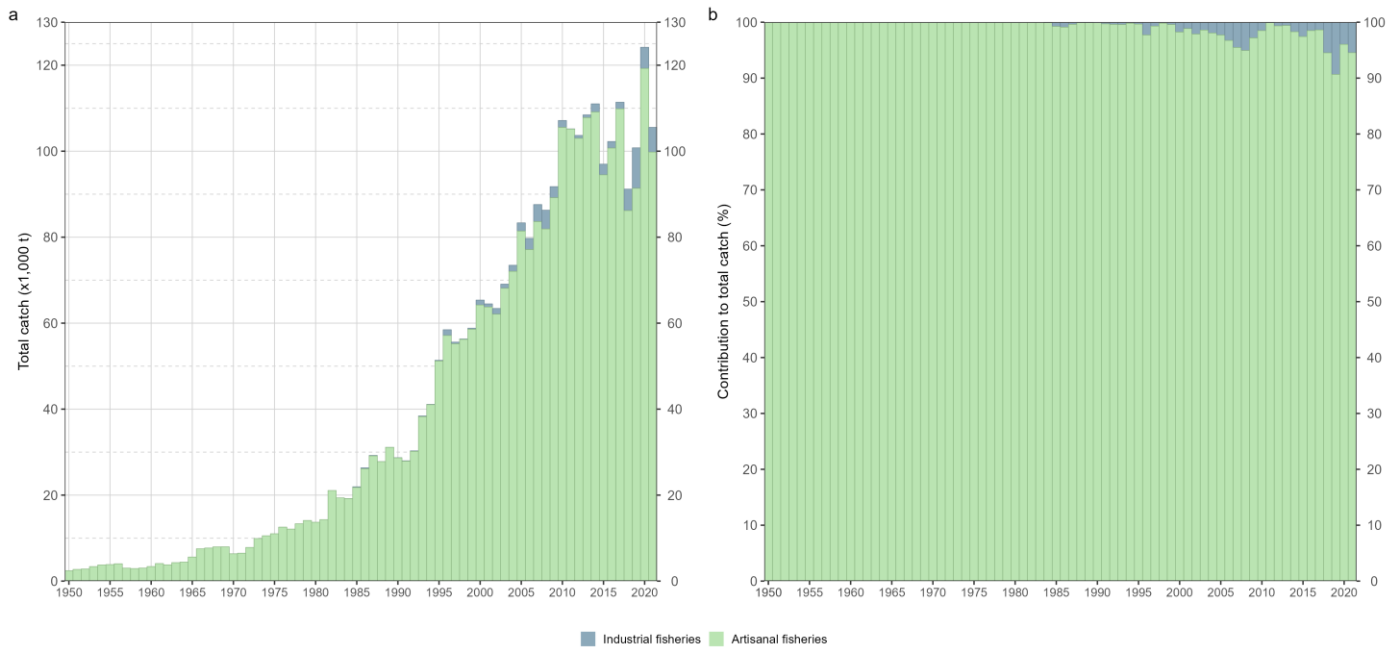


Figure 4: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of frigate tuna by type of fishery for the period 1950-2021. Data source: [best scientific estimates of retained catches](#)

Recent fishery features (2017-2021)

Table 3: Mean annual retained catches (metric tonnes; t) of frigate tuna by fishery between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

Fishery	Fishery code	Catch	Percentage
Gillnet	GN	39,435	37.0
Line Coastal longline	LIC	25,976	24.4
Purse seine Other	PSOT	15,566	14.6
Other	OT	14,891	14.0
Line Trolling	LIT	7,859	7.4
Line Handline	LIH	2,073	1.9
Baitboat	BB	761	0.7
Longline Fresh	LLF	50	0.0
Longline Deep-freezing	LLD	5	0.0
Longline Other	LLO	0	0.0

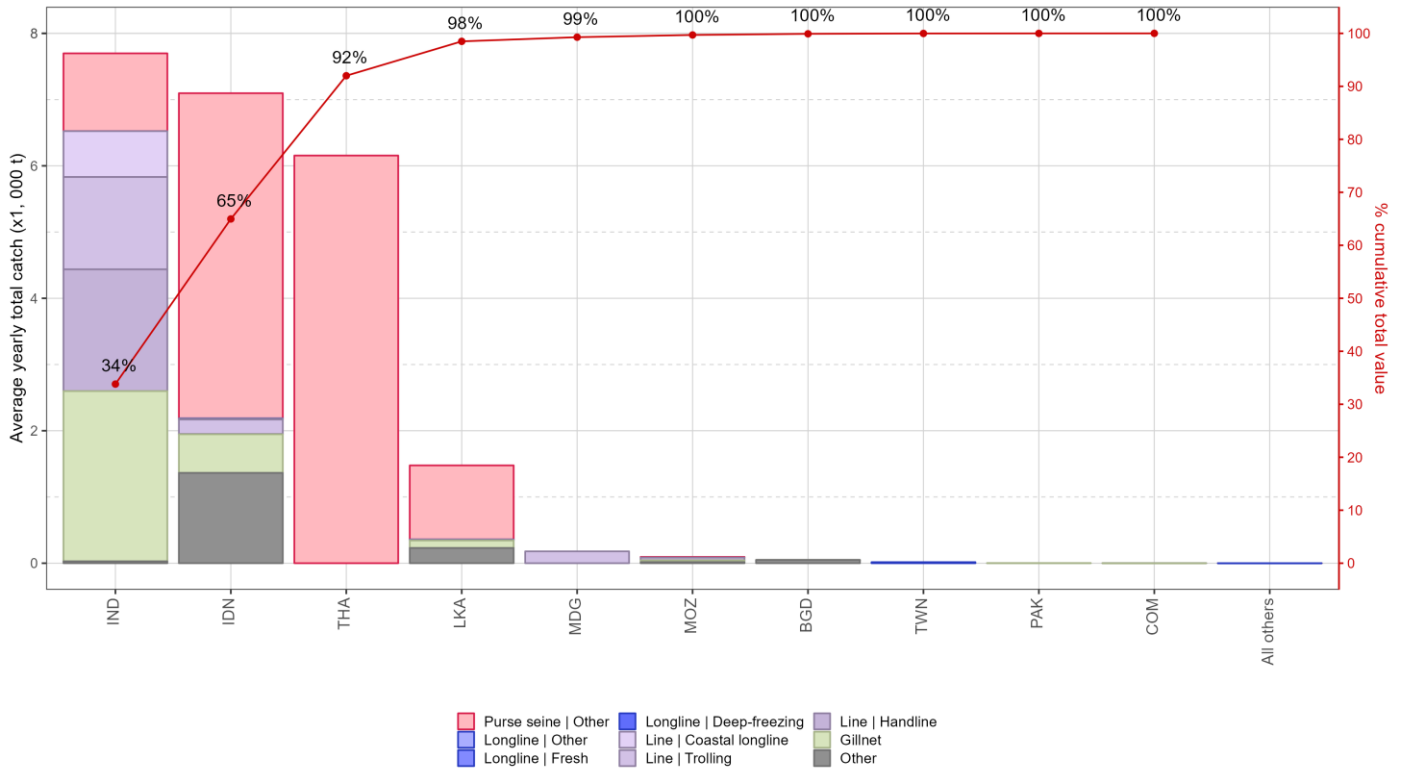


Figure 5: Mean annual retained catches (metric tonnes; t) of frigate tuna by fleet and fishery between 2017 and 2021, with indication of cumulative contribution (percentage; %) of catches by fleet. Data source: [best scientific estimates of retained catches](#)

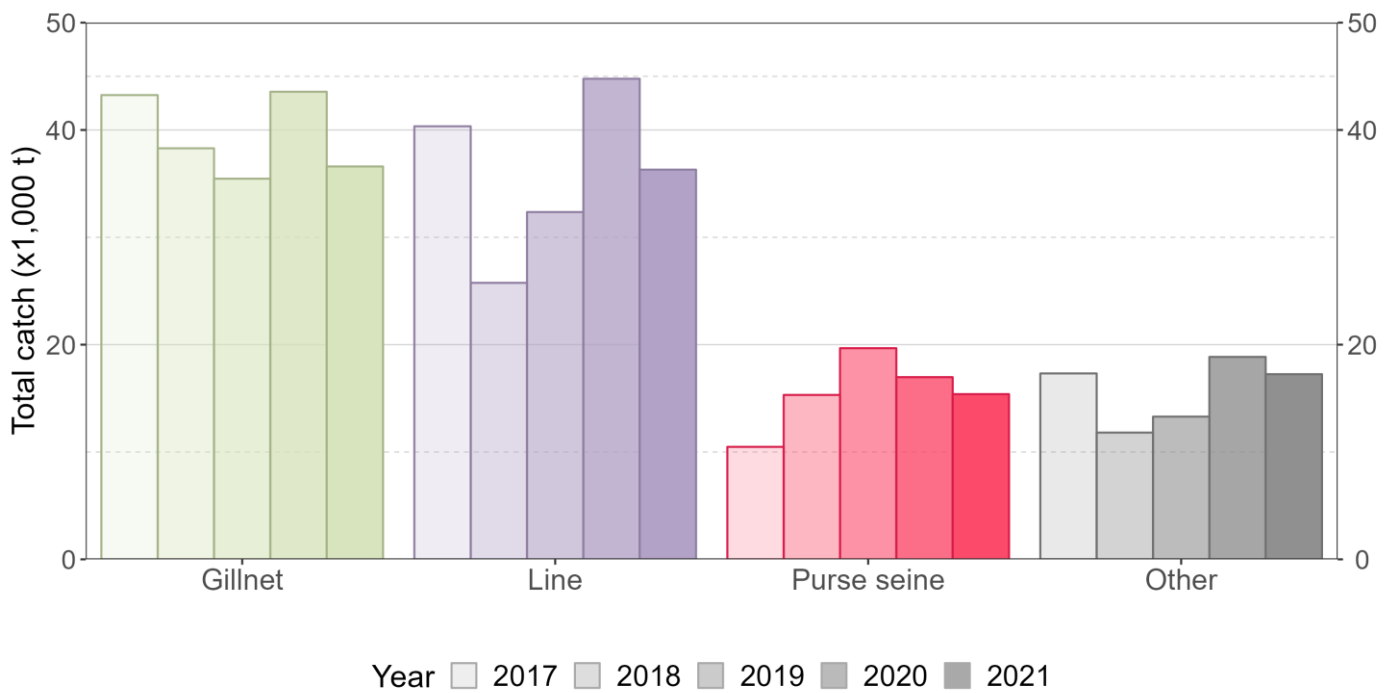


Figure 6: Annual trends in retained catch (metric tonnes; t) of frigate tuna by fishery group between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

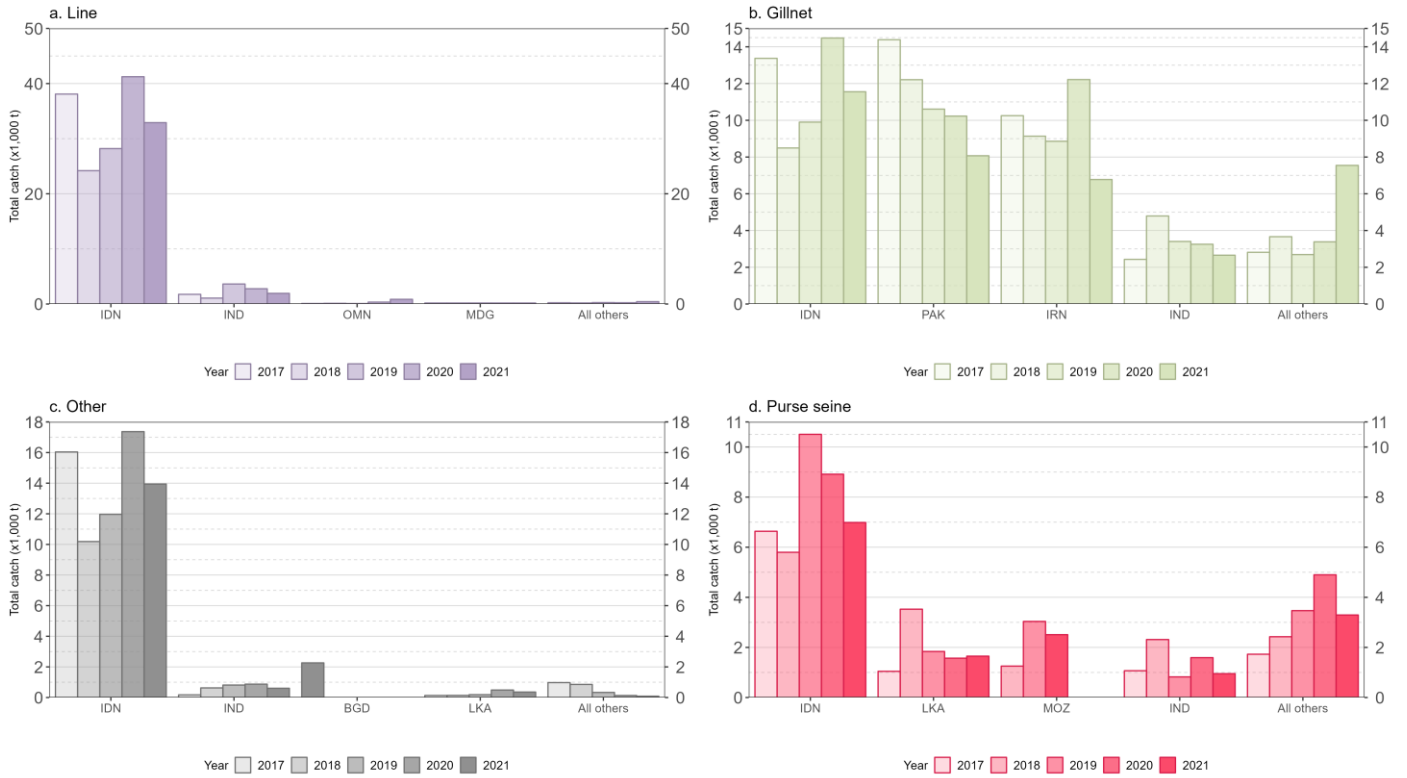


Figure 7: Annual trends in retained catch (metric tonnes; t) of frigate tuna by fishery group and fleet between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

Changes from previous Working Party

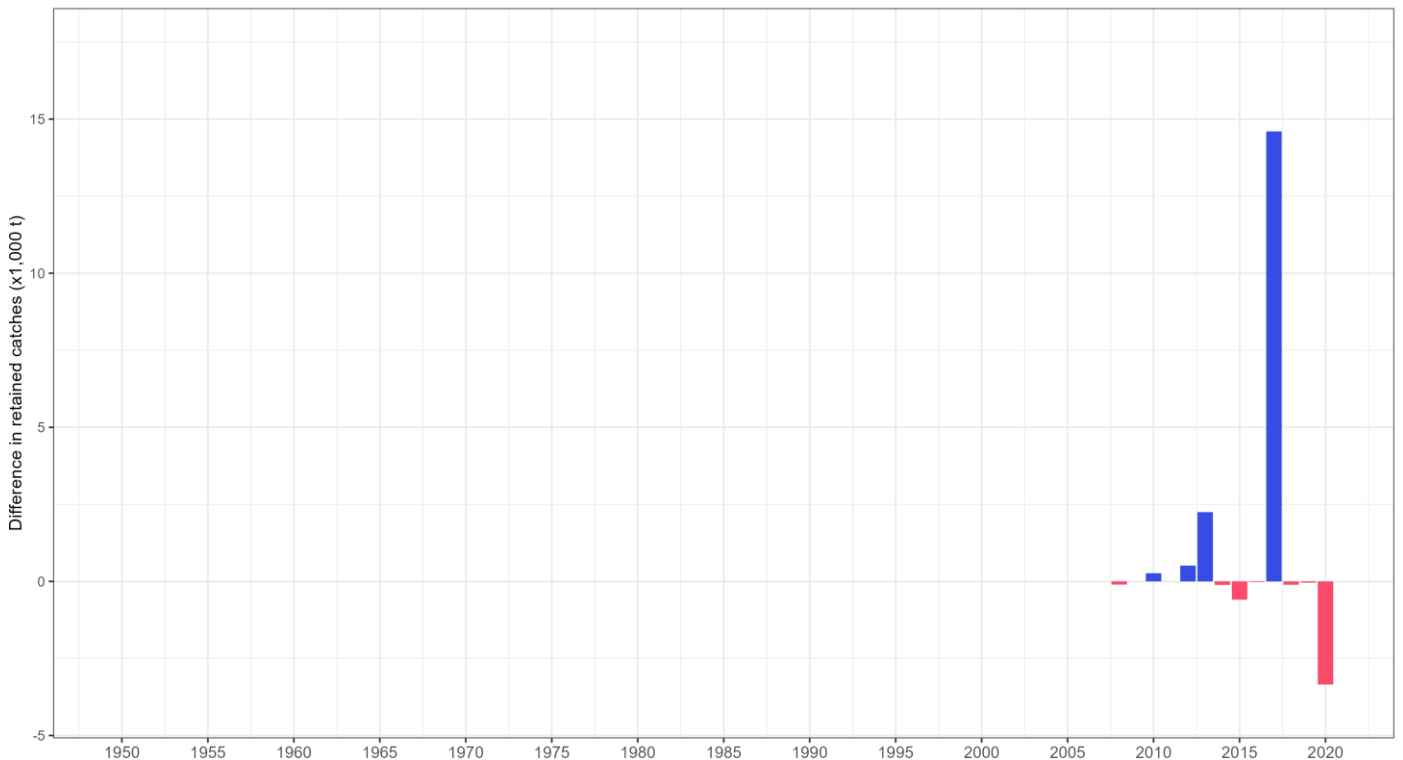


Figure 8: Differences in the annual retained catches (metric tonnes; t) of frigate tuna available at this WPNT and its previous session ([WPNT12](#) meeting held in July 2022). Details by year, fleet, fishery group, and Indian Ocean major area given in [Appendix II](#)

Uncertainties in retained catch data

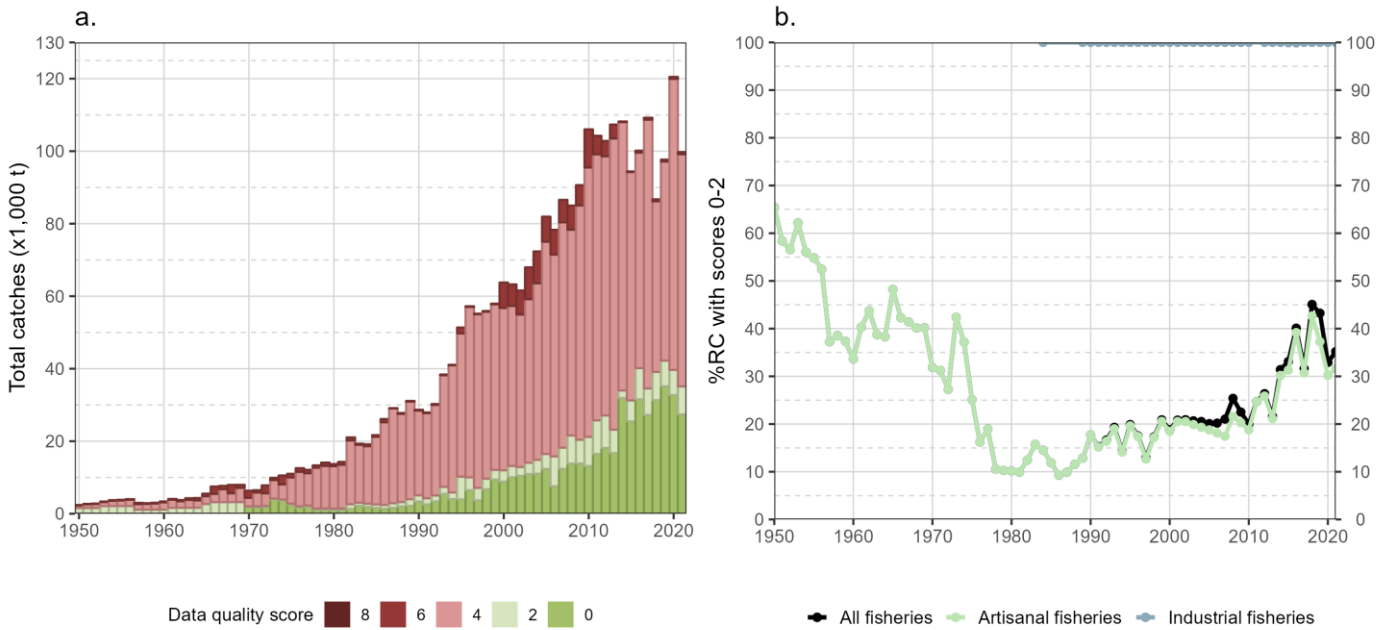


Figure 9: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches fully or partially reported to the IOTC Secretariat to all retained catches (percentage; %) of frigate tuna for all fisheries and by type of fishery, for the period 1950-2021

Discards

Very little information is available on discards of neritic tunas in coastal and semi-industrial fisheries of the Indian Ocean. Discarding of neritic tunas has been shown to occur in large-scale longline and purse seine fisheries that target tropical tunas and billfish but the quantities are considered to be small ([Huang & Liu 2010](#), [Ruiz et al. 2018](#)). The implementation of [IOTC Res. 19/05](#) on the retention of bycatch onboard purse seiners since late 2019 is assumed to have resulted in a reduction of the discards of frigate tuna in this fishery.

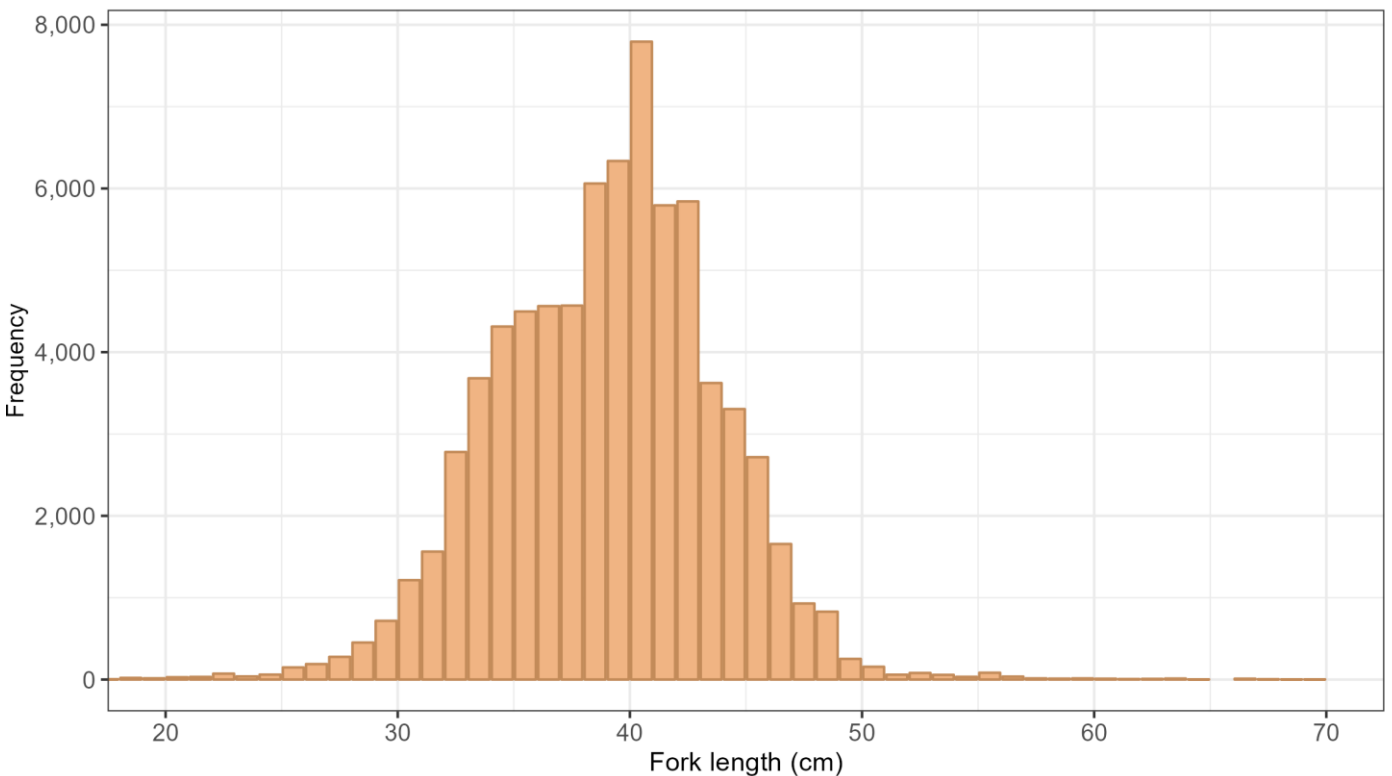


Figure 10: Size-frequency distribution of frigate tuna discarded at sea in purse seine fisheries as available in the ROS regional database

Spatial distribution of catch

Geo-references catches

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

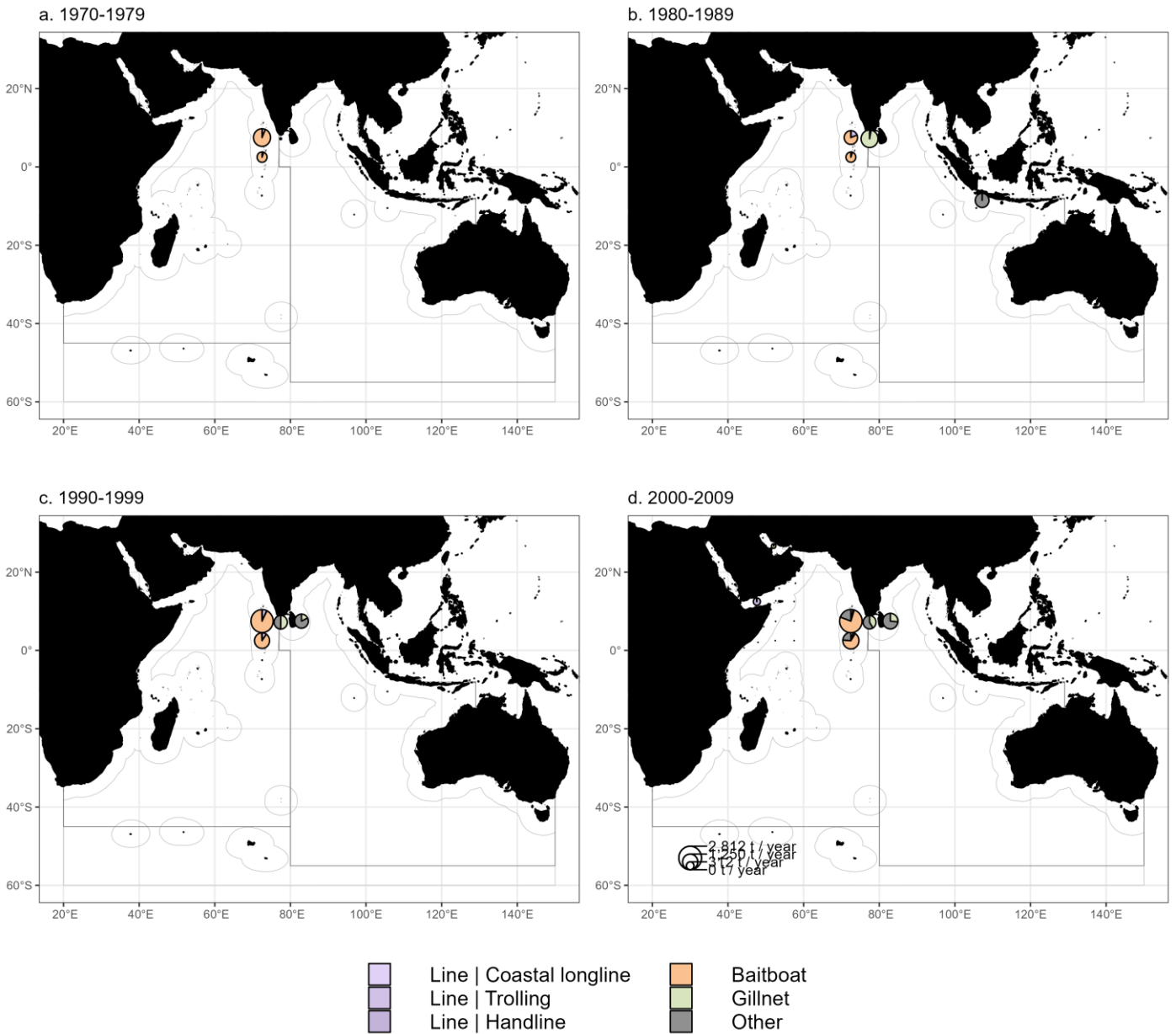


Figure 11: Mean annual time-area catches (metric tonnes; t) of frigate tuna, by decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [time-area catches](#)

Geo-referenced catches by fishery, last years (2017-2021) and decade (2010-2019)

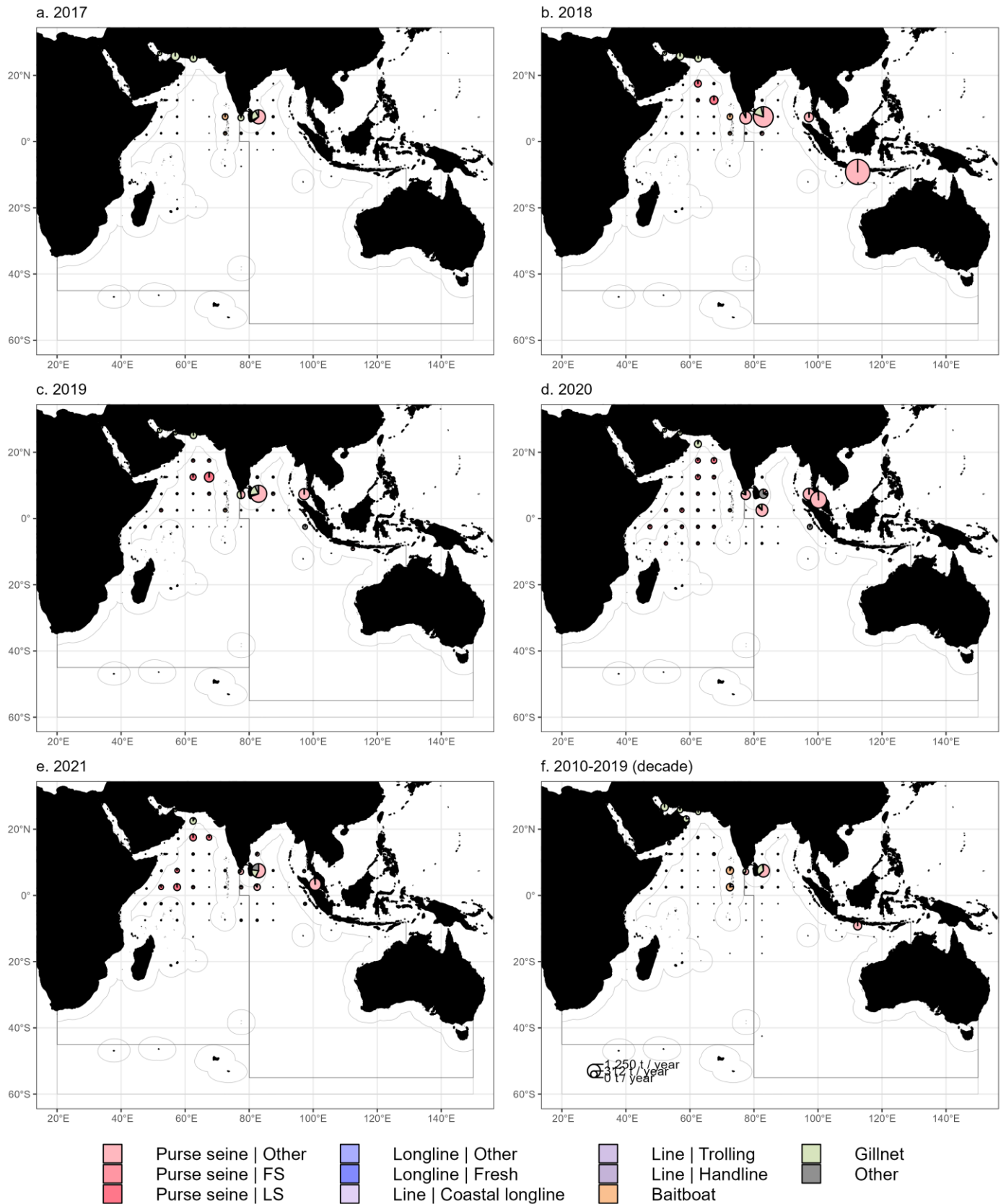


Figure 12: Mean annual time-area catches (metric tonnes; t) of frigate tuna, by year and decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [time-area catches](#)

Domestic catches within areas under national jurisdiction (2017-2021)

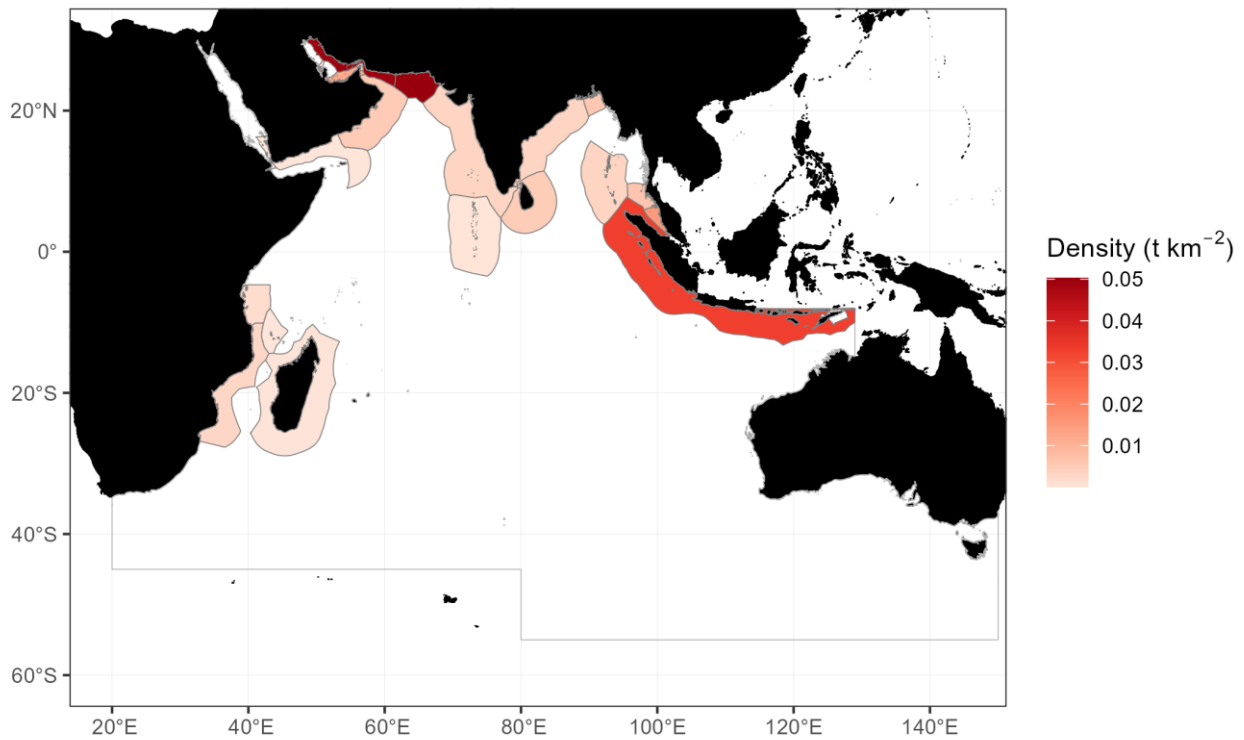


Figure 13: Mean annual density of catch ($t\ km^{-2}$) of frigate tuna reported for domestic fisheries operating in areas under national jurisdiction of IOTC coastal states between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

Uncertainties in geo-referenced catch and effort data

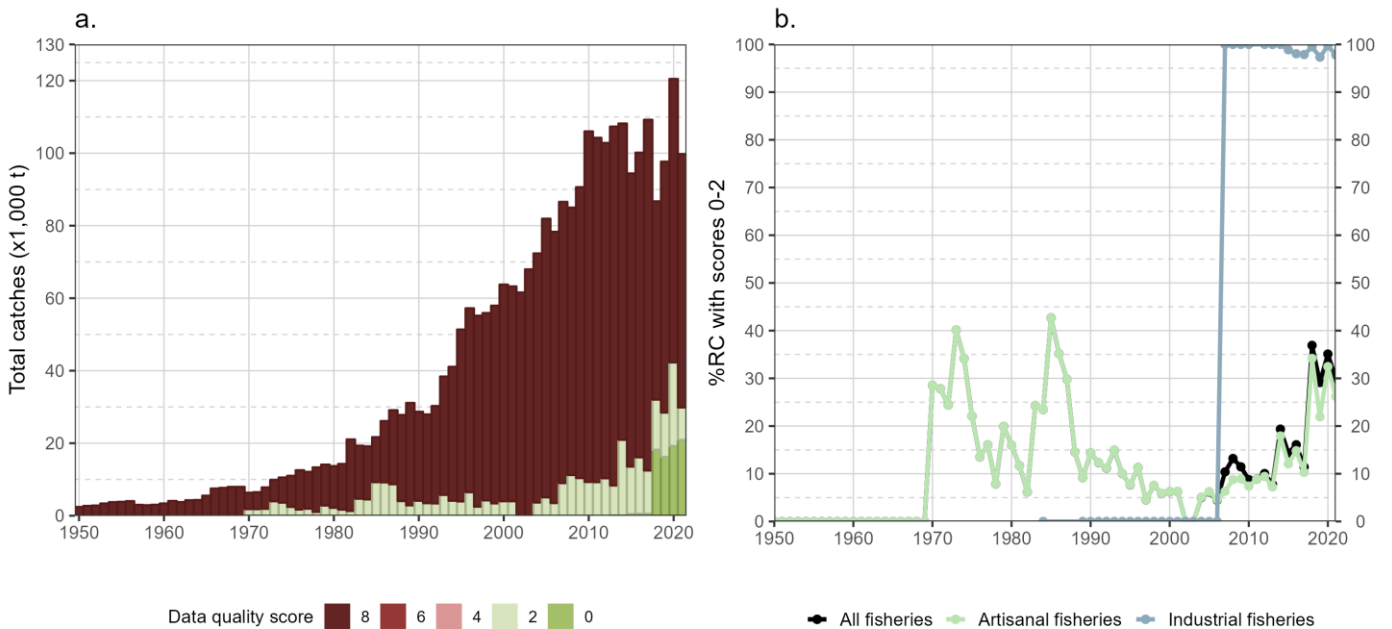


Figure 14: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches (percentage; %) with corresponding geo-referenced catch and effort data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02) to all retained catches of frigate tuna for all fisheries and by type of fishery, for the period 1950-2021

Size composition of the catch

Samples availability

By fishery group

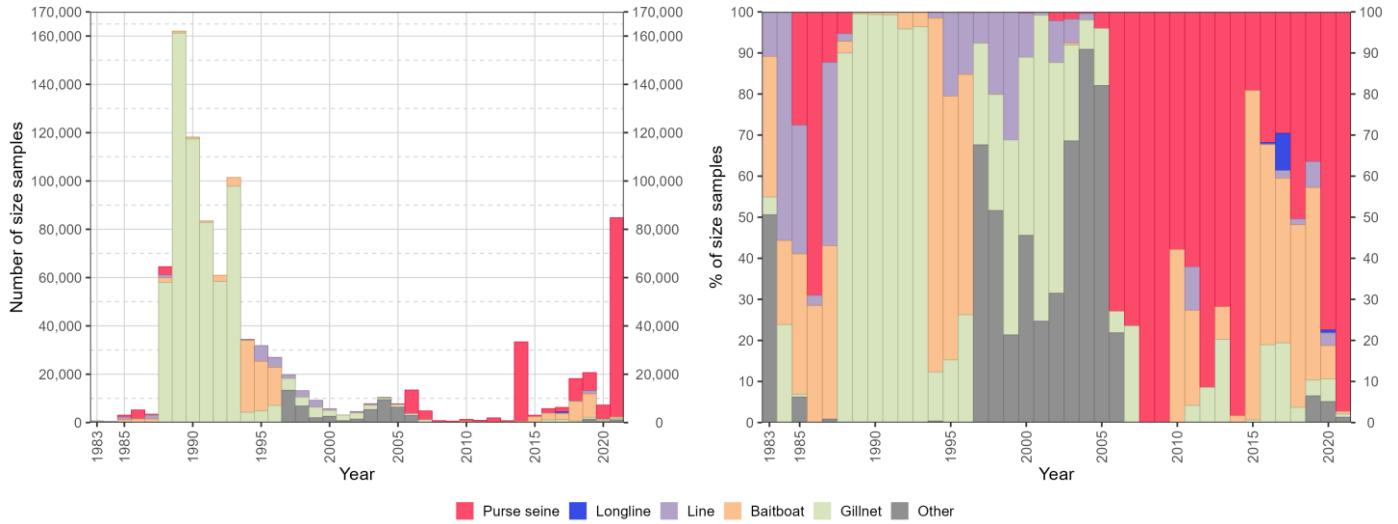


Figure 15: Availability of size-frequency data for frigate tuna as (left) absolute and (right) relative number of samples per year and fishery group. Data source: [standardized size-frequency dataset](#)

Purse seine fisheries

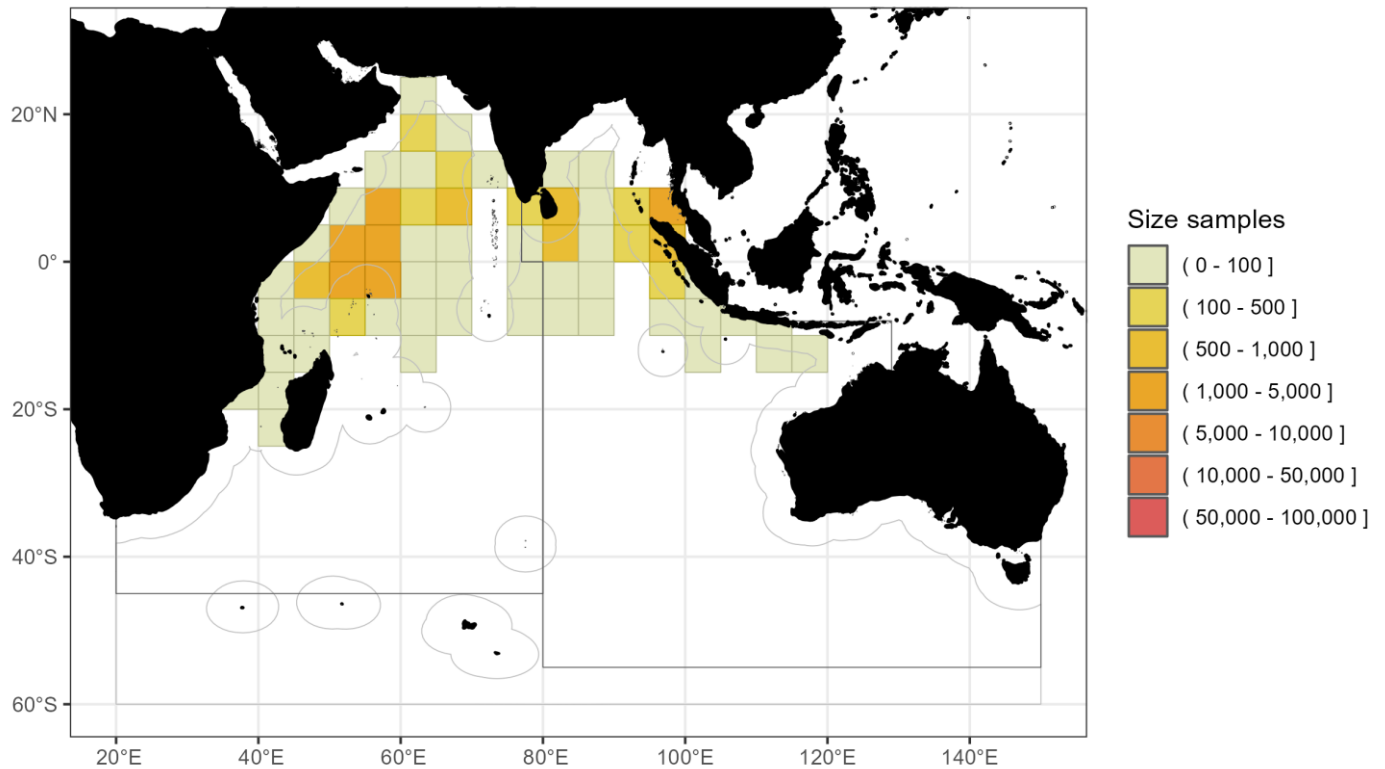


Figure 16: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in purse seine fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

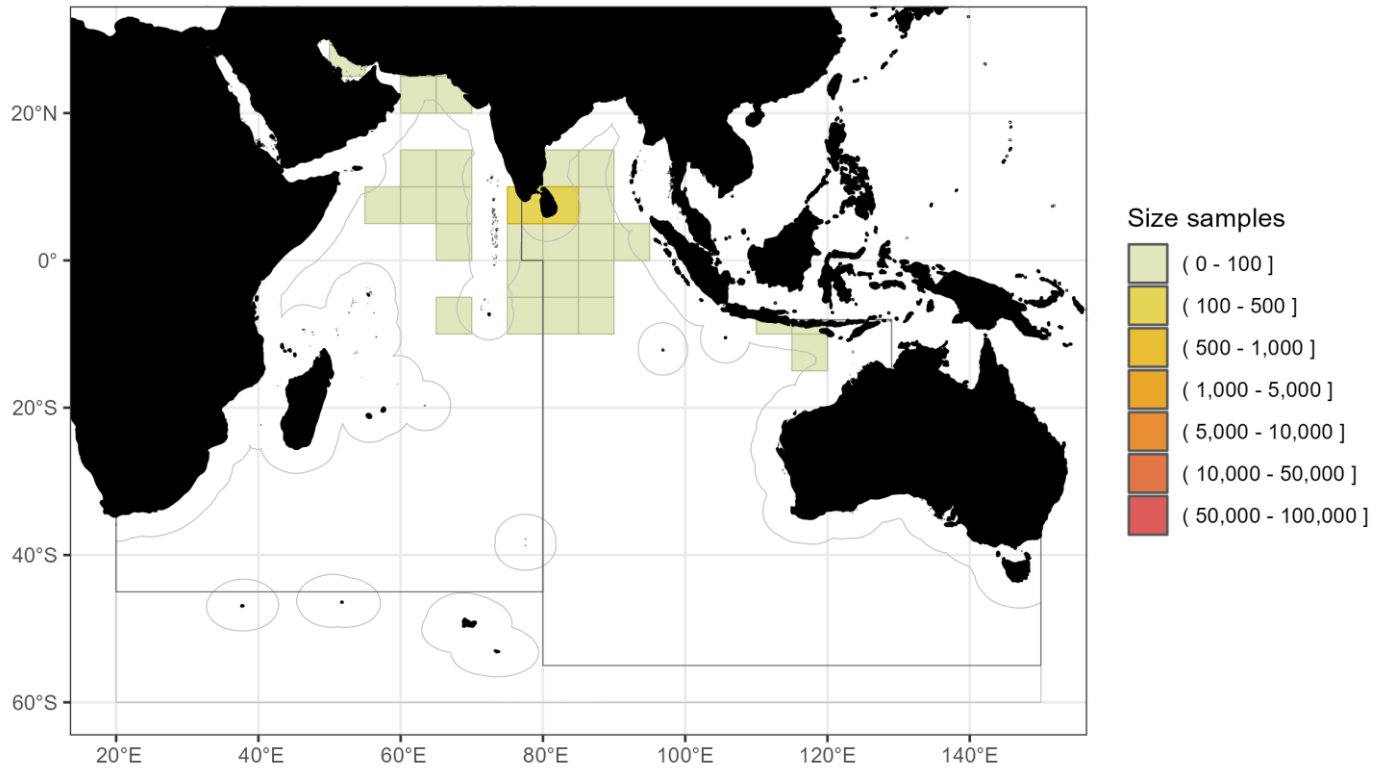


Figure 17: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in gillnet fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Line fisheries

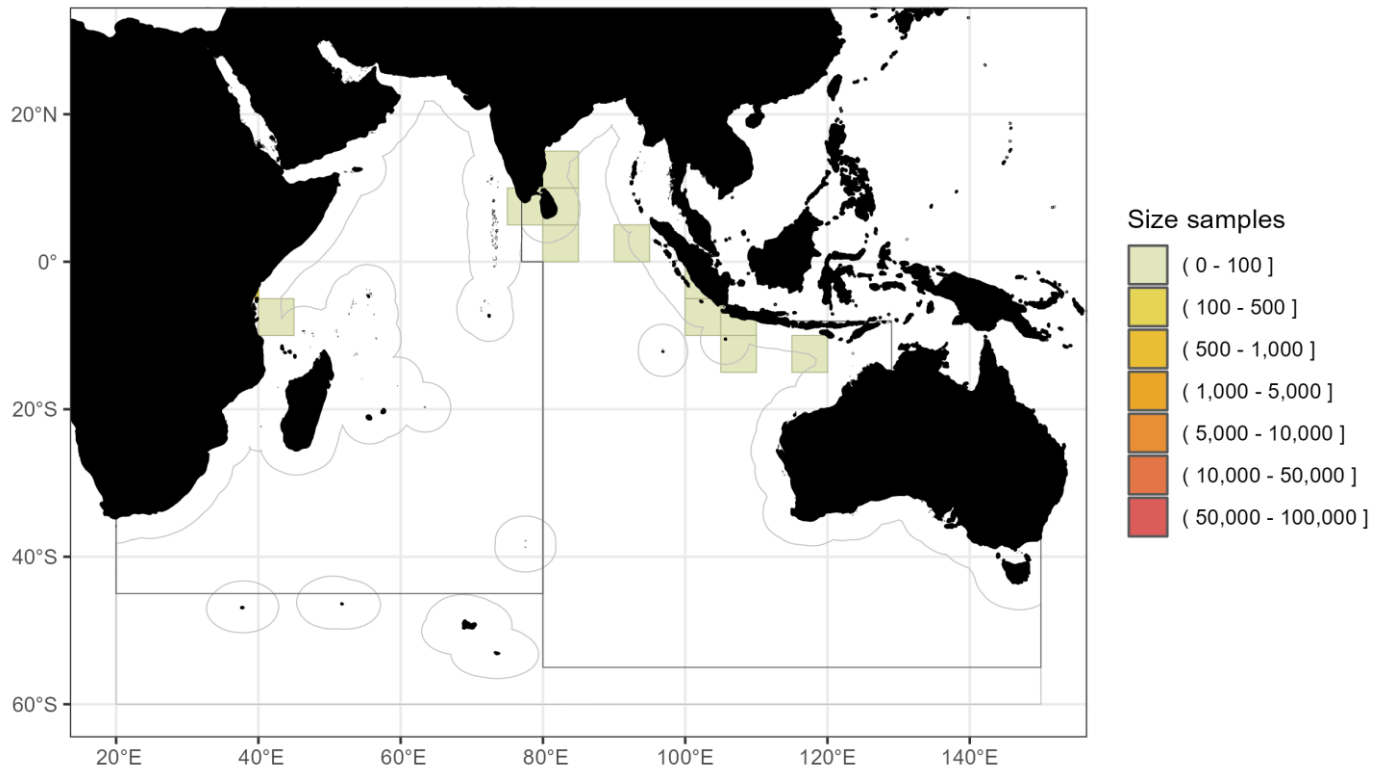


Figure 18: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in line fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Other fisheries

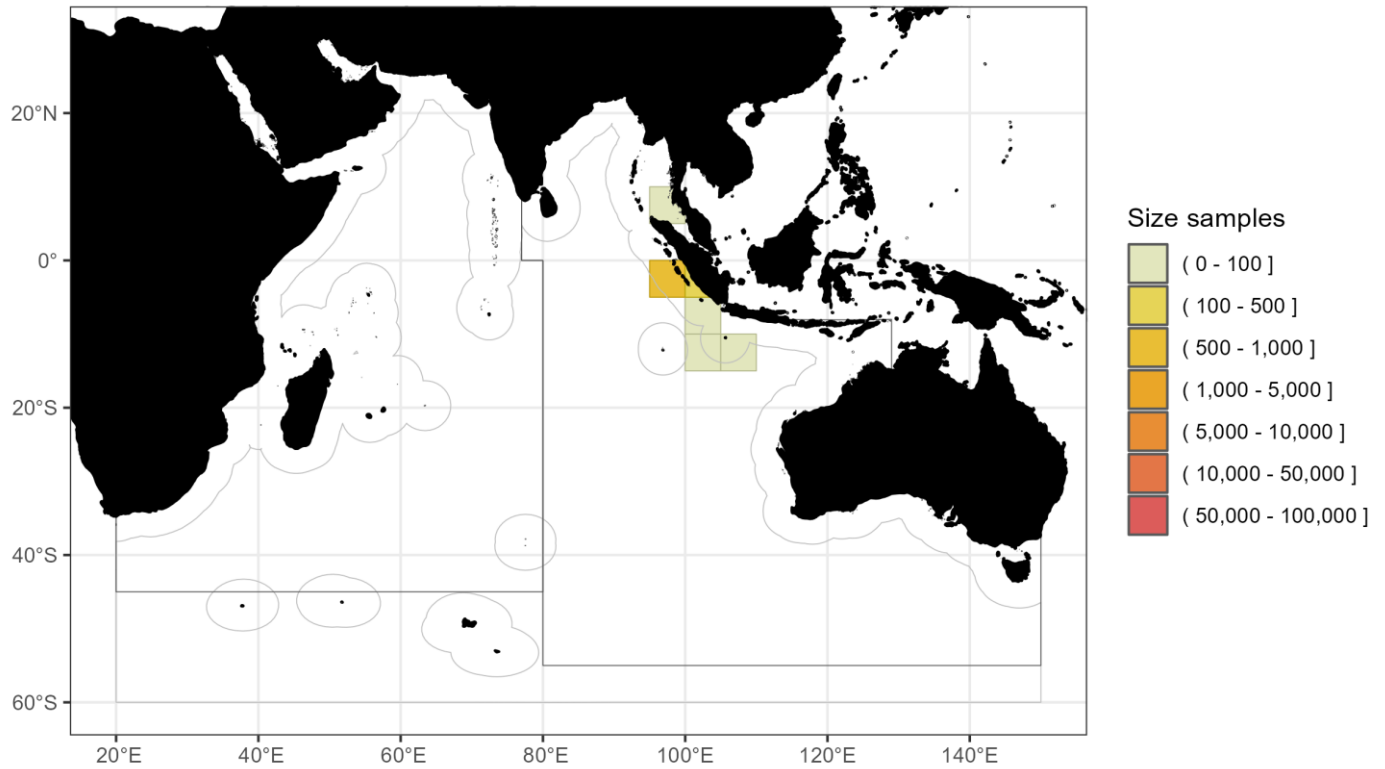


Figure 19: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in other fisheries (beach seine, harpoon, liftnet, unclassified) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

By fishery

Purse seine fisheries

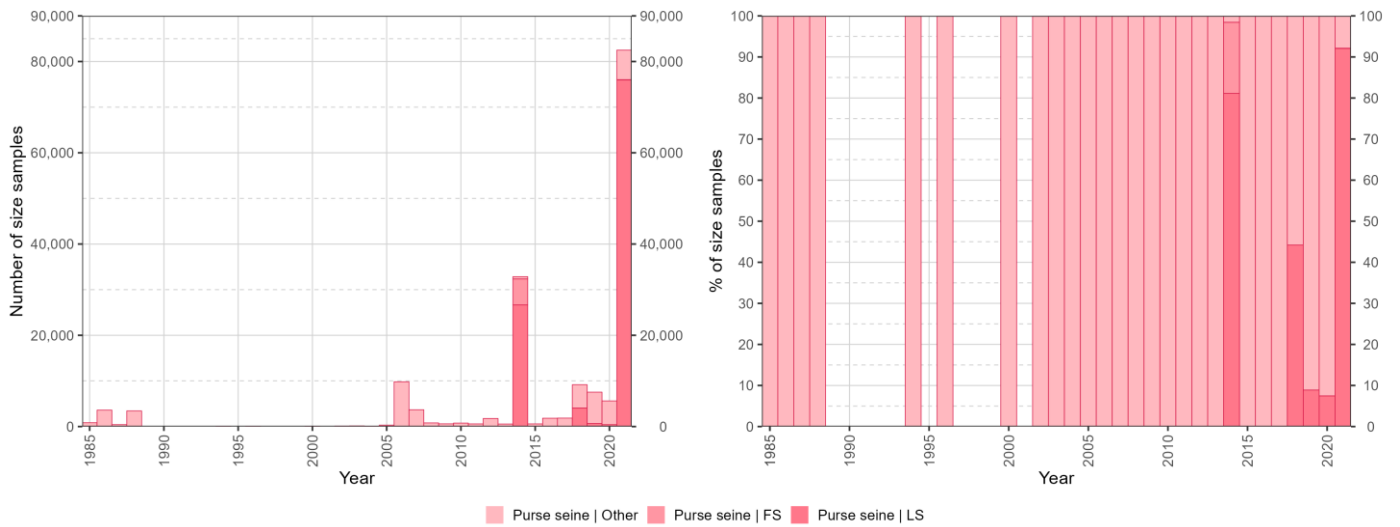


Figure 20: Availability of size-frequency data for frigate tuna as (left) absolute and (b) relative number of samples per year and type of purse seine fishery. Data source: [standardized size-frequency dataset](#)

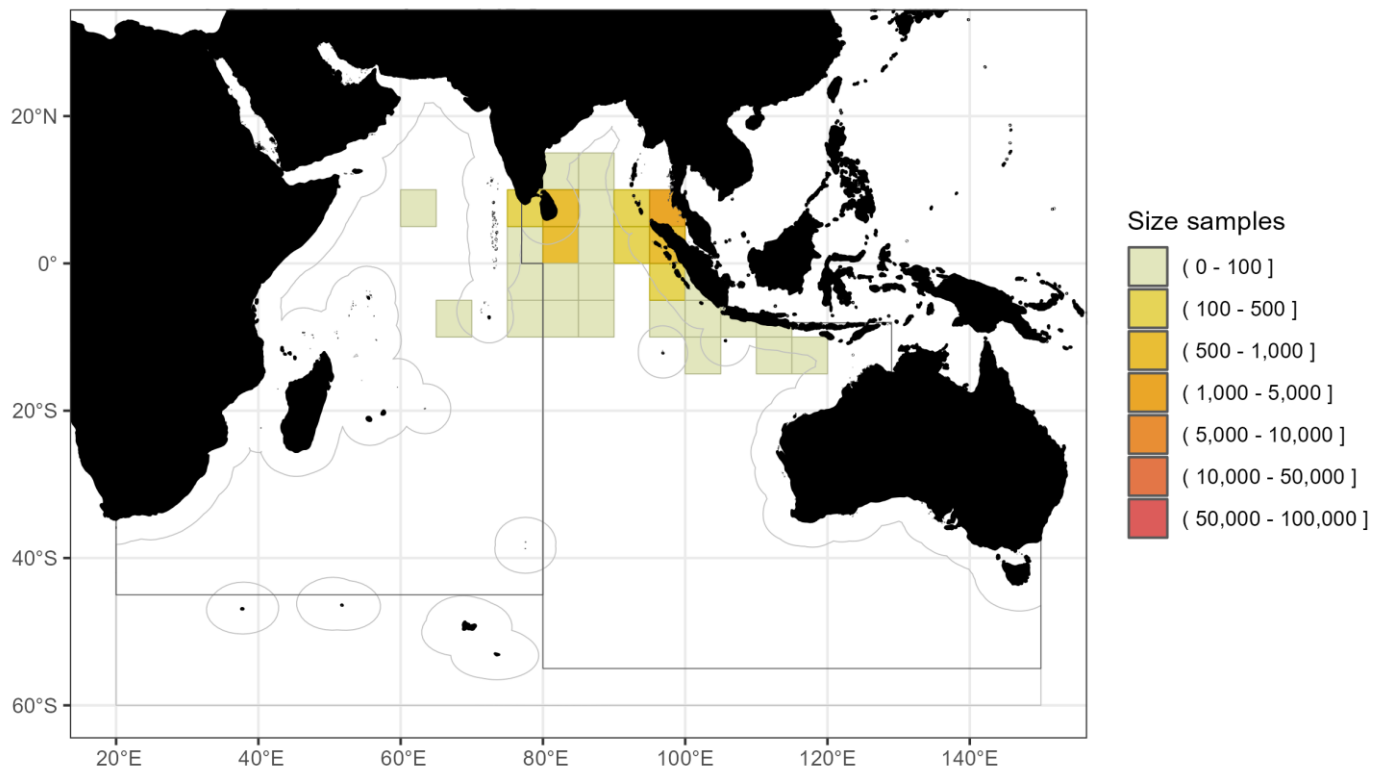


Figure 21: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in coastal and ringnet purse seine fisheries (Purse seine|Other) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

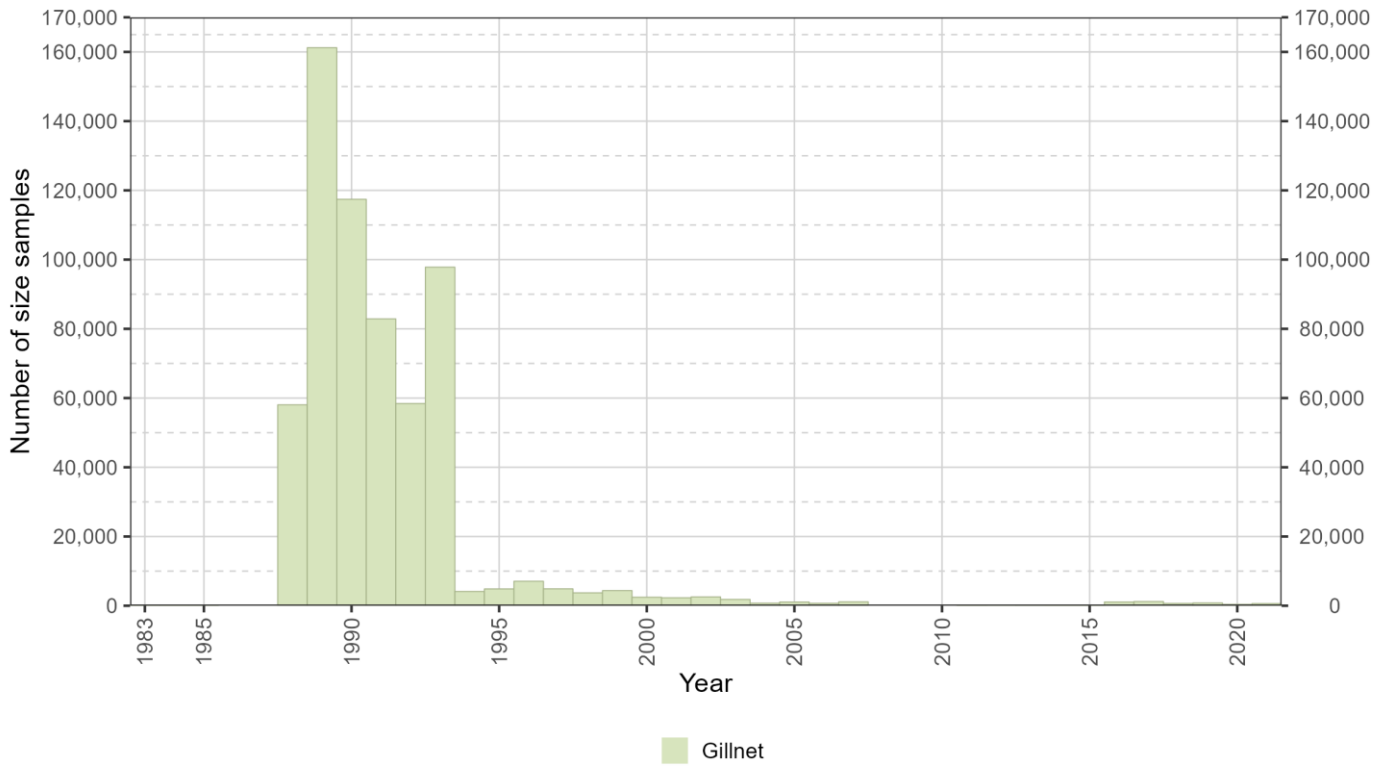


Figure 22: Availability of size-frequency data for frigate tuna as absolute number of samples per year in gillnet fisheries. Data source: [standardized size-frequency dataset](#)

Line fisheries

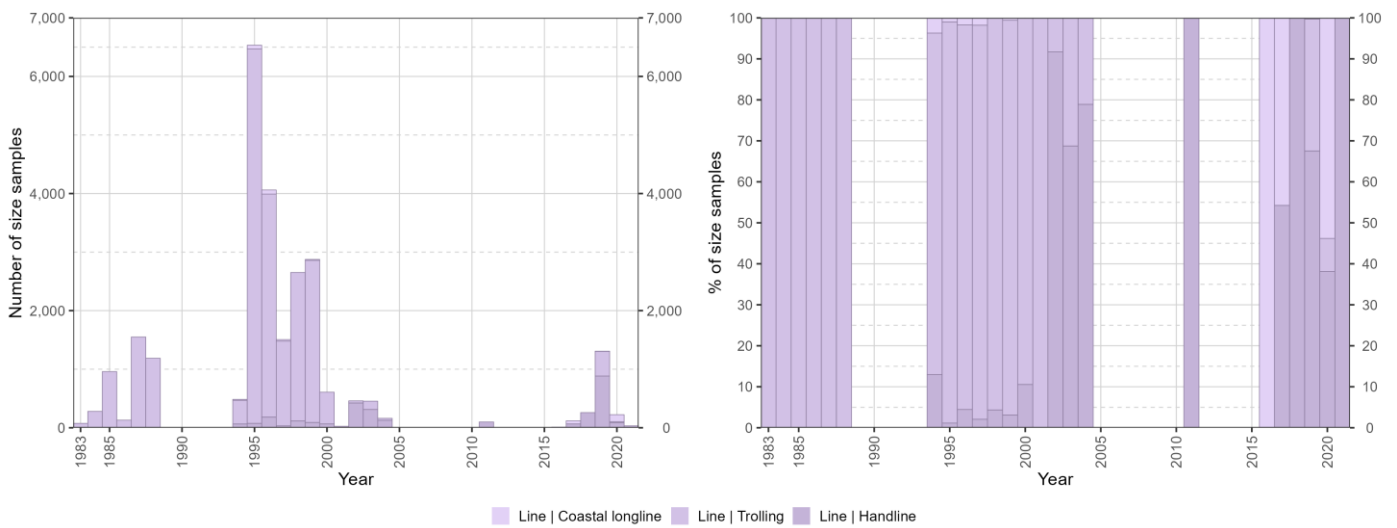


Figure 23: Availability of size-frequency data for frigate tuna as (left) absolute and (right) relative number of samples per year and line fishery type. Data source: [standardized size-frequency dataset](#)

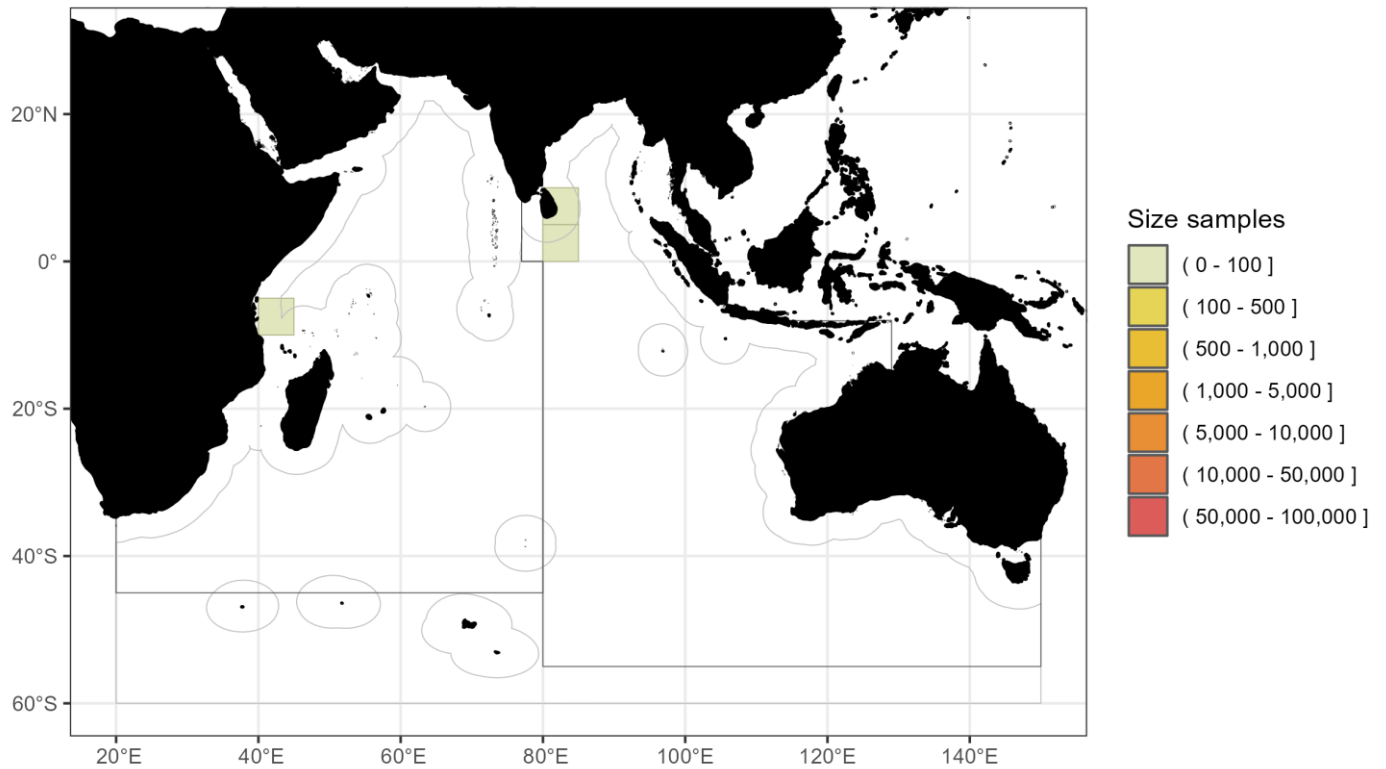


Figure 24: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in coastal longline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

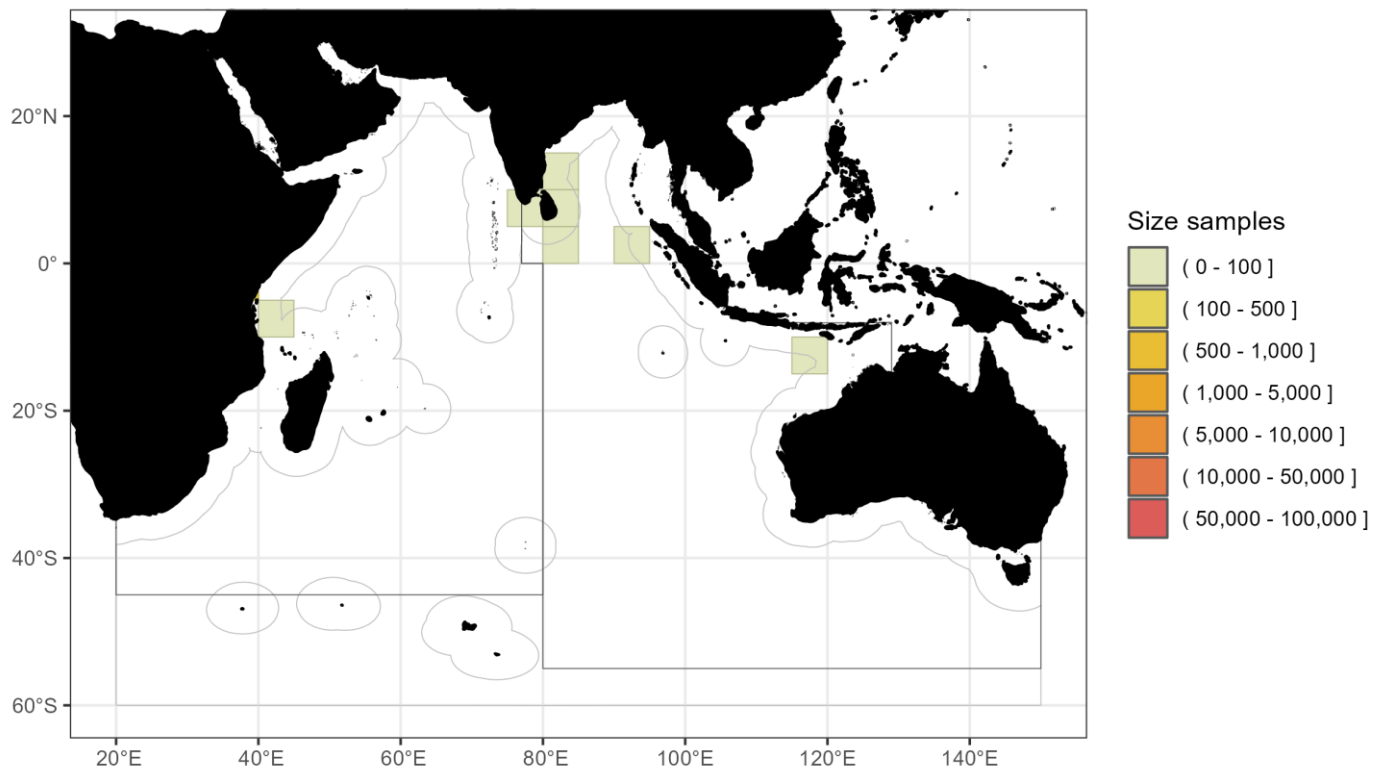


Figure 25: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in handline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

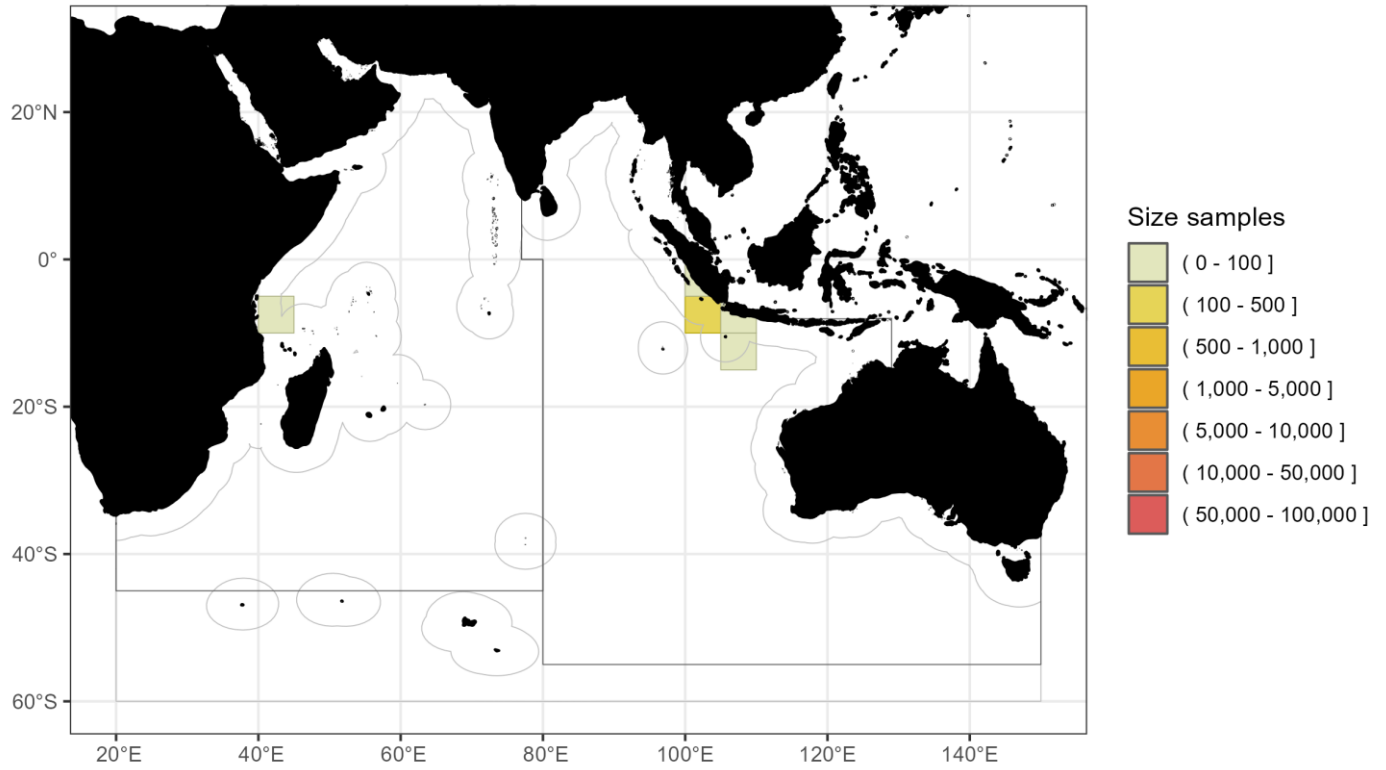


Figure 26: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for frigate tuna caught in trolling fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Other fisheries

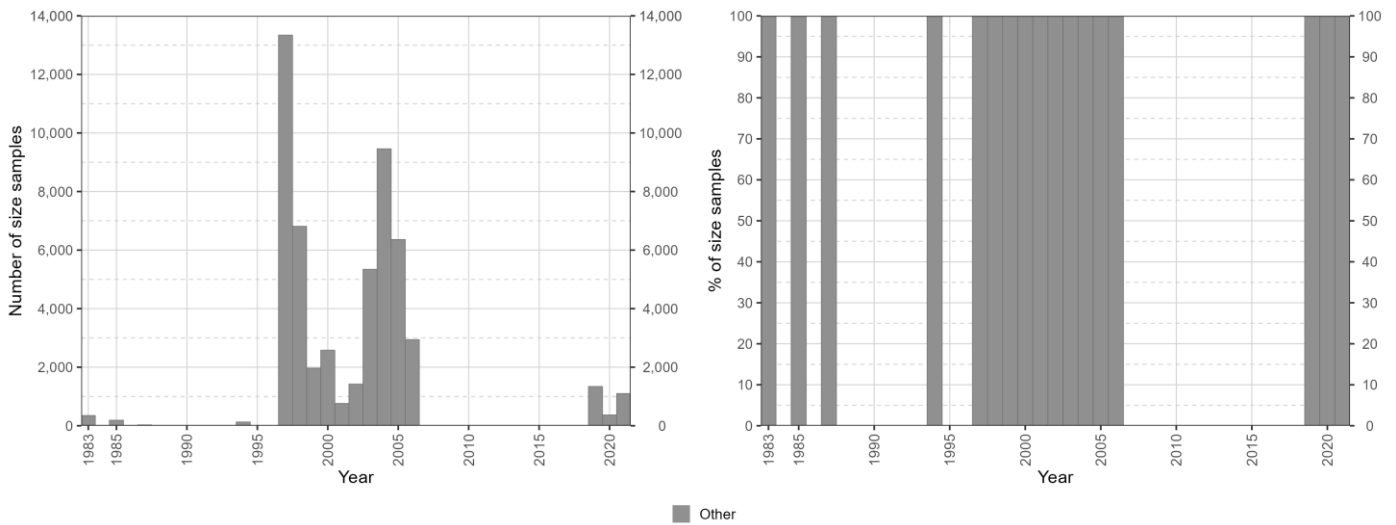


Figure 27: Availability of size-frequency data for frigate tuna as (left) absolute and (right) relative number of samples per year for 'other' fishery types (beach seine, harpoon, liftnet, unclassified). Data source: [standardized size-frequency dataset](#)

Temporal patterns and trends in size distributions

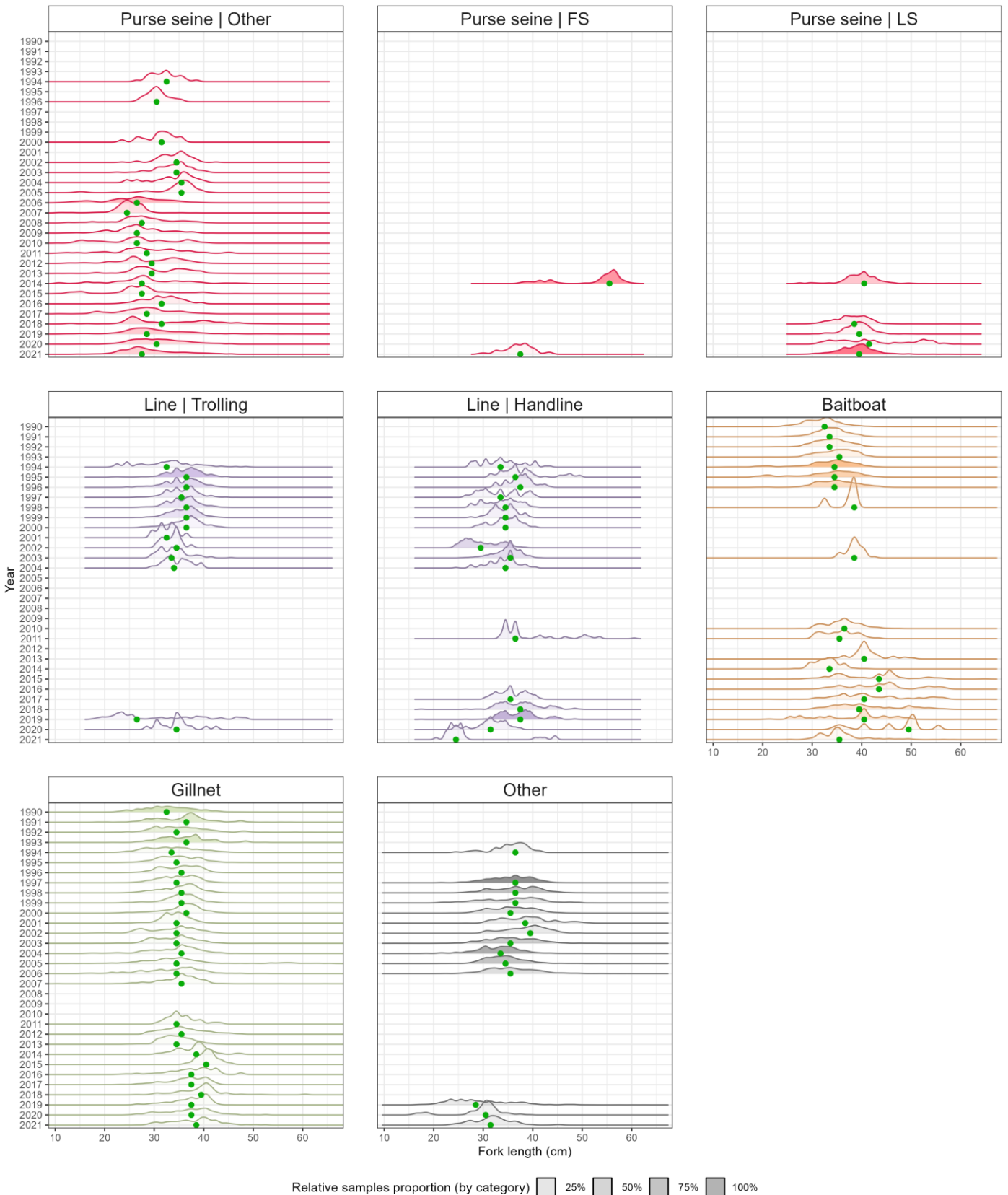


Figure 28: Relative size distribution (fork length; cm) of frigate tuna caught in coastal and ringnet purse seine fisheries (Purse seine | Other), gillnet fisheries, and other fisheries (beach seine, harpoon, liftnet, unclassified). Fill intensity is proportional to the number of samples recorded for the year, while the green dot corresponds to the median value. Data source: [standardized size-frequency dataset](#)

Size distribution by fishery and fleet

Purse seine fisheries (other)

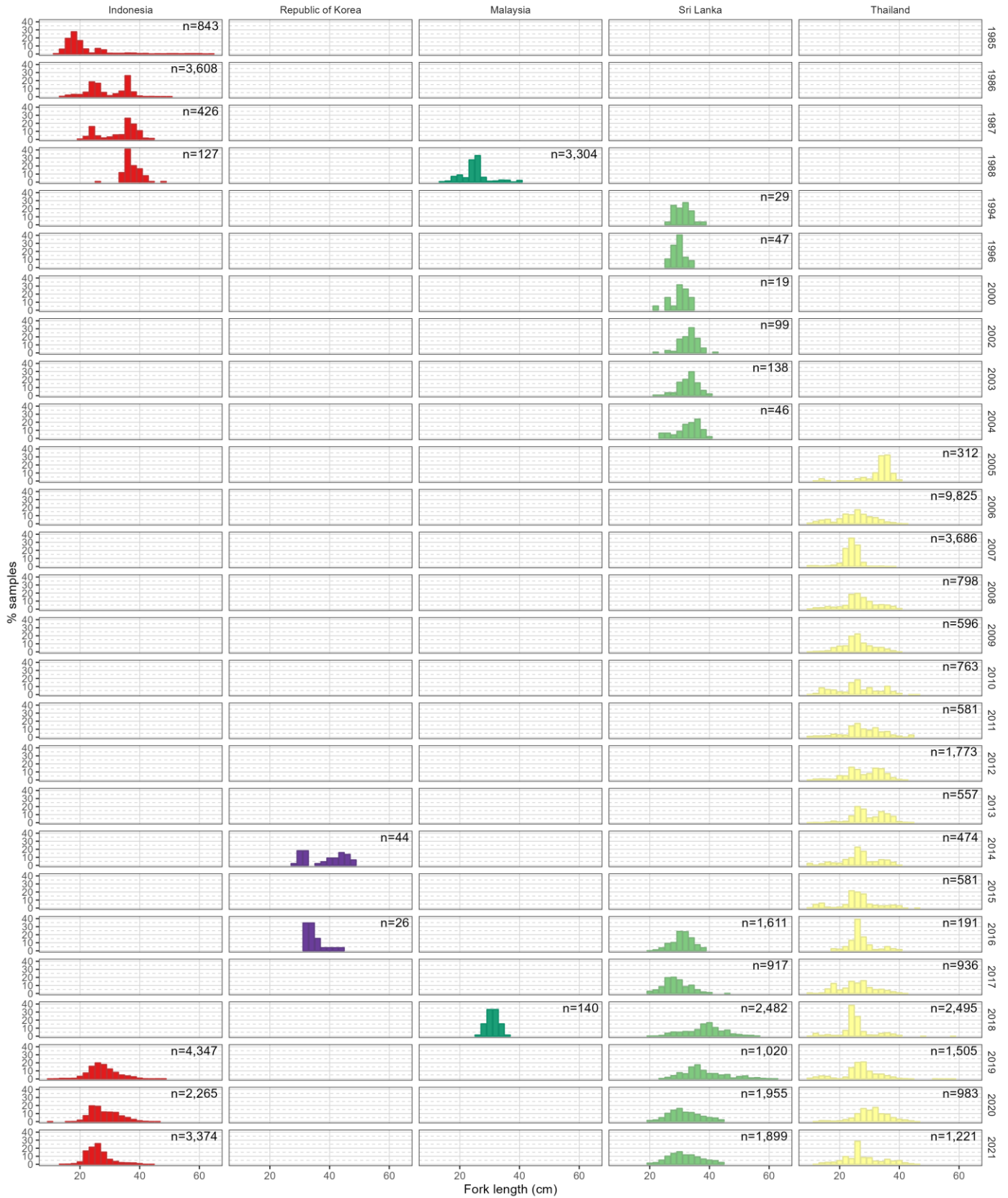


Figure 29: Relative size distribution of frigate tuna (fork length; cm) caught in coastal purse seine and ringnet fisheries (Purse seine|Other) by year and main fleet. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

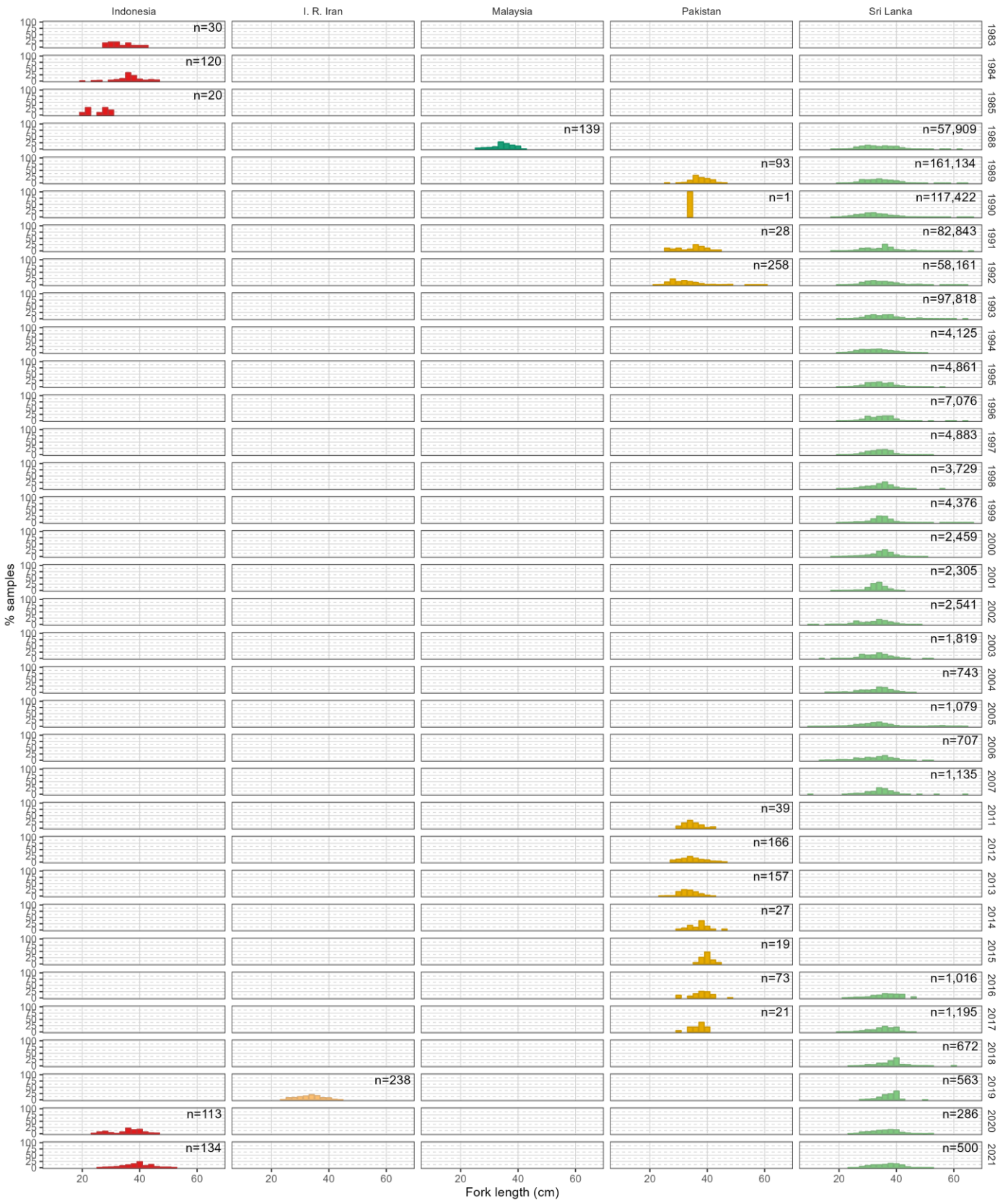


Figure 30: Relative size distribution of frigate tuna (fork length; cm) caught in gillnet fisheries by year and main fleet. Data source: [standardized size-frequency dataset](#)

Uncertainties in geo-referenced size-frequency data

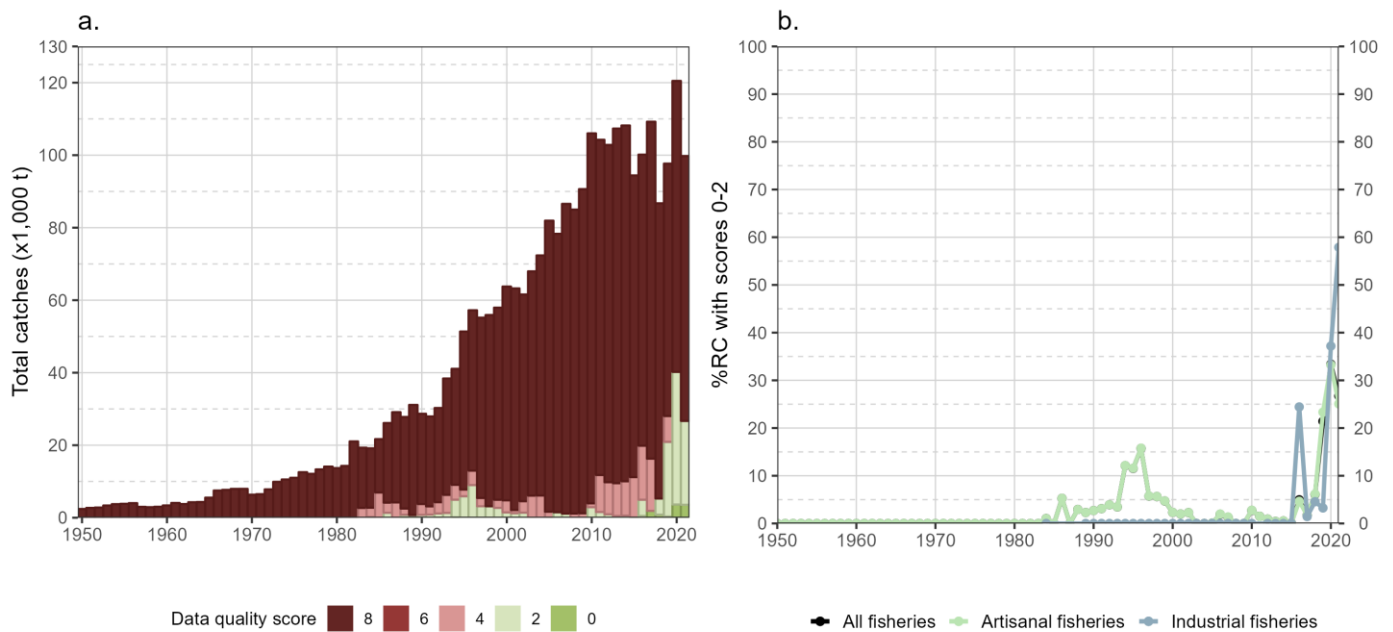


Figure 31: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches with corresponding geo-referenced size-frequency data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 to all retained catches (percentage; %) of frigate tuna for all fisheries and by type of fishery, for the period 1950-2021

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Appendix

Appendix I: Taxonomy

Table 4: Taxonomic hierarchy of frigate tuna. Source: [Integrated Taxonomic Information System](#)

Rank	Taxon
Kingdom	<i>Animalia</i>
Subkingdom	<i>Bilateria</i>
Infrakingdom	<i>Deuterostomia</i>
Phylum	<i>Chordata</i>
Subphylum	<i>Vertebrata</i>
Infraphylum	<i>Gnathostomata</i>
Superclass	<i>Actinopterygii</i>
Class	<i>Teleostei</i>
Superorder	<i>Acanthopterygii</i>
Order	<i>Perciformes</i>
Suborder	<i>Scombroidei</i>
Family	<i>Scombridae</i>
Subfamily	<i>Scombrinae</i>
Tribe	<i>Thunnini</i>
Genus	<i>Auxis</i>
Species	<i>Auxis thazard</i>

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

Table 5: Changes in best scientific estimates of annual retained catches (metric tonnes; t) of frigate tuna by 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)
2020	ARE	Gillnet	Western Indian Ocean	641	669	-28
2019	IDN	Line	Eastern Indian Ocean	28,202	28,222	-21
	IRN	Gillnet	Western Indian Ocean	8,860	8,938	-78
		Line	Western Indian Ocean	98	20	78
2018	MOZ	Gillnet	Western Indian Ocean	97	125	-29
		Line	Western Indian Ocean	44	93	-49
		Other	Western Indian Ocean	462	489	-27
2017	IDN	Baitboat	Eastern Indian Ocean	68	55	14
		Gillnet	Eastern Indian Ocean	13,372	10,712	2,660
		Line	Eastern Indian Ocean	38,090	30,513	7,577
		Other	Eastern Indian Ocean	15,971	12,794	3,177
		Purse seine	Eastern Indian Ocean	6,636	5,316	1,320
	MOZ	Gillnet	Western Indian Ocean	142	184	-42
		Line	Western Indian Ocean	61	128	-67
		Other	Western Indian Ocean	602	638	-36
	2016	IDN	Line	Eastern Indian Ocean	30,541	30,513
Other			Eastern Indian Ocean	12,806	12,794	12
2015	MOZ	Gillnet	Western Indian Ocean	1,086	1,565	-479
		Line	Western Indian Ocean	233	335	-103
2014	IDN	Gillnet	Eastern Indian Ocean	11,480	11,500	-20
		Line	Eastern Indian Ocean	32,701	32,757	-56
		Other	Eastern Indian Ocean	13,711	13,735	-24
	2013	Gillnet	Eastern Indian Ocean	13,033	12,627	406
		Line	Eastern Indian Ocean	37,123	35,966	1,157
		Other	Eastern Indian Ocean	15,566	15,081	485
2012	IDN	Purse seine	Eastern Indian Ocean	6,467	6,266	202
		Gillnet	Eastern Indian Ocean	11,156	11,063	93
		Line	Eastern Indian Ocean	31,776	31,512	264

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
2010		Other	Eastern Indian Ocean	13,324	13,213	111
		Purse seine	Eastern Indian Ocean	5,536	5,490	46
		Gillnet	Eastern Indian Ocean	10,867	10,799	68
		Line	Eastern Indian Ocean	30,953	30,759	194
		Other	Eastern Indian Ocean	12,979	12,897	81
		Purse seine	Eastern Indian Ocean	5,392	5,358	34
	MOZ	Gillnet	Western Indian Ocean	211	304	-93
		Line	Western Indian Ocean	45	65	-20
2008	MOZ	Gillnet	Western Indian Ocean	190	273	-84
		Line	Western Indian Ocean	41	59	-18