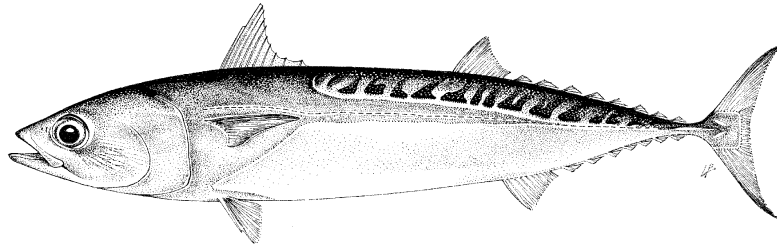


REVIEW OF FISHERIES STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN BULLET TUNA

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 bullet tuna (*Auxis rochei*) ([Risso 1810](#)) 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 bullet 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

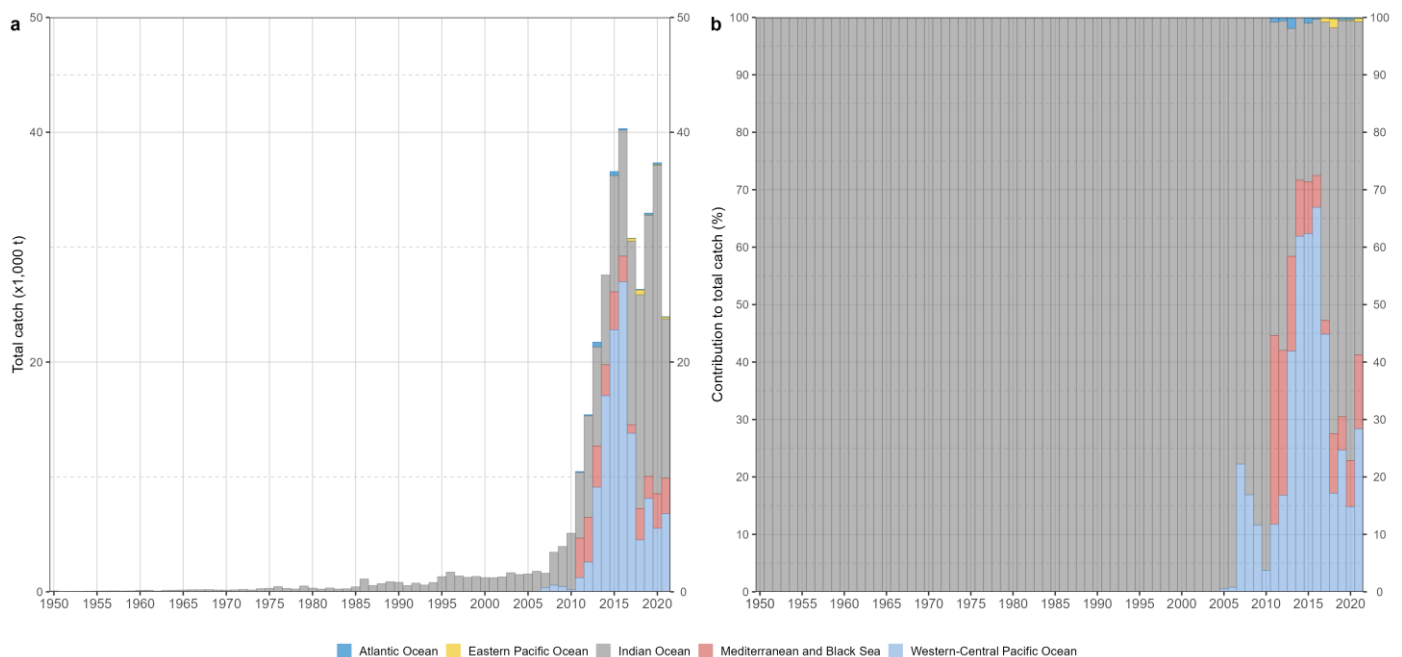


Figure 1: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) contribution to the total retained catches (percentage; %) of bullet tuna by ocean basin for the period 1950-2021. Source: [FAO global capture production database](#)

Indian Ocean catches & discards

Historical trends (1950-2021)

Table 1: Mean annual retained catches (metric tonnes; t) of bullet 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	0	28	278	552	655	5,057
Longline Other	0	0	0	3	327	451	1,026
Longline Fresh	0	0	0	0	0	0	11
Longline Deep-freezing	0	0	0	0	0	0	65
Line Coastal longline	4	6	18	38	90	212	564
Line Trolling	102	178	280	304	566	723	1,736
Line Handline	6	9	26	52	124	260	851
Baitboat	5	13	16	22	22	0	16
Gillnet	41	153	296	476	971	1,385	2,972
Other	0	1	28	217	406	870	1,414
Total	159	360	693	1,390	3,058	4,555	13,713

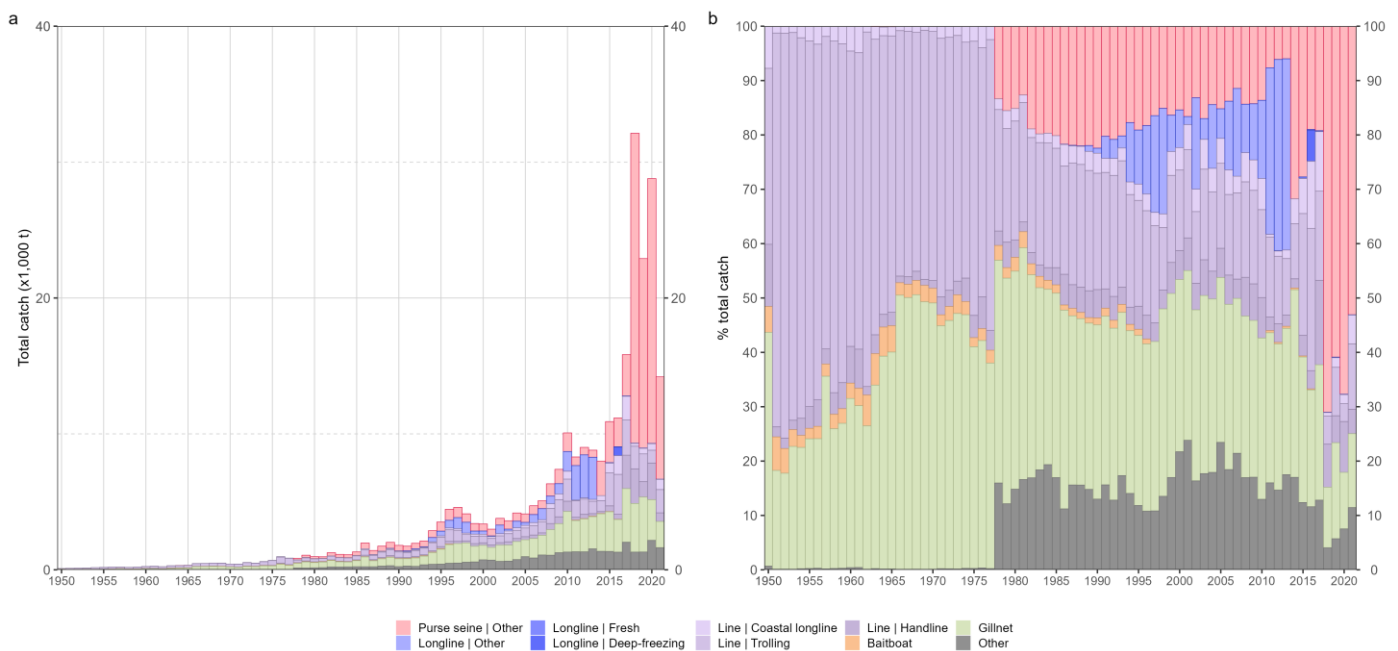


Figure 2: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of bullet tuna by fishery for the period 1950-2021. Data source: [best scientific estimates of retained catches](#)

Table 2: Annual retained catches (metric tonnes; t) of bullet 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	552	528	2,538	3,023	2,122	3,047	22,813	13,942	19,491	7,537
Longline Other	3,169	3,097	0	0	0	1	0	0	0	0
Longline Fresh	6	0	0	29	23	21	16	13	11	7
Longline Deep-freezing	0	0	0	2	631	2	3	12	10	2
Line Coastal longline	86	139	367	704	1,380	1,734	206	403	479	751
Line Trolling	1,117	911	810	2,443	2,924	2,596	1,667	2,044	947	1,709
Line Handline	311	185	135	412	376	2,462	2,543	1,132	2,691	636
Baitboat	26	33	25	21	21	0	0	0	0	0
Gillnet	2,422	2,368	2,760	2,918	2,402	3,945	3,578	4,045	2,994	1,931
Other	1,321	1,541	1,359	1,350	1,296	2,029	1,301	1,309	2,166	1,625
Total	9,009	8,803	7,995	10,903	11,175	15,837	32,129	22,901	28,789	14,198



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

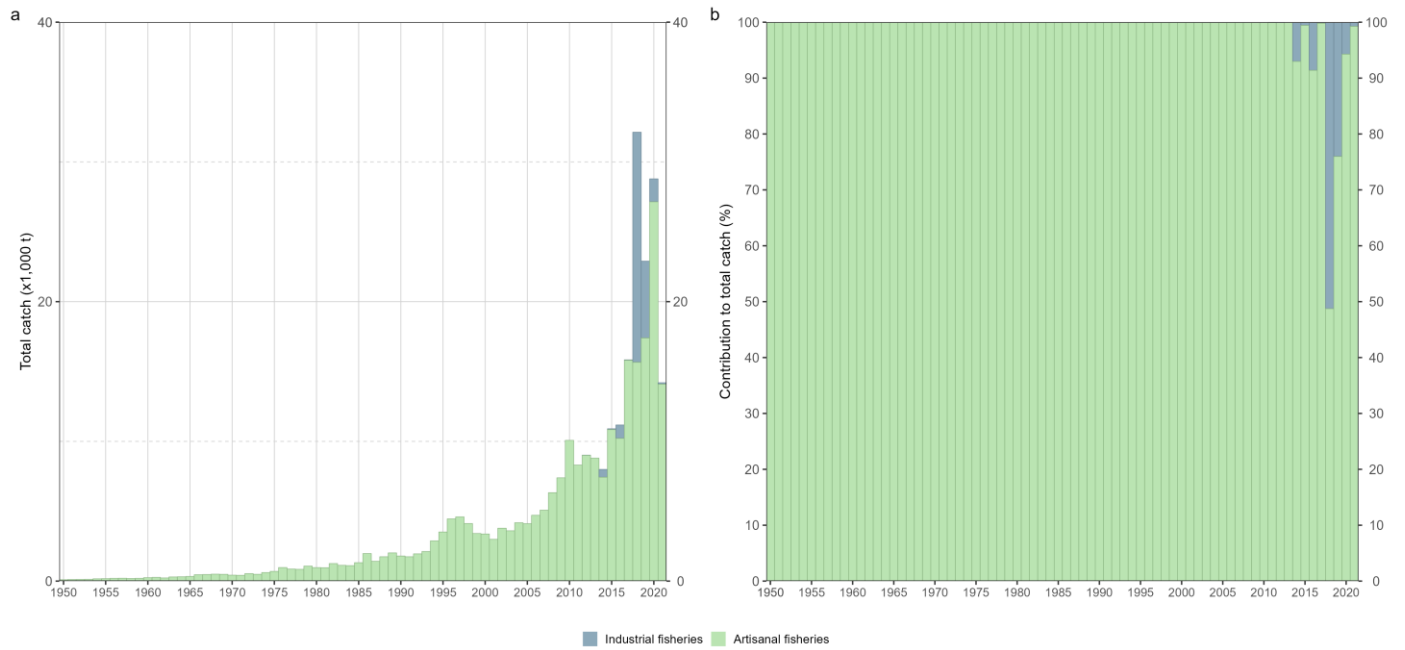


Figure 4: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) cumulative contribution to the total retained catches (percentage; %) of bullet tuna by type of fishery for the period 1950-2021. Data source: [best scientific estimates of retained catches](#)

Recent fishery features (2017-2021)

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

Fishery	Fishery code	Catch	Percentage
Purse seine Other	PSOT	13,366	58.7
Gillnet	GN	3,298	14.5
Line Handline	LIH	1,893	8.3
Line Trolling	LIT	1,793	7.9
Other	OT	1,686	7.4
Line Coastal longline	LIC	715	3.1
Longline Fresh	LLF	14	0.1
Longline Deep-freezing	LLD	6	0.0
Longline Other	LLO	0	0.0

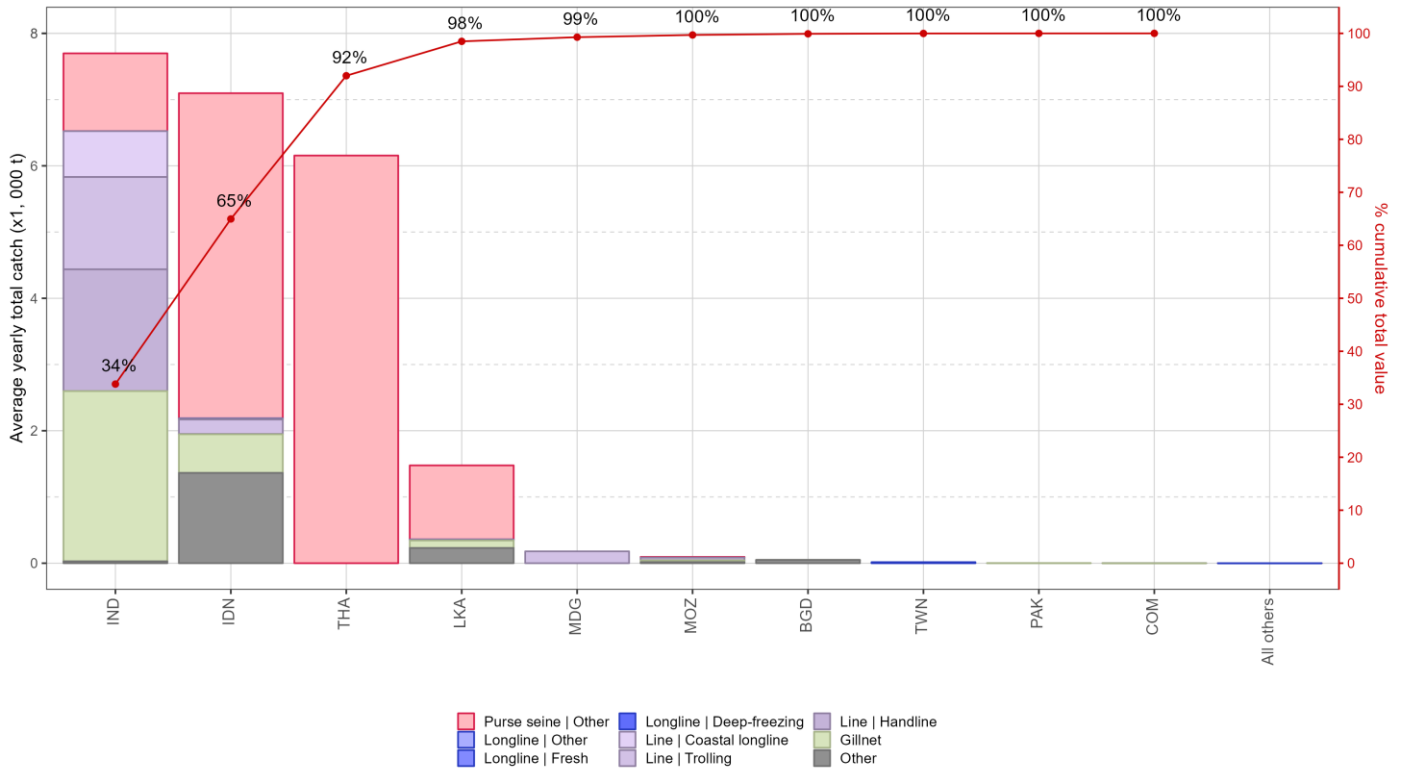


Figure 5: Mean annual retained catches (metric tonnes; t) of bullet tuna by fleet and fishery between 2017 and 2021, with indication of cumulative contribution (percentage; %) of catches by fleet. Data source: [best scientific estimates of retained catches](#)

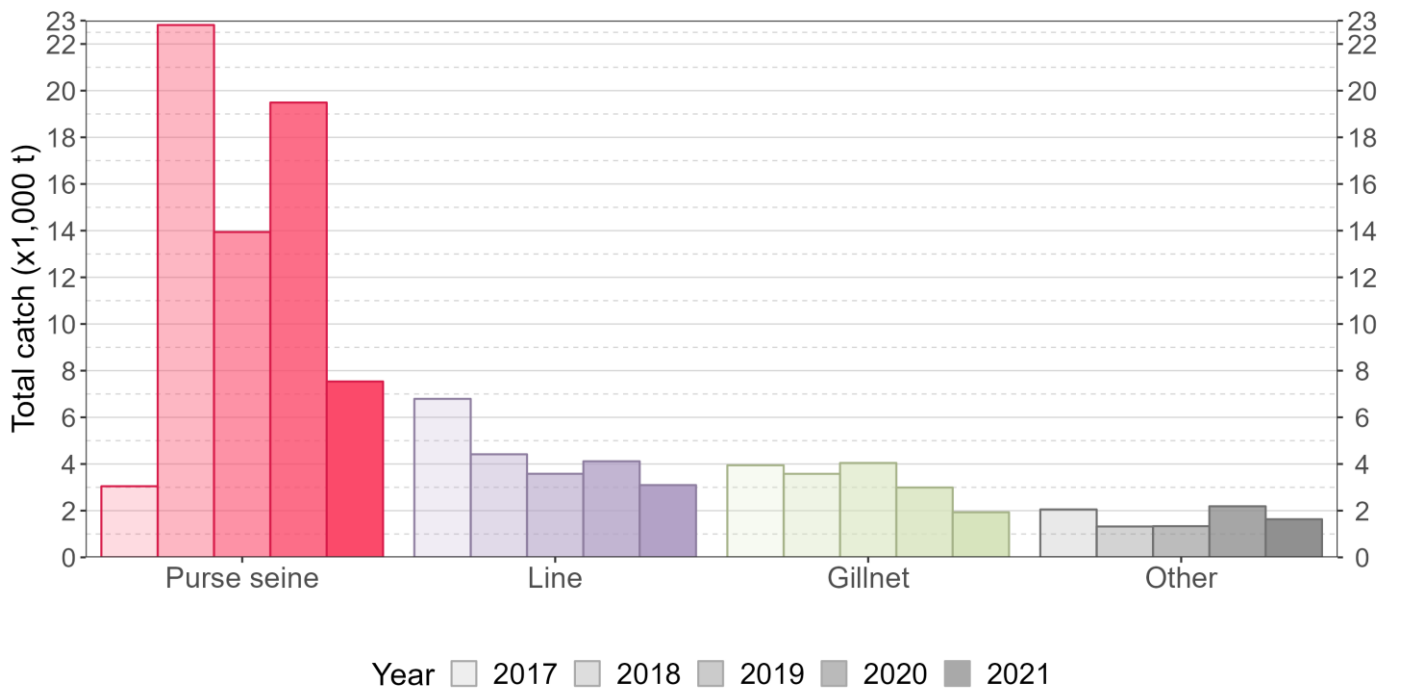


Figure 6: Annual trends in retained catch (metric tonnes; t) of bullet tuna by fishery group between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

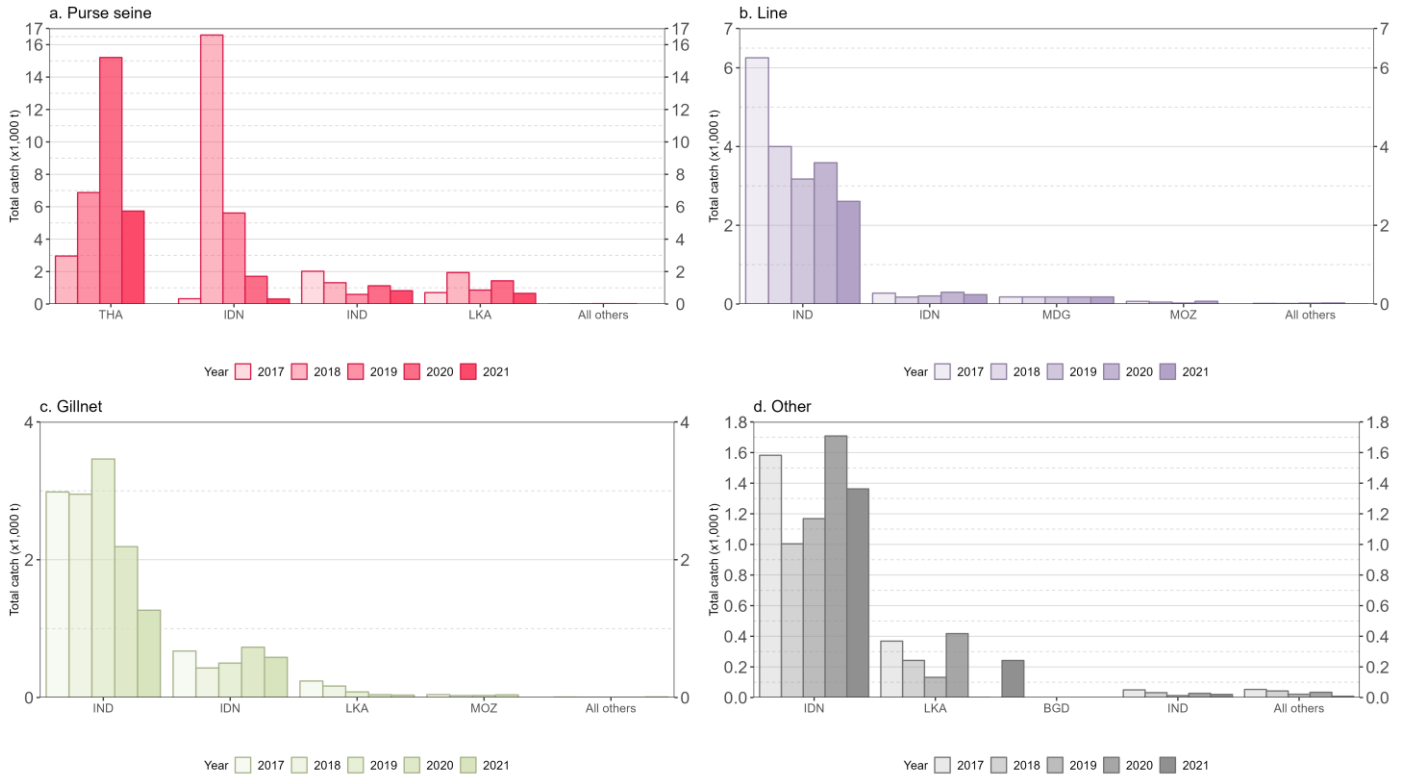


Figure 7: Annual trends in retained catch (metric tonnes; t) of bullet tuna by fishery group and fleet between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

Changes from previous Working Party

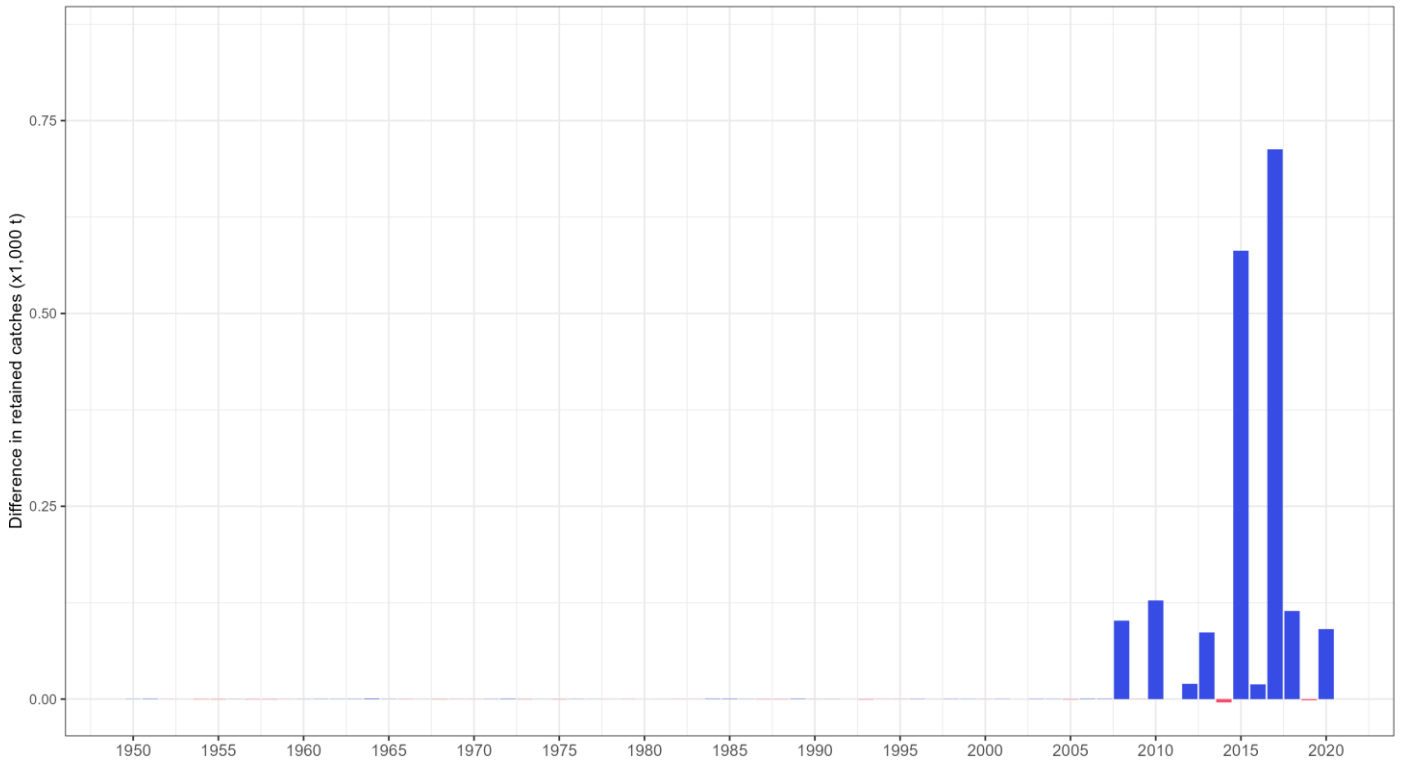


Figure 8: Differences in the annual retained catches (metric tonnes; t) of bullet tuna available at this WPNT and its previous session (WPNT12 meeting held in July 2022). Details by year, fleet, fishery group, and Indian Ocean major area given in [Appendix II](#)

Uncertainties in retained catch data

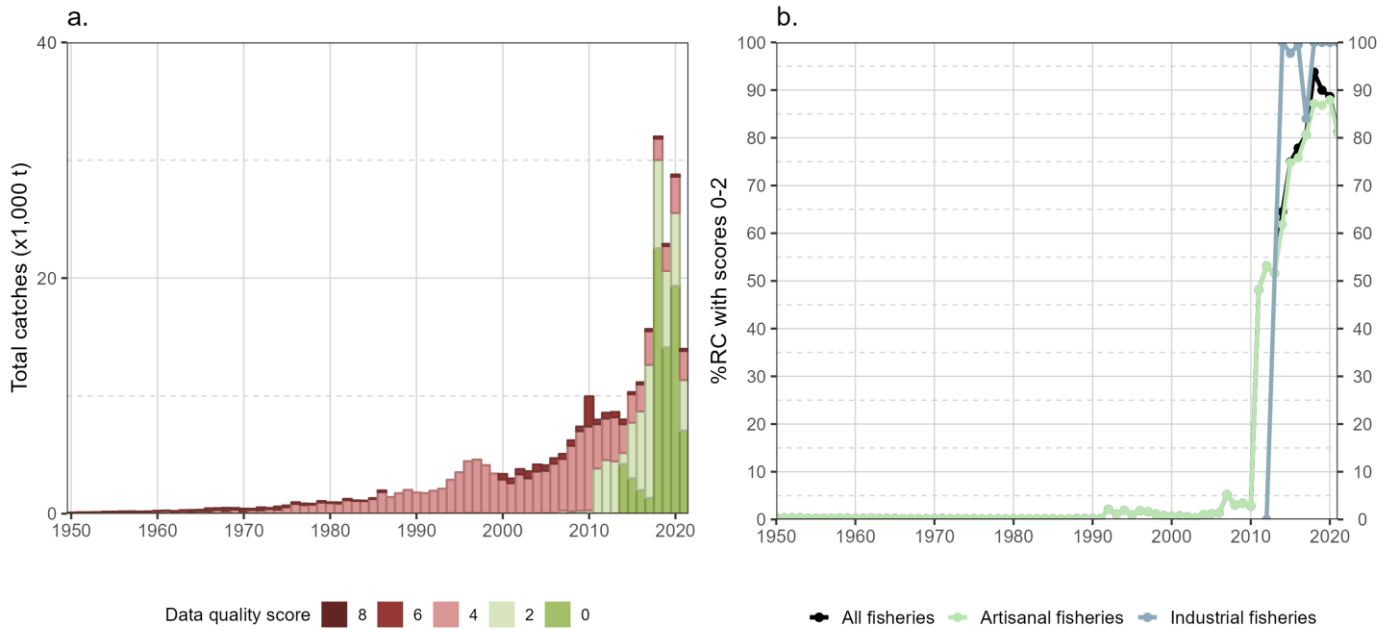


Figure 9: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches fully or partially reported to the IOTC Secretariat to all retained catches (percentage; %) of bullet tuna for all fisheries and by type of fishery, for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

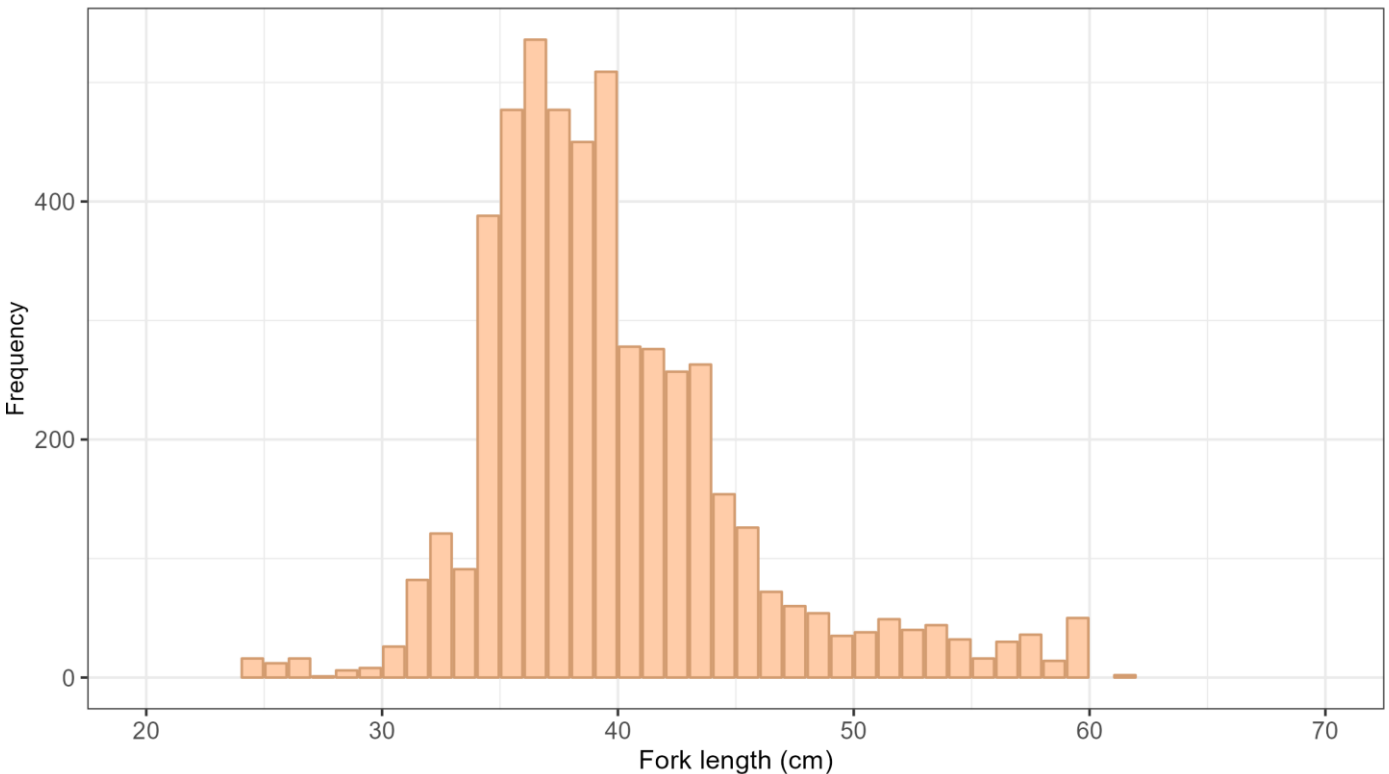


Figure 10: Size-frequency distribution of bullet tuna discarded at sea in purse seine fisheries as available in the ROS regional database

Spatial distribution of catch

Geo-references catches

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

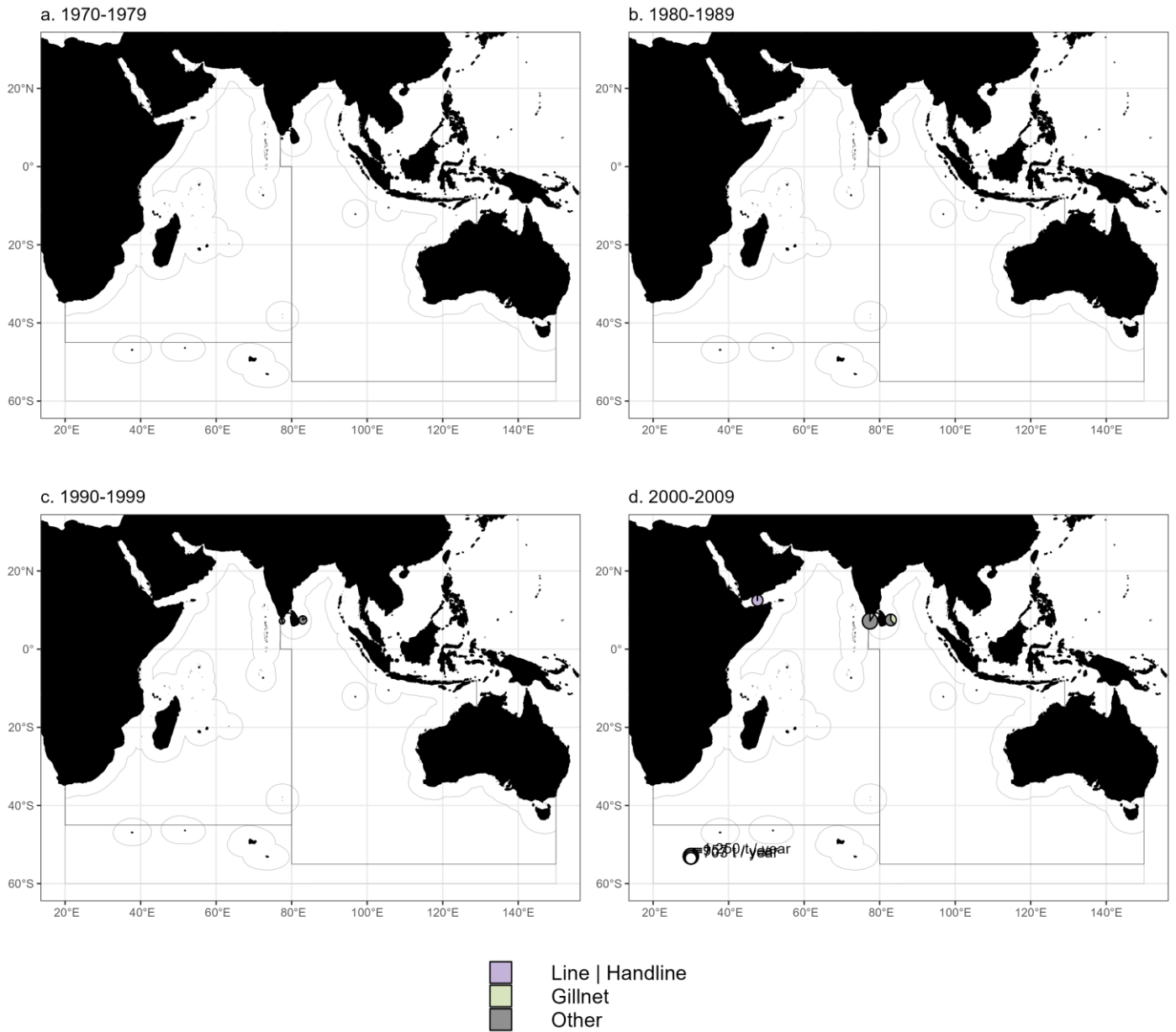


Figure 11: Mean annual time-area catches (metric tonnes; t) of bullet tuna, by decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [time-area catches](#)

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

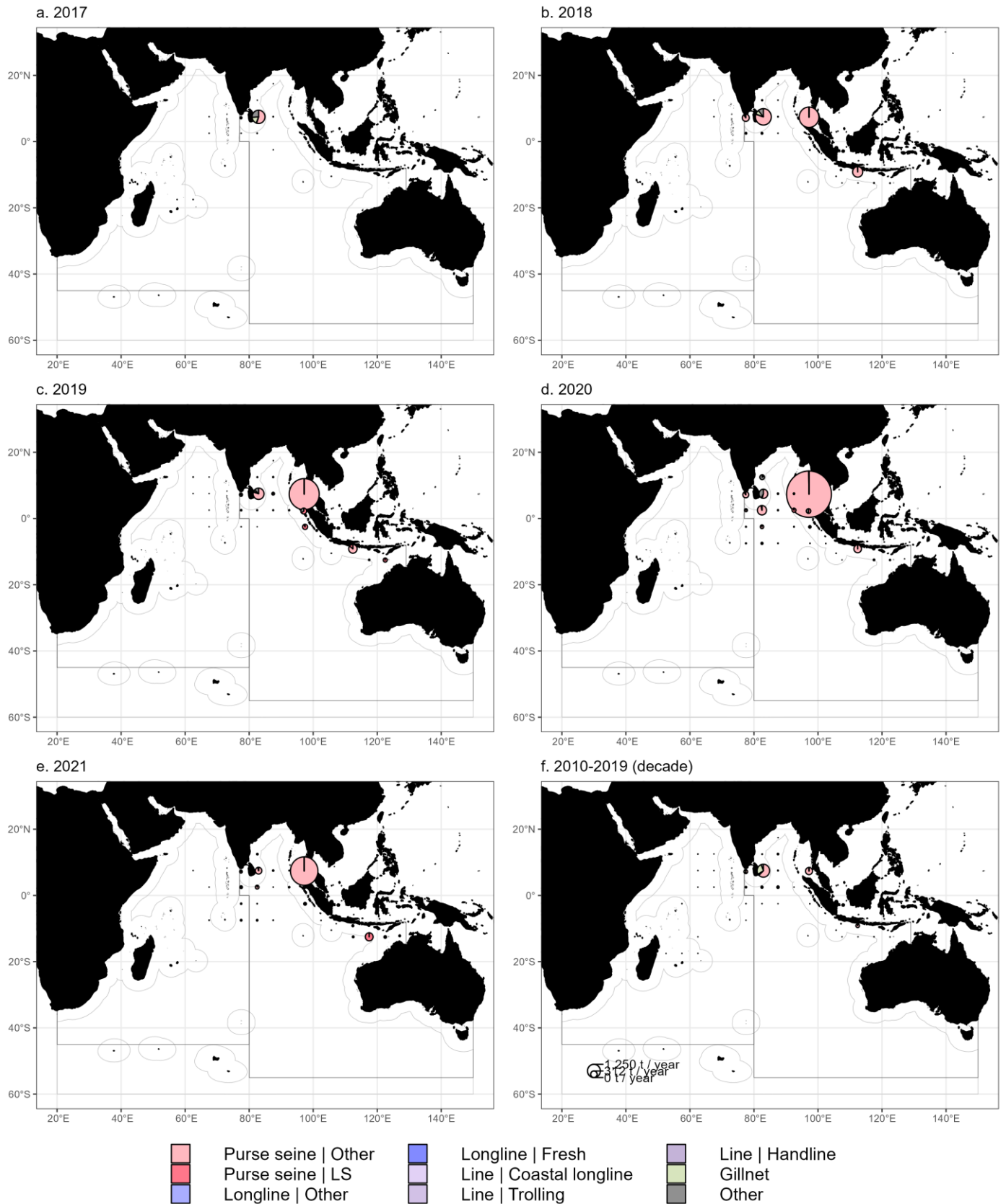


Figure 12: Mean annual time-area catches (metric tonnes; t) of bullet tuna, by year and decade, 5-degree grid area, and fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [time-area catches](#)

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

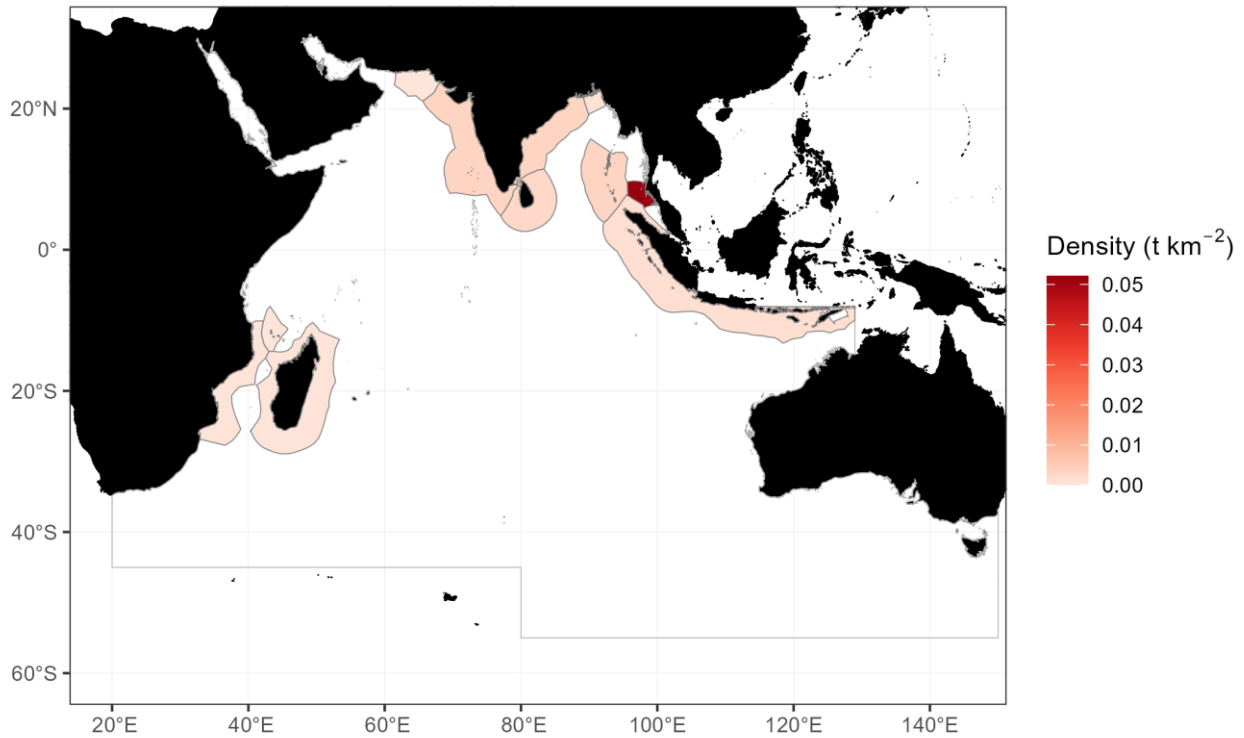


Figure 13: Mean annual density of catch ($t\ km^{-2}$) of bullet tuna reported for domestic fisheries operating in areas under national jurisdiction of IOTC coastal states between 2017 and 2021. Data source: [best scientific estimates of retained catches](#)

Uncertainties in geo-referenced catch and effort data

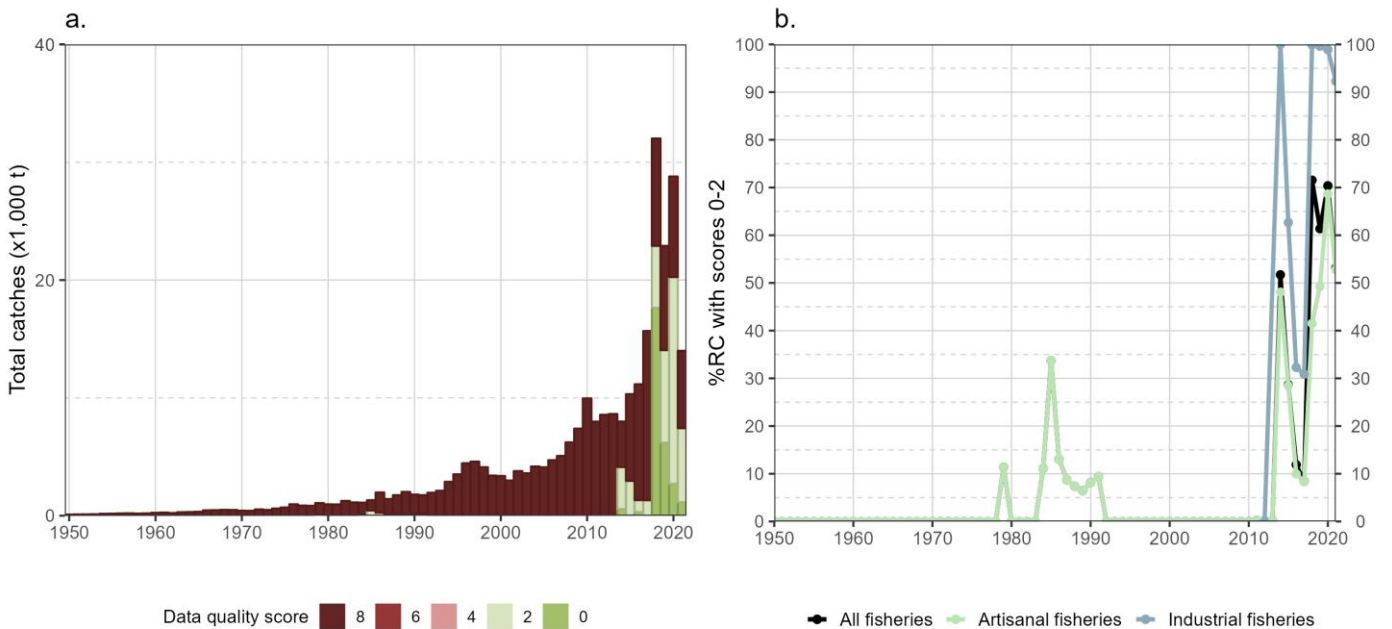


Figure 14: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches (percentage; %) with corresponding geo-referenced catch and effort data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02)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

Size composition of the catch

Samples availability

By fishery group

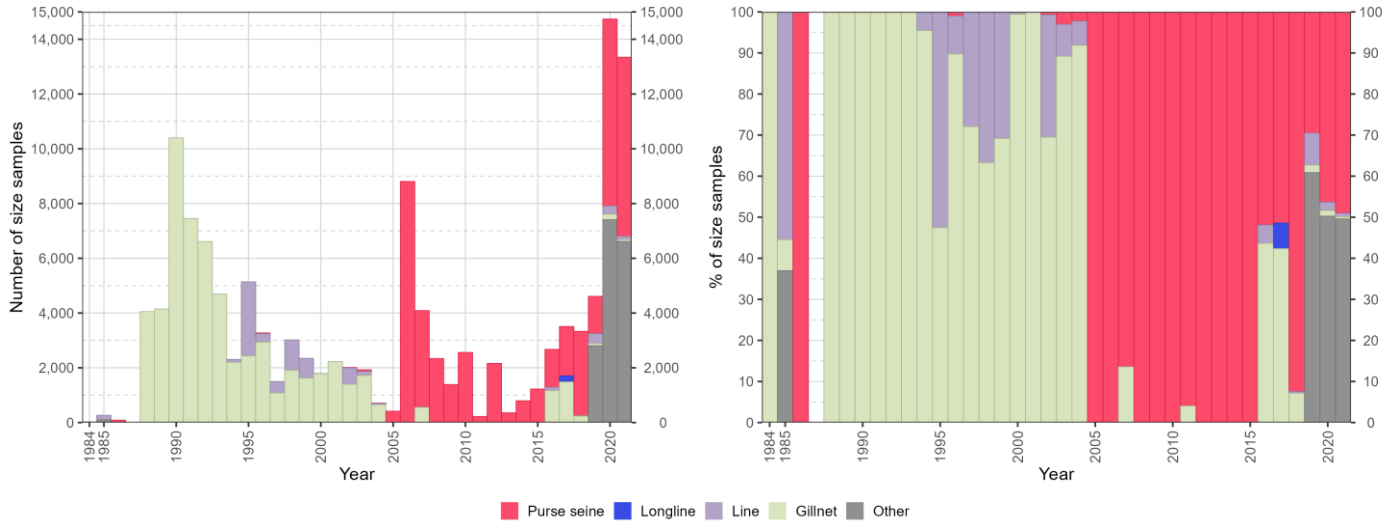


Figure 15: Availability of size-frequency data for bullet tuna as (left) absolute and (right) relative number of samples per year and fishery group. Data source: [standardized size-frequency dataset](#)

Purse seine fisheries

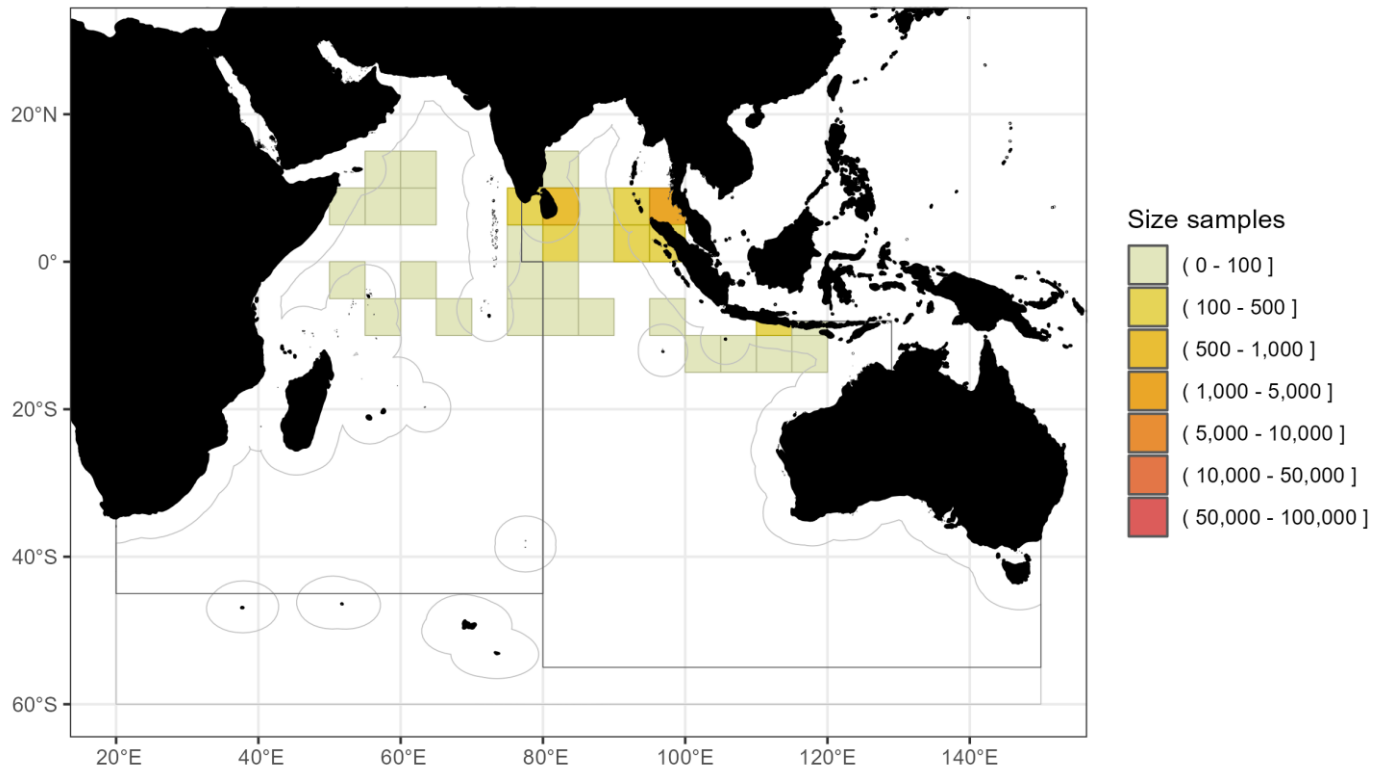


Figure 16: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in purse seine fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

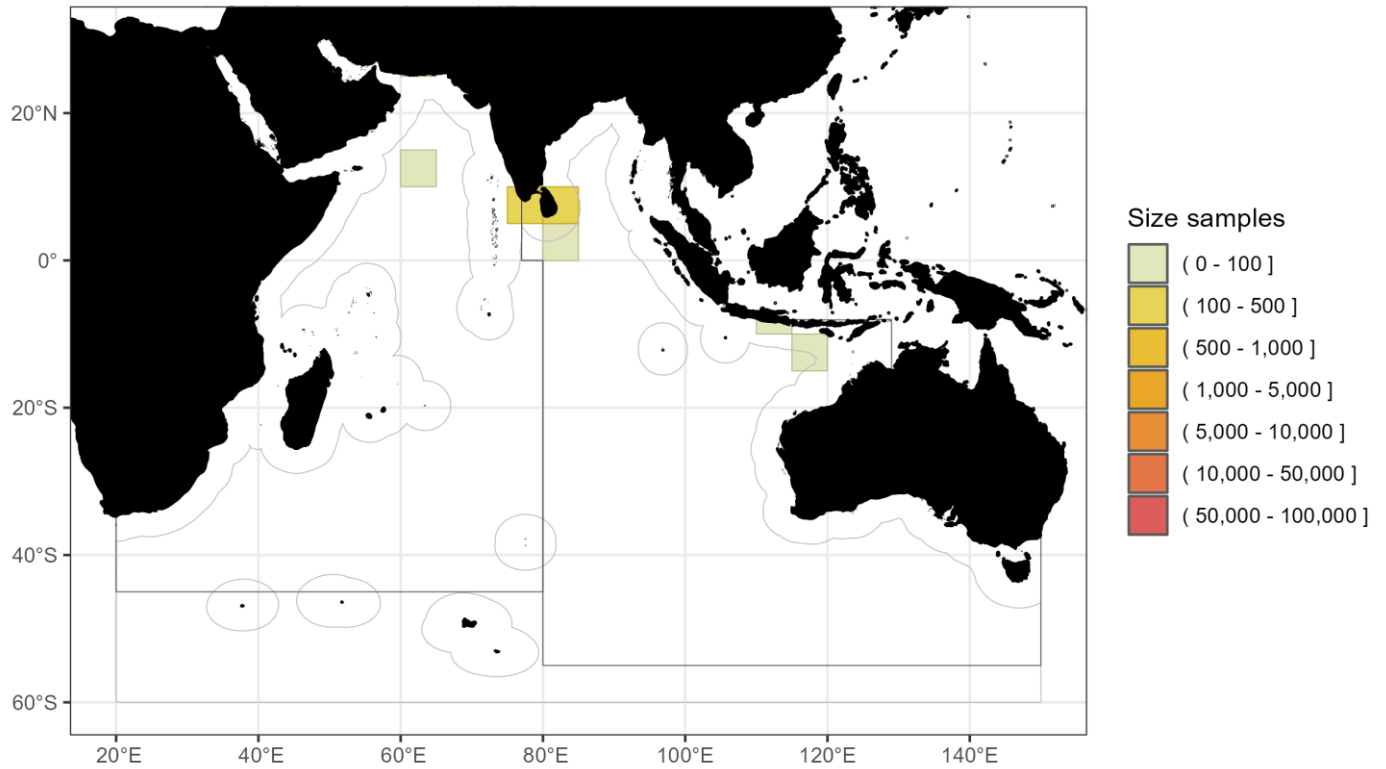


Figure 17: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in gillnet fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Line fisheries

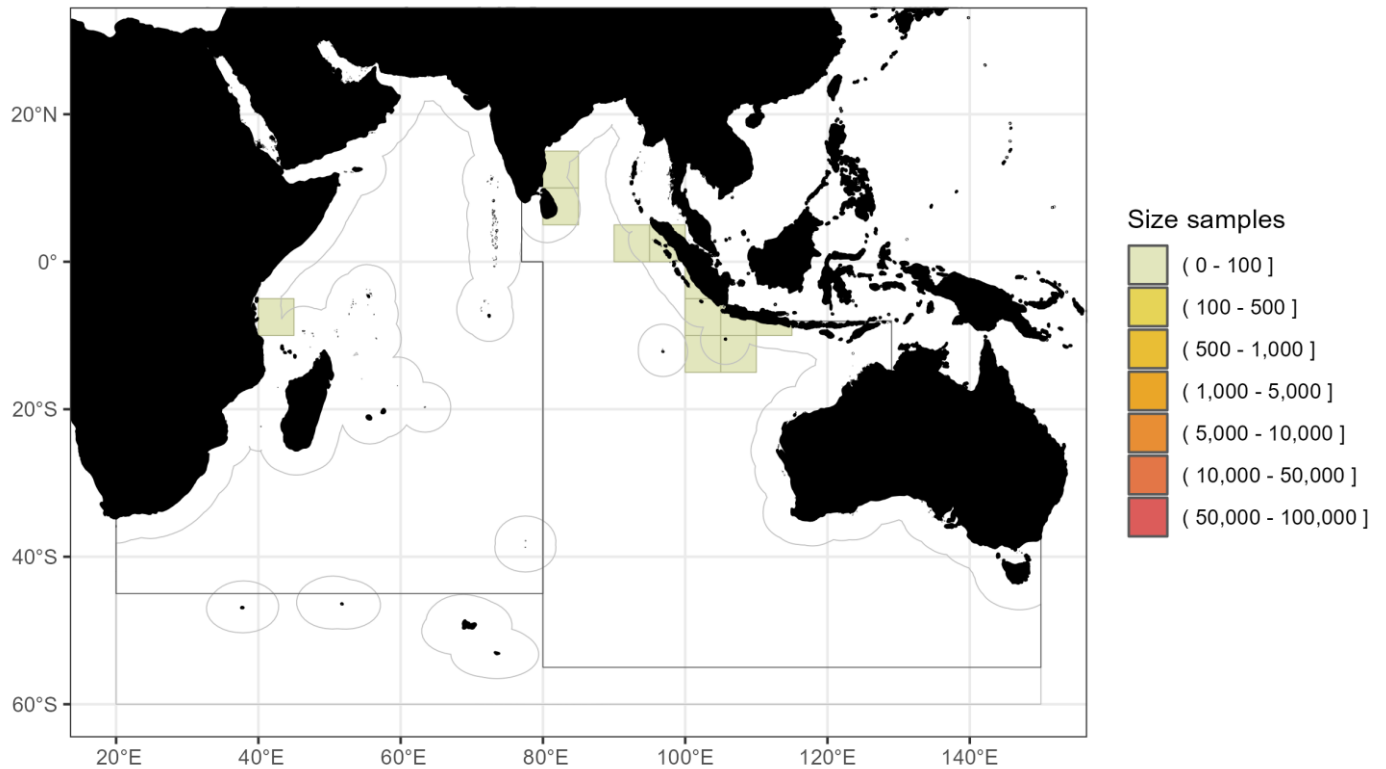


Figure 18: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in line fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Other fisheries

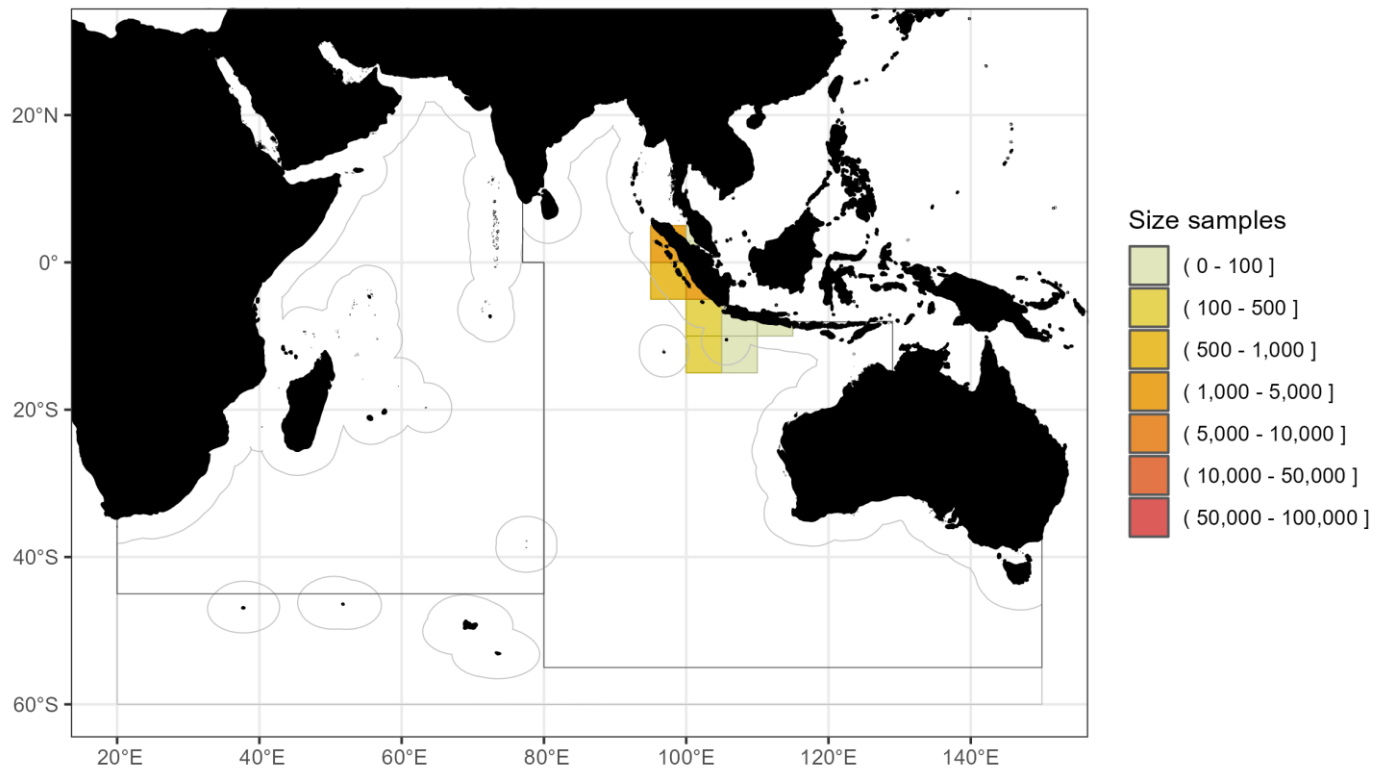


Figure 19: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in other fisheries (Beach seine, Danish seine, Liftnet) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized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

By fishery

Purse seine fisheries

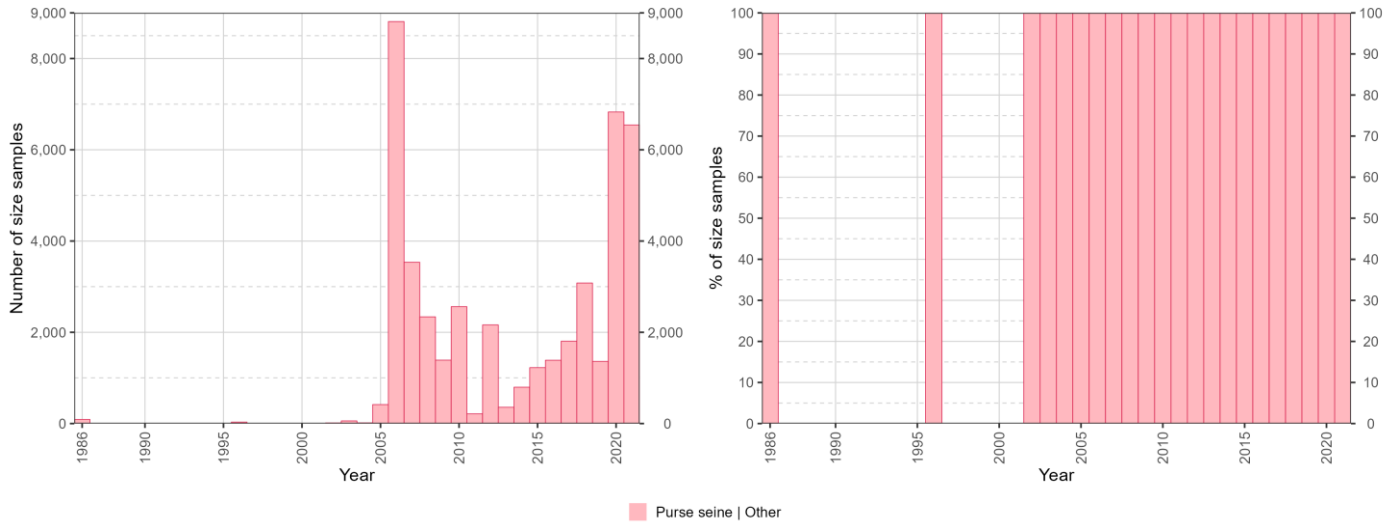


Figure 20: Availability of size-frequency data for bullet tuna as (left) absolute and (b) relative number of samples per year and type of purse seine fishery. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

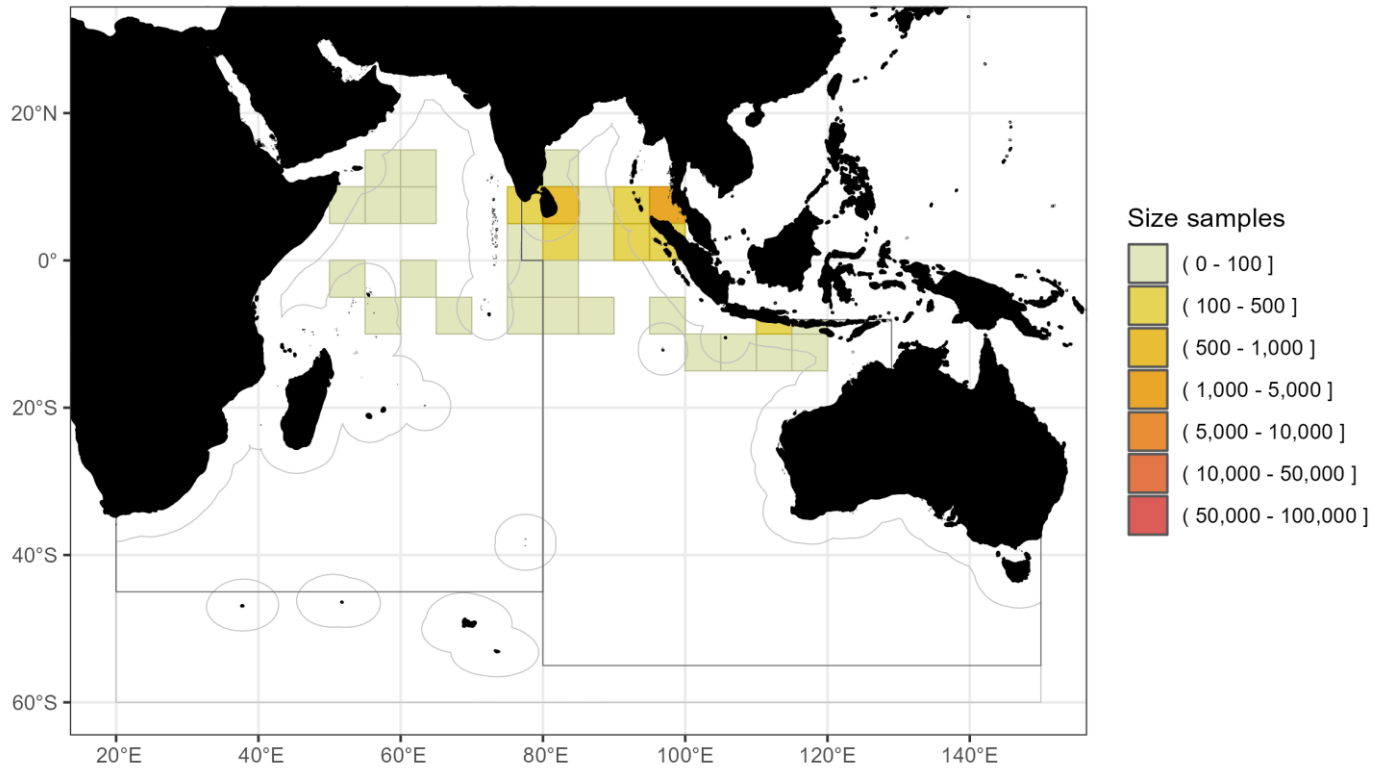


Figure 21: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in coastal and ringnet purse seine fisheries (Purse seine|Other) during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: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

Gillnet fisheries

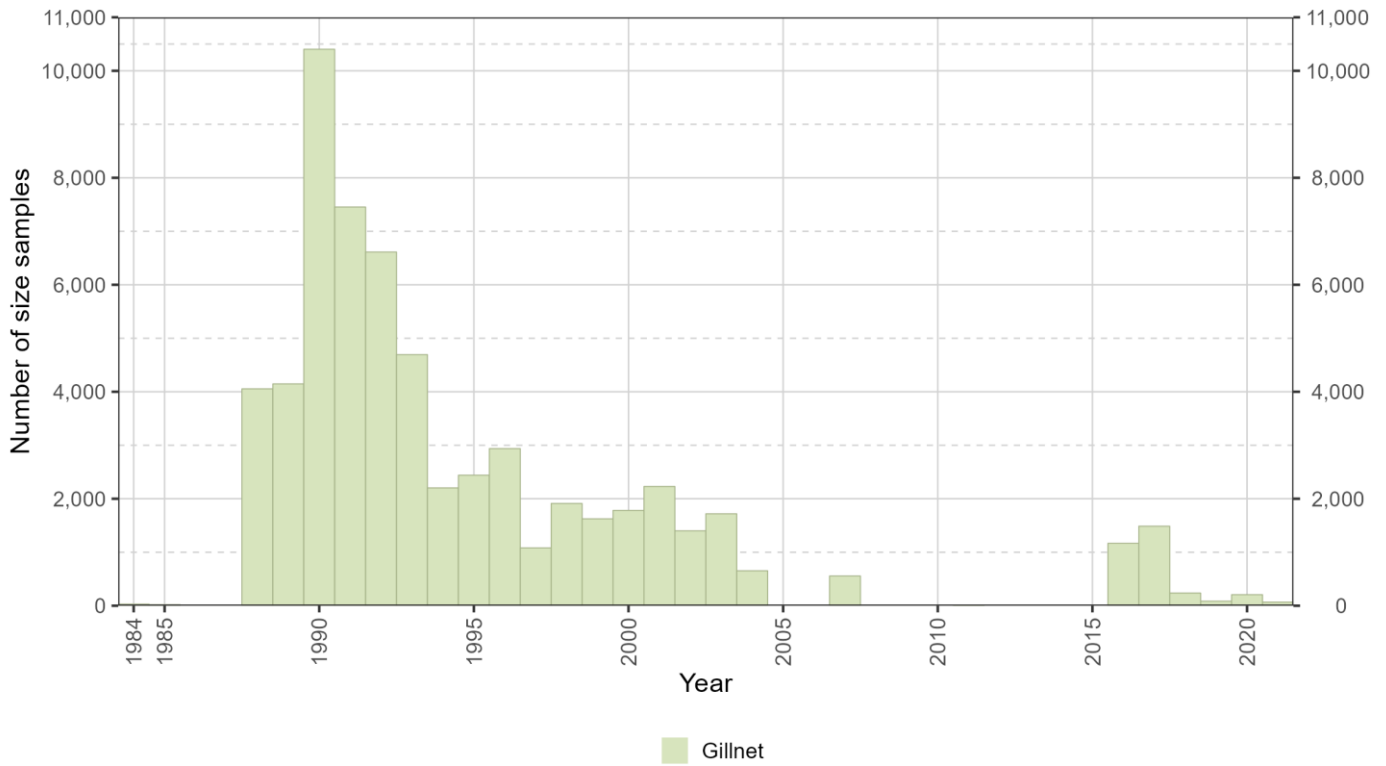


Figure 22: Availability of size-frequency data for bullet tuna as absolute number of samples per year in gillnet fisheries. Data source: [standardized size-frequency dataset](#)

Line fisheries

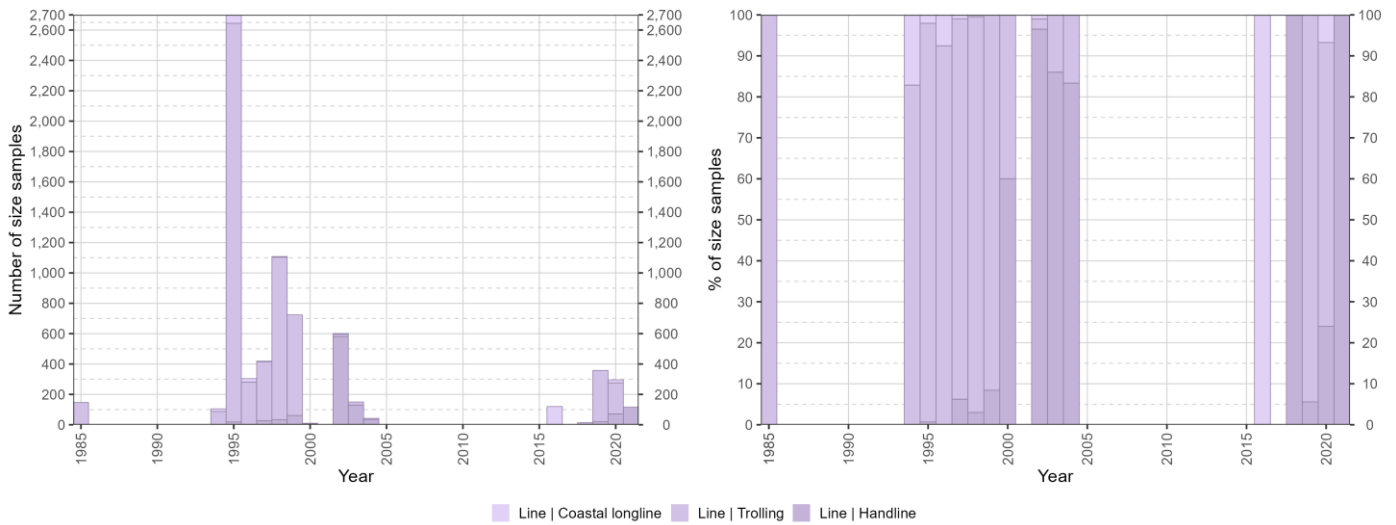


Figure 23: Availability of size-frequency data for bullet tuna as (left) absolute and (right) relative number of samples per year and line fishery type. Data source: [standardized size-frequency dataset](#)

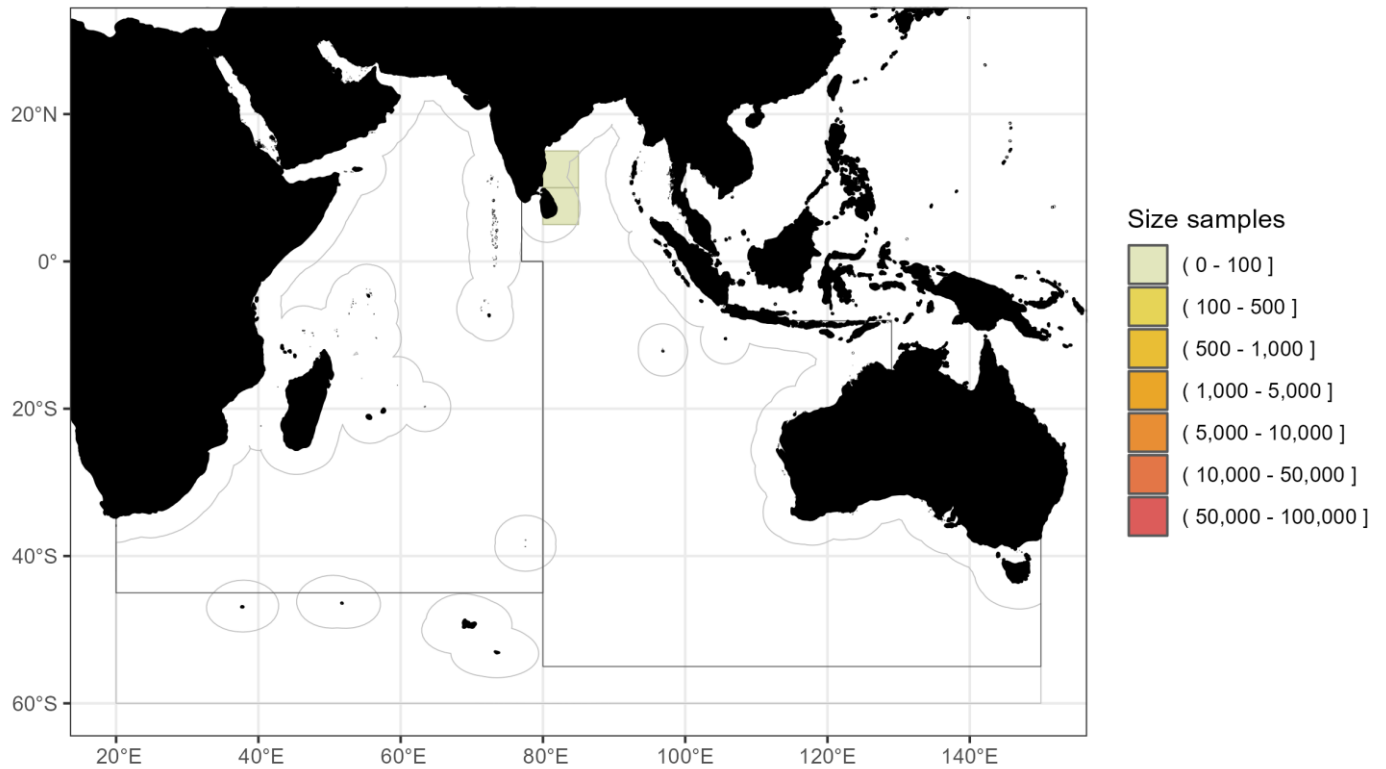


Figure 24: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in coastal longline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency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

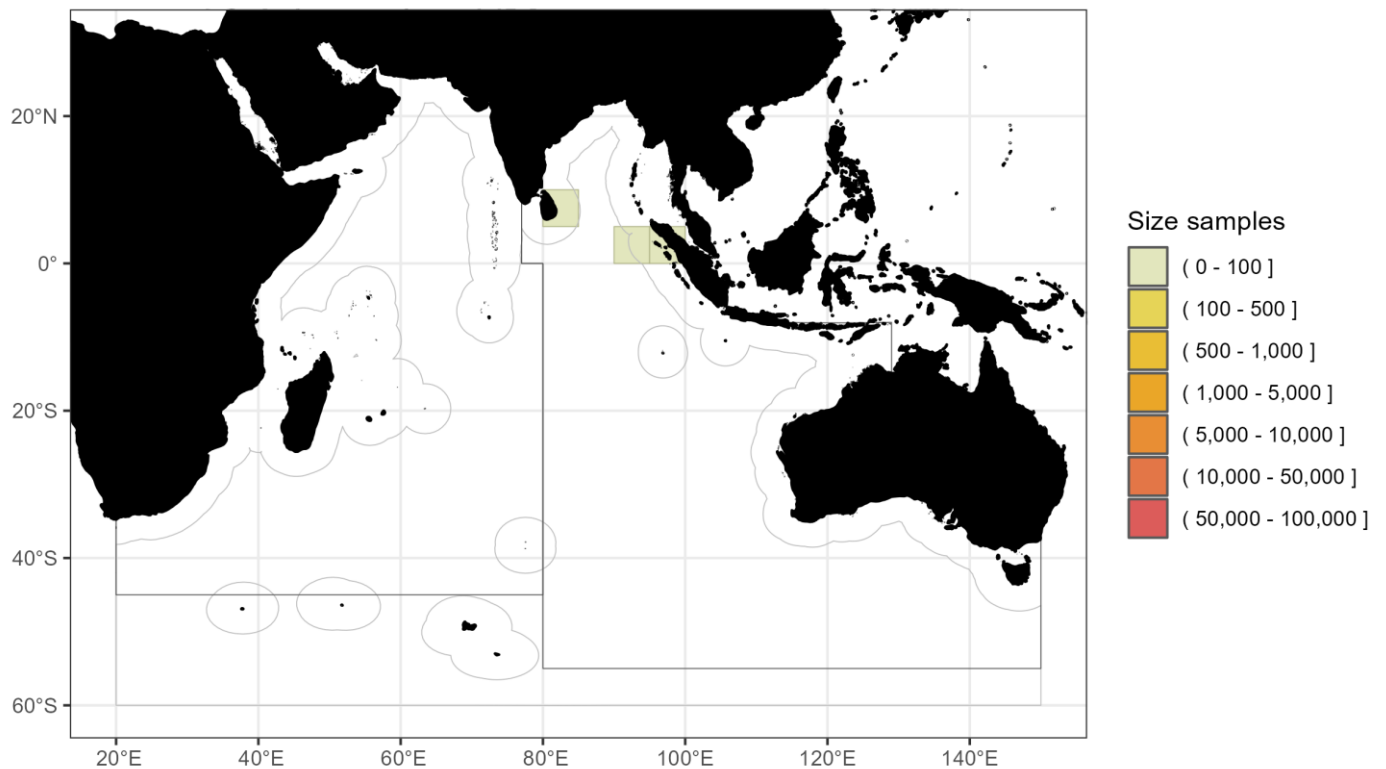


Figure 25: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in handline fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

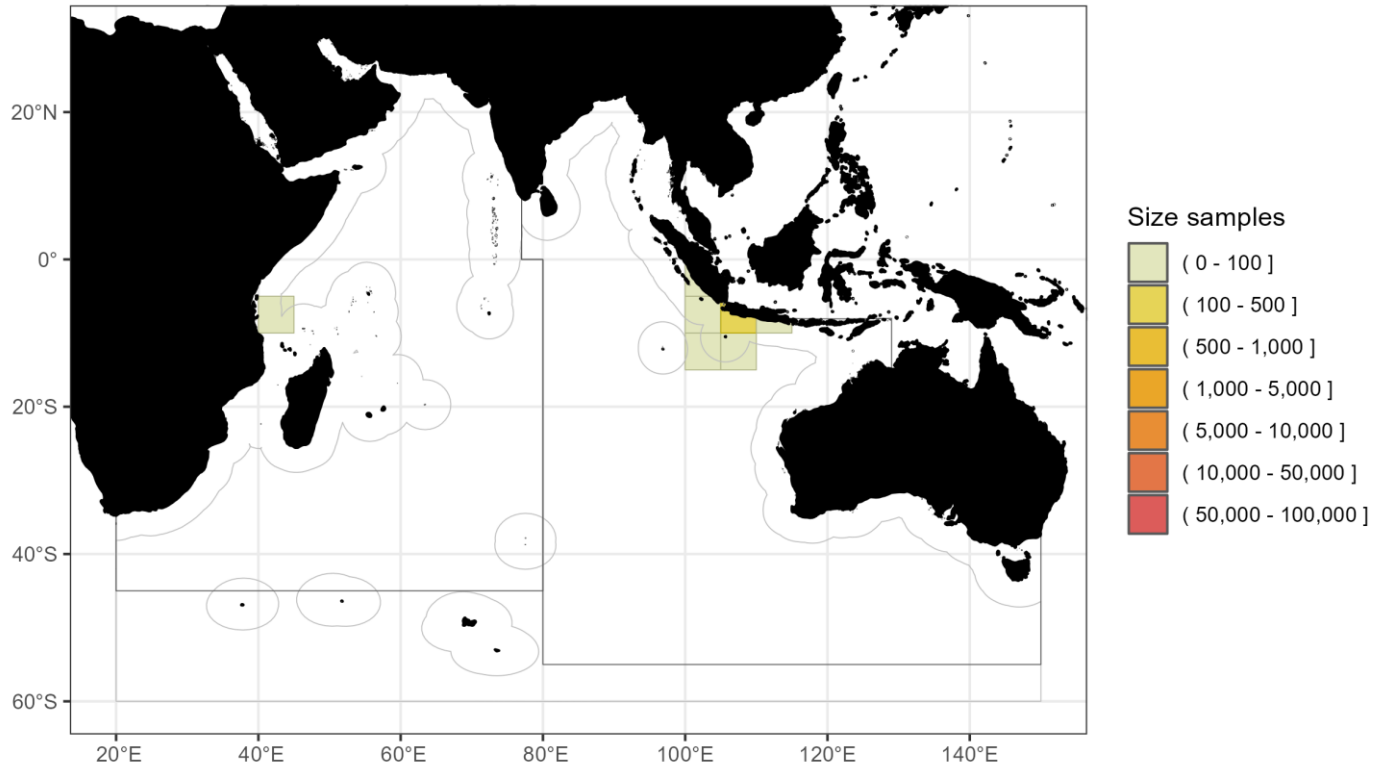


Figure 26: Spatial distribution (mean annual number of samples per 5-degree grid area) of available size-frequency data for bullet tuna caught in trolling fisheries during 2017-2021. Light grey solid lines delineate areas beyond national jurisdiction. Data source: [standardized size-frequency dataset](#)

Other fisheries

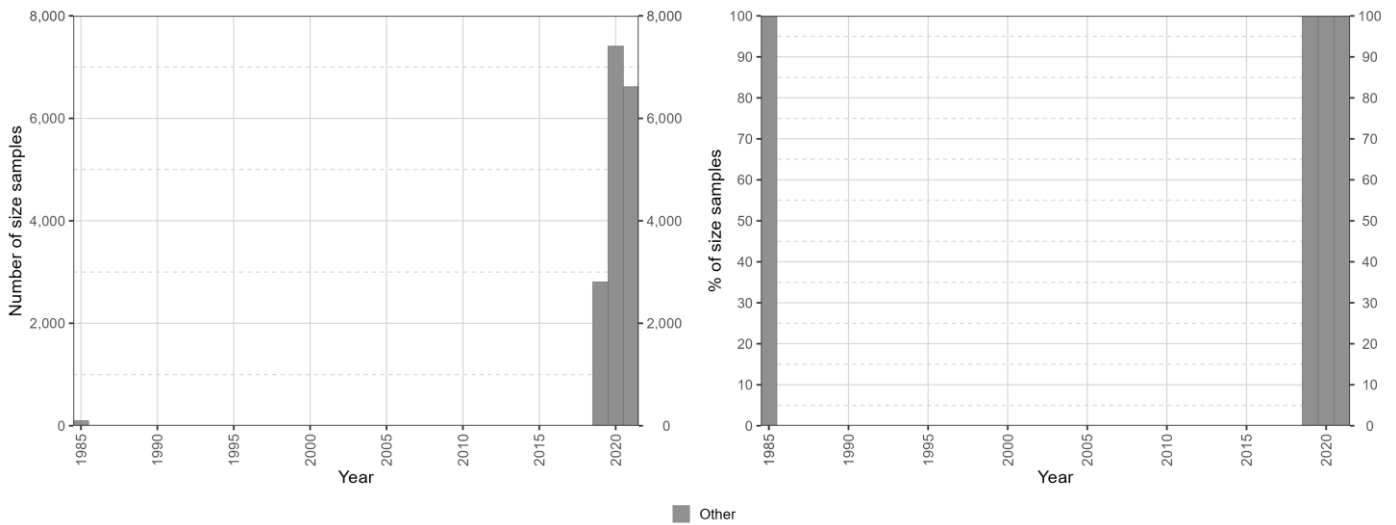


Figure 27: Availability of size-frequency data for bullet tuna as (left) absolute and (right) relative number of samples per year for 'other' fishery types (Beach seine, Danish seine, Liftnet). Data source: [standardized size-frequency dataset](#)

Temporal patterns and trends in size distributions

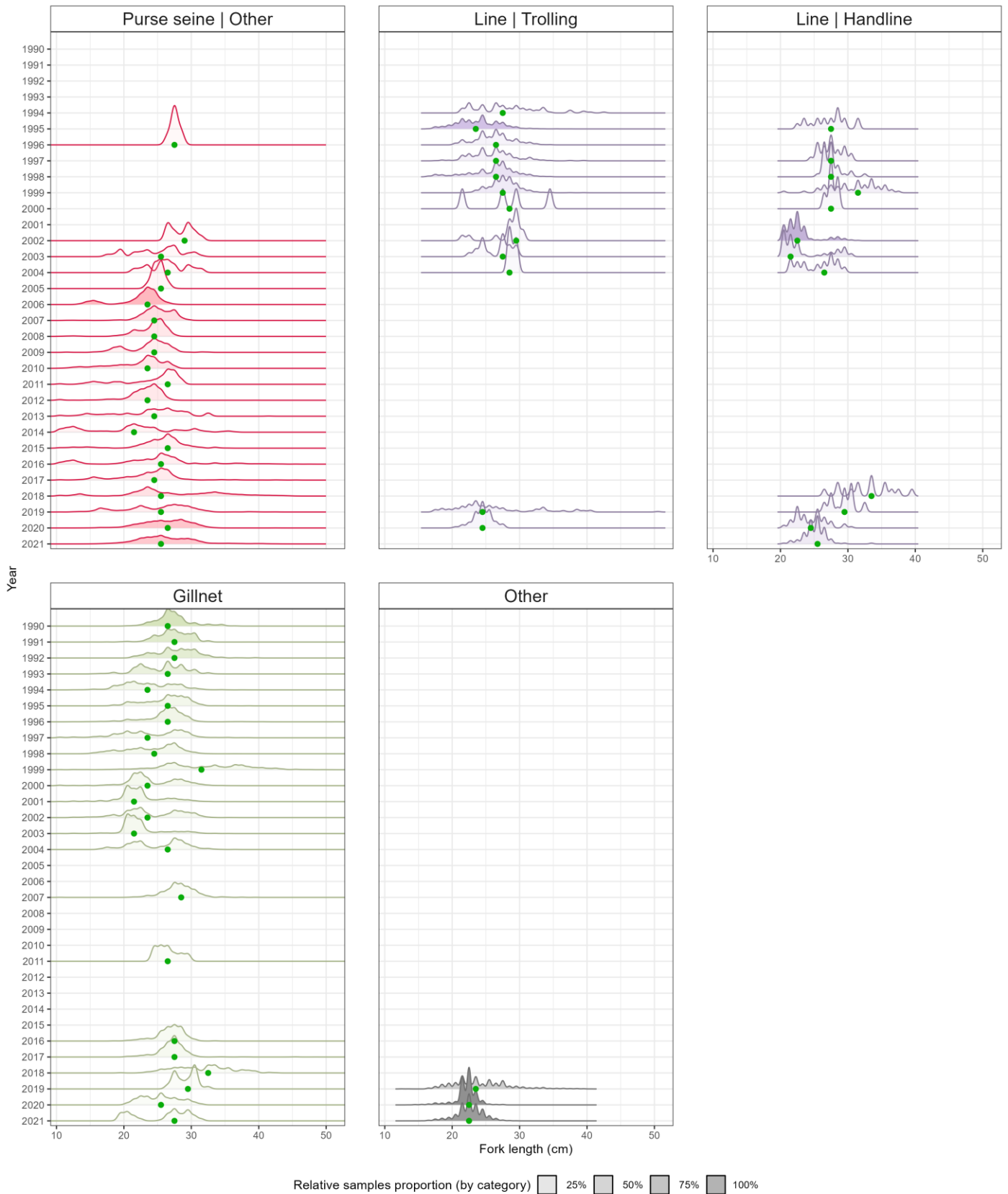


Figure 28: Relative size distribution (fork length; cm) of bullet tuna caught in coastal and ringnet purse seine fisheries (Purse seine|Other), gillnet fisheries, and other fisheries (Beach seine, Danish seine, Liftnet). Fill intensity is proportional to the number of samples recorded for the year, while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

Size distribution by fishery and fleet

Purse seine fisheries (other)

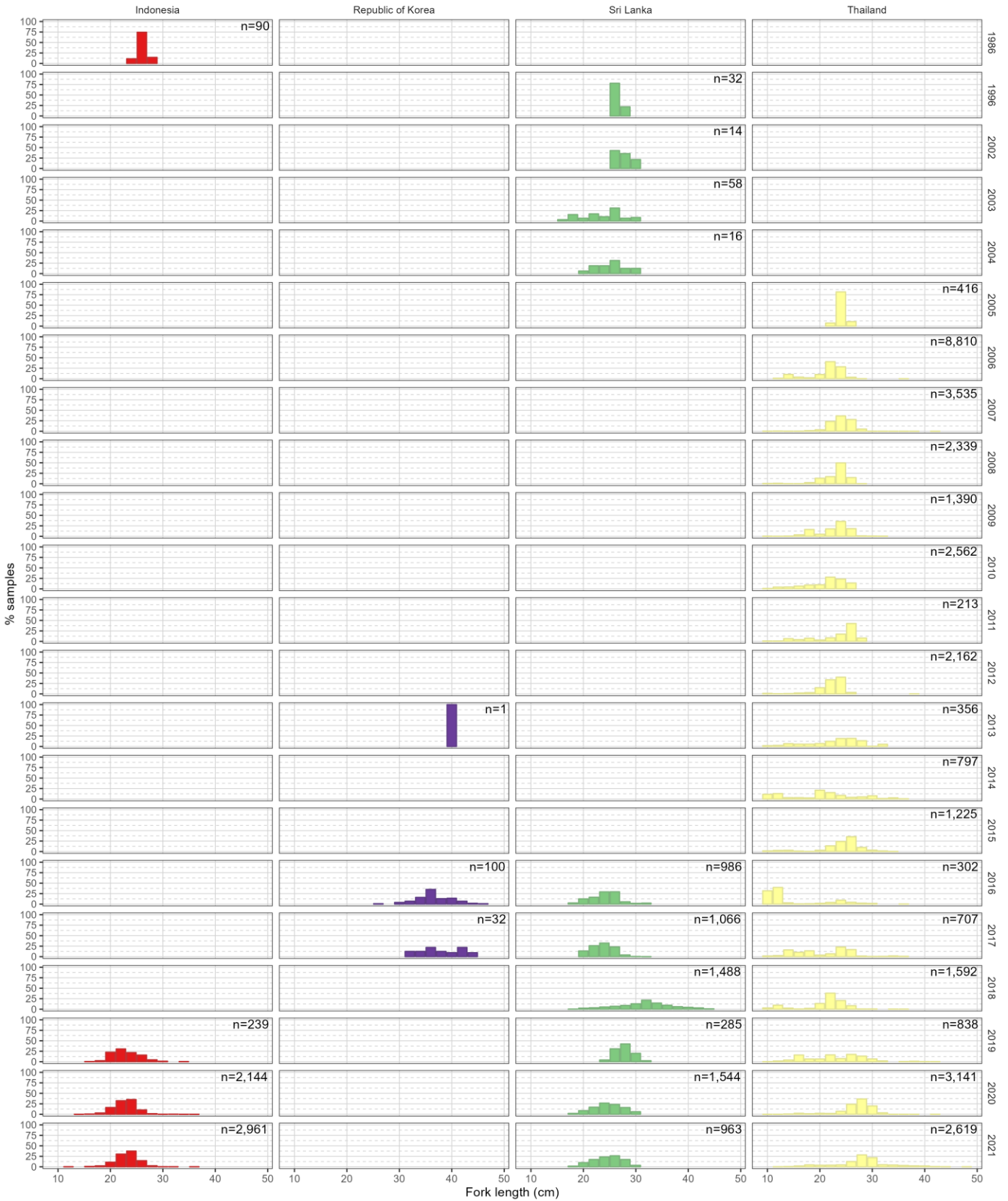


Figure 29: Relative size distribution of bullet tuna (fork length; cm) caught in coastal purse seine and ringnet fisheries (Purse seine|Other) by year and main fleet. Data source: [standardized size-frequency dataset](#)

Gillnet fisheries

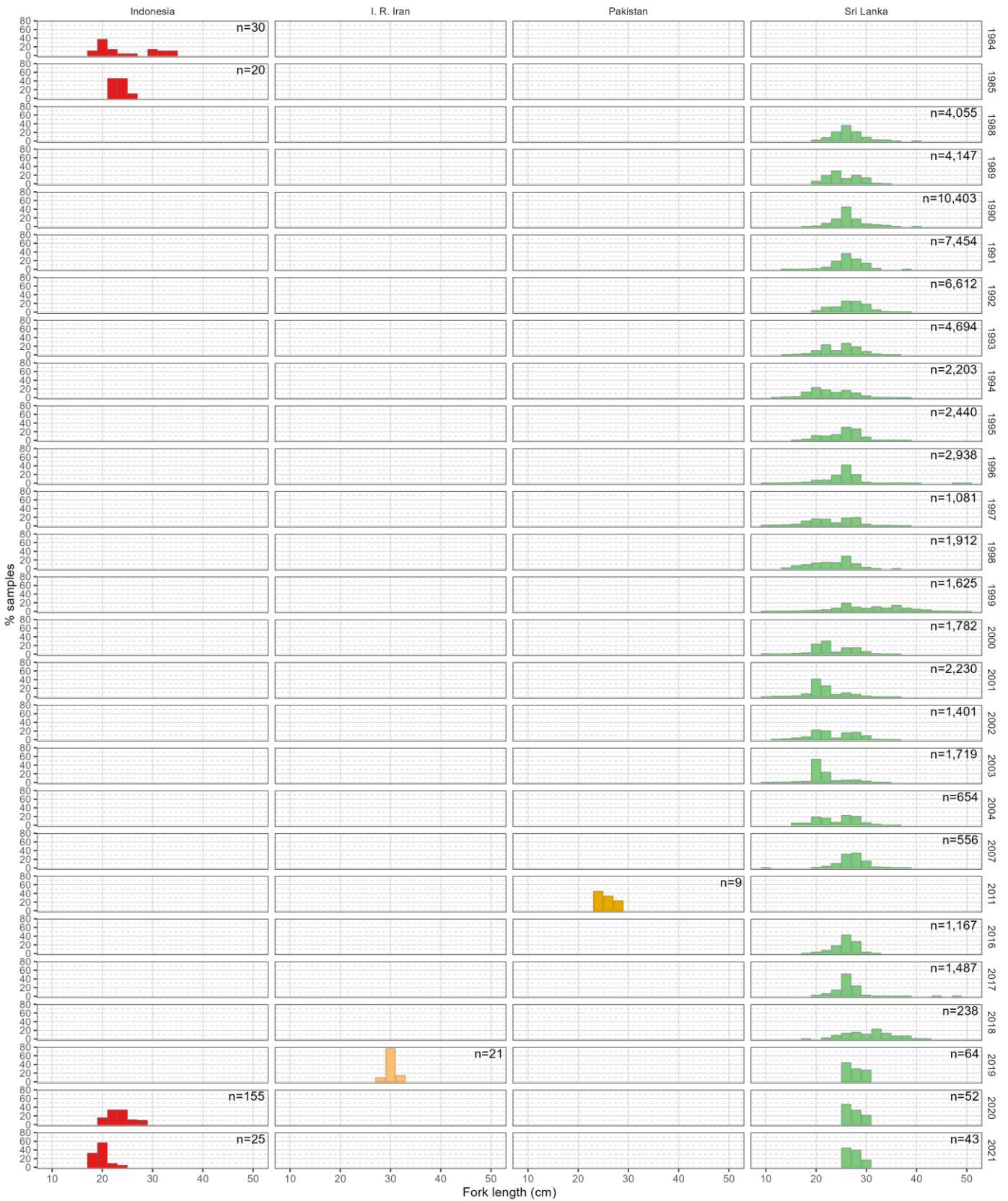


Figure 30: Relative size distribution of bullet tuna (fork length; cm) caught in gillnet fisheries by year and main fleet. Data source: [standardized size-frequency dataset](#)

Uncertainties in geo-referenced size-frequency data

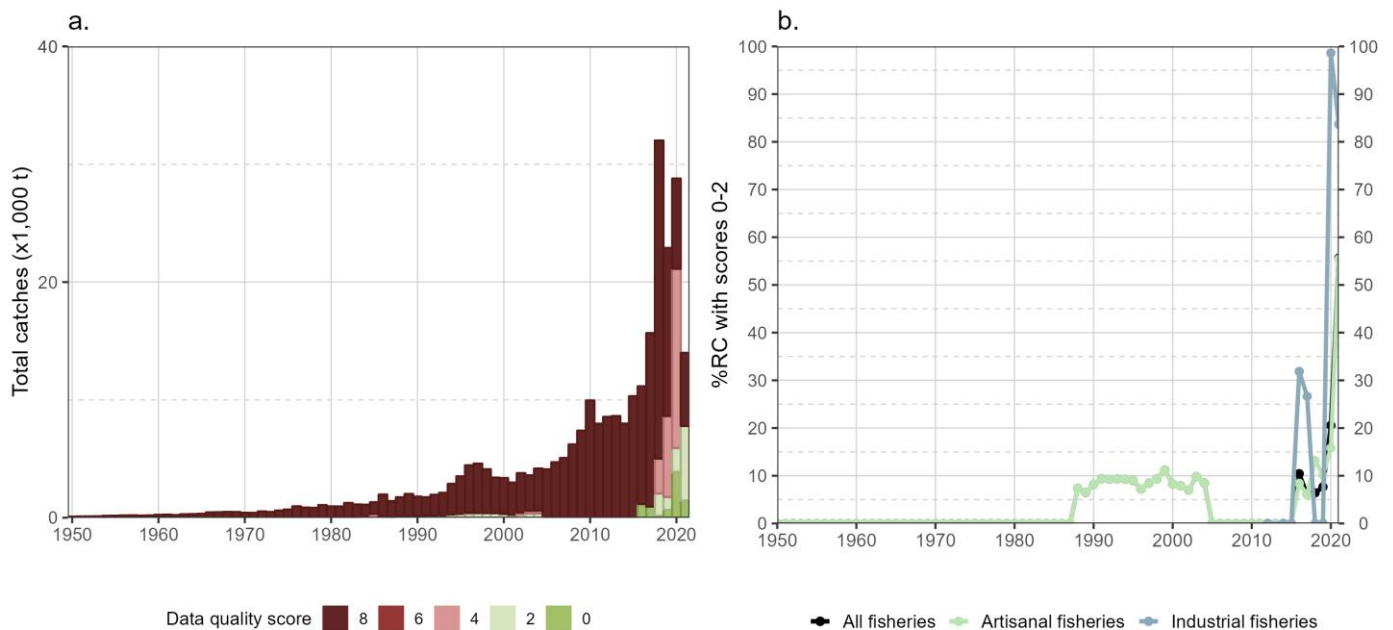


Figure 31: Annual time series of (a) cumulative retained catches (metric tonnes; t) estimated by quality score and (b) contribution of retained catches with corresponding geo-referenced size-frequency data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 to all retained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

References

Huang H-W, Liu K-M (2010) [Bycatch and Discards by Taiwanese Large-Scale Tuna Longline Fleets in the Indian Ocean](#). Fisheries Research 106:261–270.

IOTC (2023) [Review of the statistical data available for Indian Ocean neritic tuna and seerfish species under IOTC management](#). IOTC, Virtual meeting, 03-07 July 2023, p 39

Risso A (1810) [Ichthyologie de Nice, ou, Histoire naturelle des poissons du département des Alpes Maritimes](#). F. Schoell, Paris.

Ruiz J, Abascal F, Bach P, Baez J-C, Cauquil P, Grande M, Krug I, Lucas J, Murua H, Lourdes Alonso ML, Sabarros PS (2018) [Bycatch of the European, and associated flag, purse seine tuna fishery in the Indian Ocean for the period 2008-2017](#). IOTC, Cape Town, South Africa, 10-17 September 2018, p 15

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Appendix

Appendix I: Taxonomy

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 rochei</i>

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

Table 4: Changes in best scientific estimates of annual retained catches (metric tonnes; t) of bullet 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	MOZ	Gillnet	Western Indian Ocean	30	0	30
		Line	Western Indian Ocean	24	0	24
		Other	Western Indian Ocean	16	0	16
		Purse seine	Western Indian Ocean	21	0	21
2018	MOZ	Gillnet	Western Indian Ocean	29	0	29
		Line	Western Indian Ocean	49	0	49
		Other	Western Indian Ocean	27	0	27
2017	IDN	Gillnet	Eastern Indian Ocean	675	540	134
		Line	Eastern Indian Ocean	276	221	55
		Other	Eastern Indian Ocean	1,577	1,264	314
		Purse seine	Eastern Indian Ocean	324	260	64
	MOZ	Gillnet	Western Indian Ocean	42	0	42
		Line	Western Indian Ocean	67	0	67
		Other	Western Indian Ocean	36	0	36
2015	MOZ	Gillnet	Western Indian Ocean	323	0	323
		Line	Western Indian Ocean	259	0	259
2013	IDN	Gillnet	Eastern Indian Ocean	657	637	20
		Other	Eastern Indian Ocean	1,537	1,489	48
2012		Other	Eastern Indian Ocean	1,316	1,305	11
2010	MOZ	Gillnet	Western Indian Ocean	63	0	63
		Line	Western Indian Ocean	50	0	50
2008	MOZ	Gillnet	Western Indian Ocean	56	0	56
		Line	Western Indian Ocean	45	0	45