REVIEW OF THE STATISTICAL DATA AVAILABLE FOR INDIAN OCEAN NERITIC TUNA AND SEERFISH SPECIES

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Introduction

Oceanic tuna species are mostly caught by industrial fisheries in tropical waters across the world oceans and dominate the international tuna market with an annual production exceeding 5 million metric tons (IOTC 2022). In addition, several pelagic species of the Thunnini and Scomberomorini tribes sustain important commercial and subsistence fisheries in the coastal waters of many countries around the world. Information available from the FAO global capture production database indicates that catches of neritic tuna and seerfish species (i.e., *Thunnus tonggol* and 23 species of the genera Euthynnus, Auxis, and Scomberomorus) exceeded 1.9 million tons in recent years (**Fig. 1**). Assessing the importance of neritic tunas and seerfish by fishing gear and fishery at global scale is however challenging as most of these species are not monitored nor managed by any regional body in the Pacific Ocean.

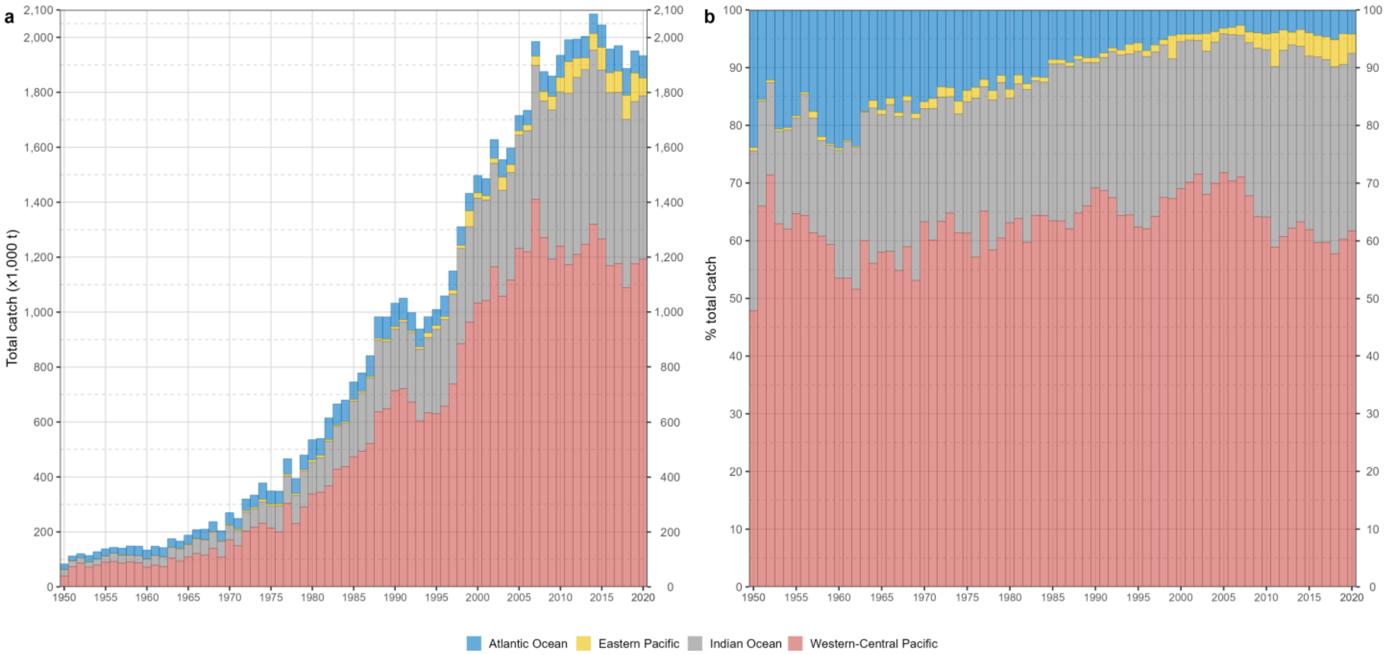

Figure 1: Annual time series of cumulative nominal catches (t) of neritic tunas and seerfish by ocean basin, 1950-2020. Source: FAO global capture production database

In the Indian Ocean, neritic tunas (i.e., bullet tuna (*Auxis rochei*), frigate tuna (*Auxis thazard*), kawakawa (*Euthynnus affinis*) and longtail tuna (*Thunnus tonggol*)) as well as the two most abundant seerfish species (i.e., narrow-barred Spanish mackerel (*Scomberomorus commerson*) and Indo-Pacific king mackerel (*Scomberomorus guttatus*)) are under the management of the Indian Ocean Tuna Commission (IOTC). The overarching objective of this paper is to provide participants at the data preparatory meeting of the 12th Session of the IOTC Working Party on Neritic Tunas (WPNT12) with a review of the status of the information available on these six species. IOTC fisheries statistics are available from 1950 but some subsistence fisheries catching neritic tunas and seerfish have been operating in some coastal areas of the Indian Ocean for centuries (e.g., Yadav et al. 2020). The document provides an overview of the data sets available to the IOTC Secretariat as of May 2022, the methods used for processing and assessing the reporting quality of the main data sets, and a description of the main trends and features of Indian Ocean neritic tunas and seerfish fisheries over the last seven decades.

Materials

Several fisheries data sets shall be reported to the IOTC Secretariat by the Contracting Parties and Cooperating Non-Contracting Parties (CPCs) as per the IOTC Conservation and Management Measures (CMMs) and following the standards and formats defined in the IOTC Reporting guidelines. Although not mandatory, the use of the IOTC forms is recommended to report the data to the Secretariat as they facilitate data curation and management.

Nominal catch data

Nominal catches correspond to the total retained catches (in live weight) per year, Indian Ocean major area, fleet, and fishing gear (IOTC Res. 15/02) and can be reported through IOTC form 1RC. In addition, in order to support the monitoring of the catch limits implemented by some industrial fisheries for the CPCs having objected to IOTC Resolution 21/01 as part of the interim plan for rebuilding the yellowfin tuna stock, IOTC Res. 19/01 requests CPCs to submit their catches of yellowfin tuna from 2019 explicitly disaggregated by vessel length and area of operation (i.e., for vessel of 24 m overall length and over, and for those under 24 m if they fish outside the Exclusive Economic Zone (EEZ) of the flag state) (IOTC Form 1RC-YFT).

Changes in the IOTC consolidated data sets of nominal catches (i.e., raw and best scientific estimates) may be required as a result of:

i. updates received by December 30th each year, of the preliminary data for longline fleets submitted by June 30th of the same year (IOTC Res. 15.02);

ii. revisions of historical data by CPCs following corrections of errors, addition of missing data, changes in data processing, etc.

iii. changes in the estimation process performed by the Secretariat based on evidence of improved methods and/or assumptions (e.g., selection of proxy fleets, updated morphometric relationships) and upon endorsement by the Scientific Committee.

Geo-referenced catch and effort data

Catch and effort data refer to finer-scale data, usually from logbooks, reported in aggregated format and stratified per year, month, grid, fleet, gear, type of school, and species (IOTC Res. 15/02). The IOTC forms designed for reporting geo-referenced catch and effort data vary according to the nature of the fishing gear (e.g., surface, longline, and coastal gears). In addition, information on the use of fish aggregating devices (FADs) and activity of the support vessels that assist industrial purse seiners also has to be collected and reported to the Secretariat through IOTC forms 3FA and 3SU.

Discard data

The IOTC follows the definition of discards adopted by FAO in previous reports (Alverson et al. 1994, Kelleher 2005) which considers all non-retained catch, including individuals released alive or discarded dead. Estimates of total annual discard levels in live weight (or number) by Indian Ocean major area, species and type of fishery shall be reported to the Secretariat as per IOTC Res. 15/02. The IOTC form 1DI has been designed for the reporting of discards and the data contained shall be extrapolated at the source to represent the total level of discards for the year, gear, fleet, Indian Ocean major area, and species concerned, including turtles, cetaceans, and seabirds.

Nevertheless, discard data reported to the Secretariat with IOTC Form 1DI are generally scarce, not raised, and not complying with all IOTC reporting standards. For these reasons, the most accurate information available on discards comes from the IOTC Regional Observer Scheme (IOTC Res. 11/04) that aims to collects detailed information (e.g., exact location in space and time of the sets and interactions, including the fate of observed individuals) on discards of IOTC and bycatch species for industrial fisheries (see below).

Size frequency data

The size composition of catches may be derived from the data set of individual body lengths or weights collected at sea and during the unloading of fishing vessels. The IOTC Form 4SF provides all fields requested for a complete reporting of size frequency data to the stratification by fleet, year, gear, type of school, month, grid and species as required by IOTC Res. 15/02. While the great majority of size data reported through IOTC Form 4SF are for retained catches, CPCs can also use the same form to report size data of discarded individuals. Furthermore, additional size data (including those for individuals discarded at sea) may be collected through onboard observer programs and reported to the Secretariat as part of the ROS (see below).

Socio-economic data

Little information is available on the socio-economic dimension of fisheries catching neritic tunas and seerfish in the Indian Ocean. The majority of the catches is sold locally, in raw or processed form (e.g., local canneries), or exported to markets in neighboring countries. In addition, a small component of the catches of neritic tunas, in particular longtail tuna, is exported to the European Union (EU) or other markets in the region (e.g., Saudi Arabia, Sri Lanka).

The IOTC Form 7PR has been designed to voluntarily report prices of fish per type of product and market but little data have been received so far at the Secretariat with the notable exception of time series of monthly prices by species, fishing gear, and region reported by Oman since 2015 (Appendix I), and Malaysia since 2018. In addition, some information on the value of marine fishery landings has been collected by the Southeast Asian Fisheries Development Center (SEAFDEC) since the late 1970s. Annual price data (USD) for some neritic tunas and seerfish are available for Thailand between 2009 and 2017 but the information remains sparse and mostly indicative of the differences of value between species as the series are not complete.

The Fisheries Development Division of the Pacific Islands Forum Fisheries Agency (FFA) has been collating monthly time series of fuel price which is a major driver of costs in high seas fisheries and considered a good proxy of fishing costs (Sala et al. 2018), with the assumption that real non-fuel fishing costs have remained constant over time (Ruaia et al. 2020). The crude oil spot price, computed as the arithmetic average of the spot price of Brent, Dubai, and West Texas, provides a global index of the value of fuel for fishing vessels as crude oil forms the basis for most fuels used in most fishing vessels (e.g., marine diesel oil). The time series of fuel price is given in Appendix II.

Regional Observer Scheme

Resolution 11/04 on the ROS makes provision for the development and implementation of national observer schemes among the IOTC CPCs starting from July 2010 with the overarching objective of collecting *“verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence”*. The ROS aims to cover *“at least 5% of the number of operations/sets for each gear type by the fleet of each CPC while fishing in the IOTC Area of competence of 24 meters overall length and over, and under 24 meters if they fish outside their EEZs shall be covered by this observer scheme”*. Observer data collected as part of the ROS include: (i) fishing activities and vessel positions, (ii) catch estimates with a view to identifying catch composition and monitoring discards, bycatch, and size frequency, (iii) gear type, mesh size and attachments employed by the master, and (iv) information to enable the cross-checking of entries made to the logbooks (i.e., species composition and quantities, live and processed weight and location). In addition, the ROS database includes morphometric data (i.e., lengths and weights) collected at sea by fisheries observers which are of particular interest for deriving morphometric relationships. A full description of the ROS data requirements for each fishing gear is provided in IOTC (2021a).

A comprehensive description of the status, coverage, and data collected as part of the ROS is provided in IOTC (2021b). Although incomplete and characterized by a large variability in coverage between fisheries and over space and time, observer data include information on the fate of the catches (i.e., retained or discarded at sea) as well as on the condition of the discards. Observer data are also the main source of spatial information on interactions between IOTC fisheries and seabirds, marine turtles, cetaceans, as well as any other species encountered.

To date, the ROS regional database contains information for a total of 1,583 commercial fishing trips (886 from purse seine vessels and 697 from longline vessels of various types) made during the period 2005-2020 from 7 fleets: Japan, EU,France and Sri Lanka for longline fisheries and EU,Spain, EU,France, Japan, Korea, Mauritius, and Seychelles for purse seine fisheries. In addition, some observer reports have been submitted to the Secretariat by some CPCs (e.g., Taiwan,China) but data sets were not provided in electronic format at the operational level following the ROS standards, *de facto* preventing the entry of these data in the ROS regional database.

Morphometric data

Different length-length and length-weight relationships have been estimated for Indian Ocean neritic tunas based on morphometric data collected through fisheries monitoring programs and research projects (**Table 1**).

Table 1: Summary of IOTC reference morphometric relationships for Indian Ocean neritic tunas and seerfish. L_{fork} = fork length (cm); W_{round} = round weight (kg). Source: IOTC-2022-WPNT12-DATA11

Species	Equation	MinFL	MaxFL	a	b
Bullet tuna	RD=a*FL^b	10	40	1.7000e-05	3.0000
Kawakawa	RD=a*FL^b	20	65	2.6000e-05	2.9000
Frigate tuna	RD=a*FL^b	20	45	1.7000e-05	3.0000
Longtail tuna	RD=a*FL^b	29	128	2.0000e-05	2.8300
Narrow-barred Spanish mackerel	RD=a*FL^b	20	200	1.1760e-05	2.9002
Indo-Pacific king mackerel	RD=a*FL^b	20	80	1.0000e-05	2.8940

Methods

The release of the curated public-domain data sets for neritic tuna and seerfish species is done following some processing data steps which are briefly summarized below.

Data processing

First, standard controls and checks are performed to ensure that the metadata and data submitted to the Secretariat are consistent and include all mandatory fields (e.g., dimensions of the strata, etc.). The controls depend on each data set and may require the submission of revised data from CPCs if the original one is found to be incomplete.

Second, a series of processing steps is applied to derive the best scientific estimates of nominal catches for the 16 IOTC species (see **Appendix V** of IOTC (2014)), by implementing the following rules:

a. When nominal catches are not reported by a CPC, catch data from the previous year may be repeated or catches may be derived from a range of sources, e.g., partial catch and effort data, the FAO FishStat database, data on imports of tropical tunas from processing factories collaborating with the International Seafood Sustainability Foundation, etc.;

b. For some specific fisheries characterized by well-known, outstanding issues in terms of data quality, a process of re-estimation of species and/or gear composition may be performed based on data available from other years or areas, or by using proxy fleets, i.e., fleets occurring in the same strata which are assumed to have a very similar catch composition, e.g., Moreno et al. (2012) and IOTC (2018);

c. Finally, a disaggregation process is performed to break down the catches by species and gear when they are reported as aggregates (IOTC 2016). Briefly, the process derives the catch proportion of each IOTC species of an aggregate in a given stratum from past reports of catches where the species and gears were reported separately following a substitution scheme.

A total of 9 species aggregates including IOTC neritic tuna and seerfish species have been used by some CPCs for reporting nominal catch data between 1950 and 2020 (**Table 2**).

Table 2: Species groups including neritic tuna and seerfish species used for reporting nominal catches to the IOTC Secretariat

Species code	Species name	BLT	COM	FRI	GUT	KAW	LOT
AG06	Kawakawa, frigate and bullet tunas	✓		✓		✓	
AG07	Longtail tuna and kawakawa					✓	✓
AG09	Wahoo and seerfishes nei		✓		✓		
AG10	Skipjack tuna and kawakawa					✓	
FRZ	Frigate and bullet tunas	✓		✓			
KGX	Seerfishes nei		✓		✓		
TUN	Tunas nei	✓		✓		✓	✓
TUS	True tunas nei						✓
TUX	Tuna-like fishes nei	✓	✓	✓	✓	✓	✓

A total of 6 gear aggregates including IOTC neritic tuna and seerfish species have been used by some CPCs for reporting nominal catch data between 1950 and 2020 (**Table 3**).

Table 3: List of gear aggregates with their component gear codes (limited to gear aggregates that have reported catches of neritic tunas)

Aggr. code	Gear aggregate	Category	BB	GILL	HAND	LIFT	LL	LLCO	PS	PSS	RR	SPOR	TRAW	TROL
BBPS	Baitboat and purse seine	Baitboat	✓						✓					
GIHT	Gillnet and hand line and troll line	Gillnet		✓	✓									✓
HATR	Hand line and Troll line	Trolling			✓									✓
HOOK	Hook and line	Trolling			✓			✓						✓
LLTR	Coastal Longline and Troll line combination	Longline						✓						✓
UNCL	Unclassified	Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Details on the results of the estimation process for deriving the 2020 best scientific estimates and changes in time series of nominal catches relative to the previous Working Party on Neritic Tunas are provided in Appendix III and Appendix IV, respectively.

Third, and applying to all 16 IOTC species plus the most common shark species, filtering and conversions are applied to the size-frequency data in order to harmonize their format and structure and remove data which are non compliant (at the source) with IOTC standards, e.g., because provided with size bins exceeding the maximum width considered meaningful for the species (IOTC 2020).

Fourth, and applying to all 16 IOTC species plus the most common shark species defined in the appendices of IOTC Resolution 15/01, filtering and conversions are applied to the size-frequency data in order to harmonize their format and structure and remove data which are non-compliant with IOTC standards, e.g., when provided with size bins exceeding the maximum width considered meaningful for the species (IOTC 2020). The standard length measurements considered at IOTC are the eye fork length (EFL; straight distance from the orbit of the eye to the fork of the tail) for black and blue marlins and the fork length (FL; straight distance from the tip of the lower jaw to the fork of the tail) for all other species subject to mandatory size measurements (IOTC 2020). All size samples collected using other types of measurements are converted into FL and EFL by using the IOTC equations, considering size range and intervals that may vary with species. If no IOTC-endorsed equations exist to convert from a given length measurement for a species to the standard FL and EFL measurements, the original size data are not disseminated but kept within the IOTC databases for future reference.

Data quality

A scoring system has been designed to assess the reporting quality of nominal catch, catch-effort, and size-frequency data submitted to the Secretariat for all IOTC species. The determination of the score varies according to each type of data set and aims to account for reporting coverage and compliance with IOTC reporting standards (**Table** 4). Overall, the lower the score, the better the quality. It is to note that the quality scoring does not account for sources of uncertainty affecting the data such as issues in sampling and processing as well as under- or misreporting.

Table 4: Key to IOTC quality scoring system

Data set	Criterion	By species	By gear
Nominal catch	Fully available	0	0
	Partially available	2	2
	Fully estimated	4	4
Catch and effort	Available according to standards	0	0
	Not available according to standards	2	2
	Low coverage (<30% logbooks)	2	
	Not available	8	
Size frequency	Available according to standards	0	0
	Not available according to standards	2	2
	Low coverage (<1 fish per ton caught)	2	
	Not available	8	

Results

Nominal catches & discards

The best scientific estimates of nominal catches provide a decadal view on the history of the fisheries catching neritic tuna and seerfish species in the Indian Ocean. These species are caught with a large diversity of fishing gears all over the Indian Ocean although catch levels appear to decrease with latitude and very few catches have been reported over time from the coastal waters of South Africa and Australia.

Historical trends (1950-2020)

The contribution of catches of neritic tunas and seerfish to total catches of IOTC species in the Indian Ocean has changed substantially over the last decades in relation with the development and expansion of coastal and industrial fisheries, e.g., with the arrival of industrial purse seine fleets to the Indian Ocean in the early-1980s, which saw an increase in targeting of tropical tunas (**Fig. 2**). In recent years, the six species of neritic tuna and seerfish under IOTC mandate represented about one third of the total catches of IOTC species.

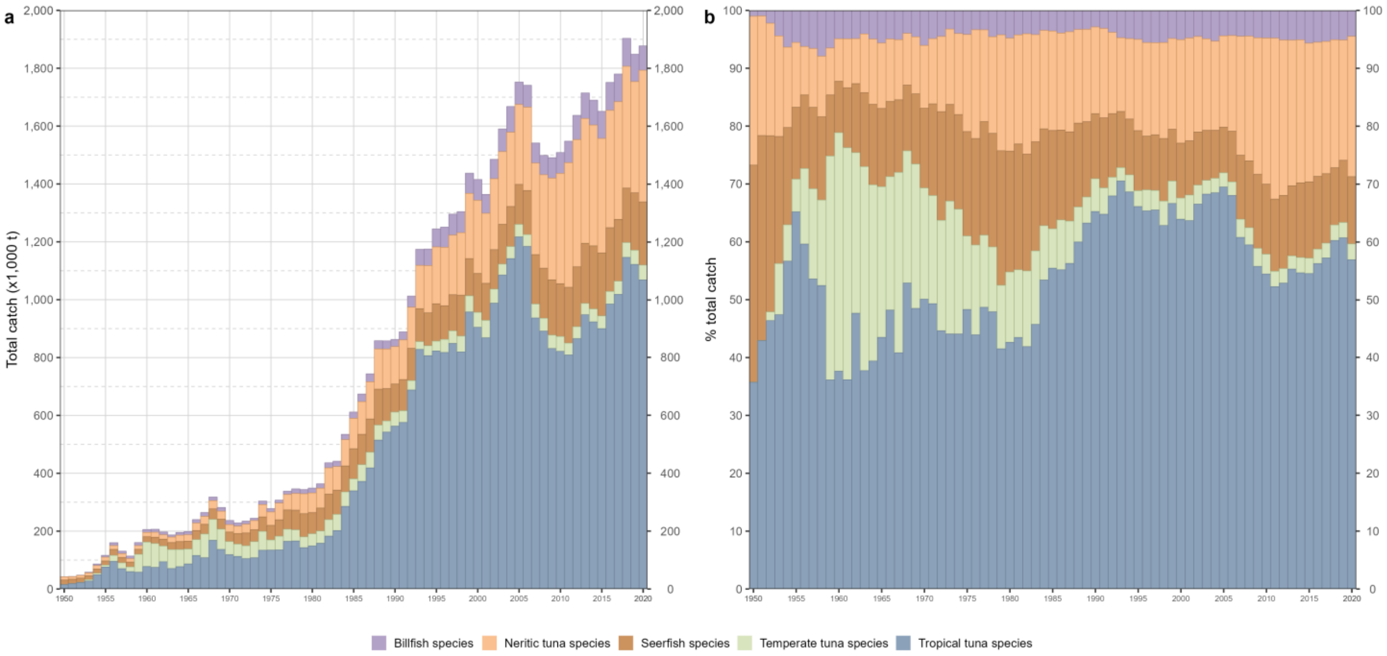

Figure 2: Annual time series of (a) cumulative nominal absolute and (b) relative catches (t) of all IOTC tuna and tuna-like species by species category for the period 1950-2020

The total nominal catches of the IOTC neritic tuna and seerfish species showed a major increase over the last seven decades, from less than 34,000 t in the 1950s to a maximum of about 673,000 t in 2020 (**Fig. 3**). Neritic tuna and seerfish species are mainly caught using drifting gillnets and purse seine nets in coastal waters where they are also caught using troll lines, hand lines, small longlines and other gears (e.g., beach seines). Very few catches are reported for pole and line and high seas longline fisheries (**Fig. 3**).

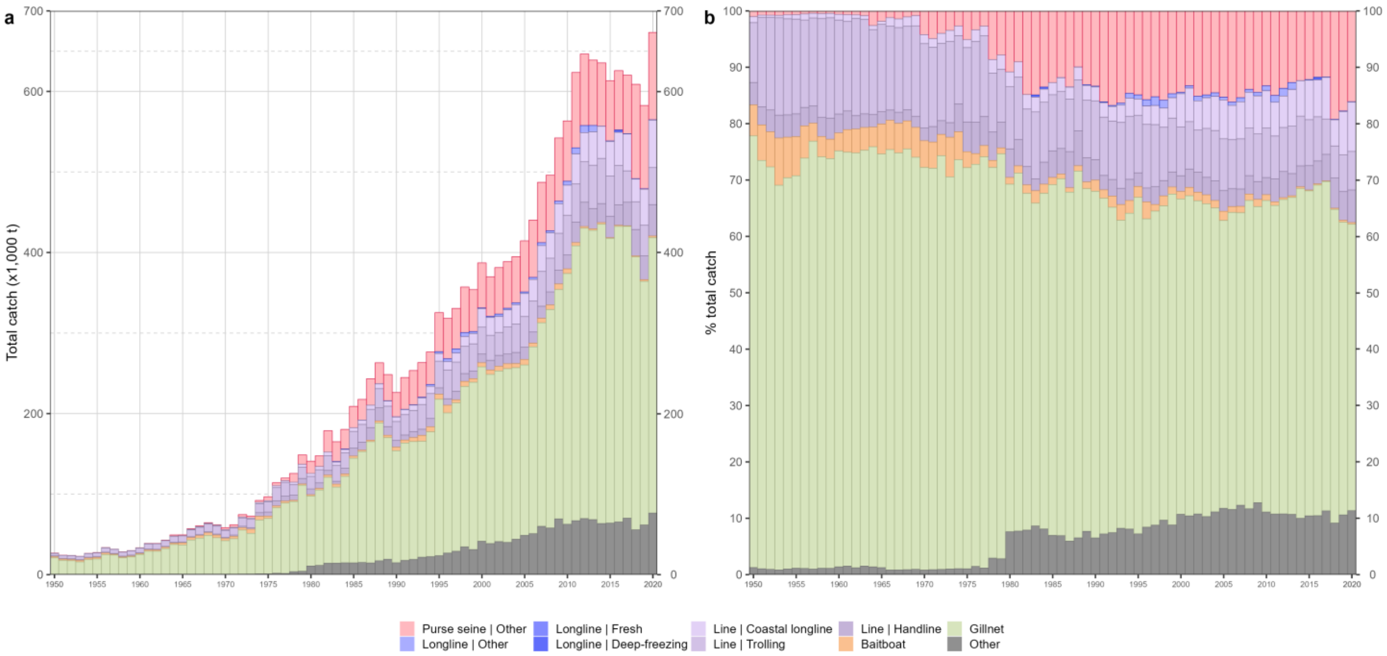

Figure 3: Annual time series of (a) cumulative nominal absolute and (b) relative catches (t) of IOTC neritic tunas and seerfish by fishery for the period 1950-2020

About 17.8 million metric tons of neritic tunas and seerfish have been reported to have been caught in the Indian Ocean since the 1950s, with narrow-barred Spanish mackerel being the main contributor with about 5.3 million tons caught between 1950 and 2020 (**Fig. 4**). Kawakawa and longtail tuna contributed about equally with cumulative catches of about 4.1 and 3.8 million tons of fish taken during that period, respectively, while catches of frigate tuna and Indo-Pacific king mackerel were lower with about 2.8 and 1.6 million tons, respectively. Bullet tuna represents the smallest component of the IOTC neritic species with a cumulative catch of about 0.3 million tons between 1950 and 2020 (**Fig. 4**).

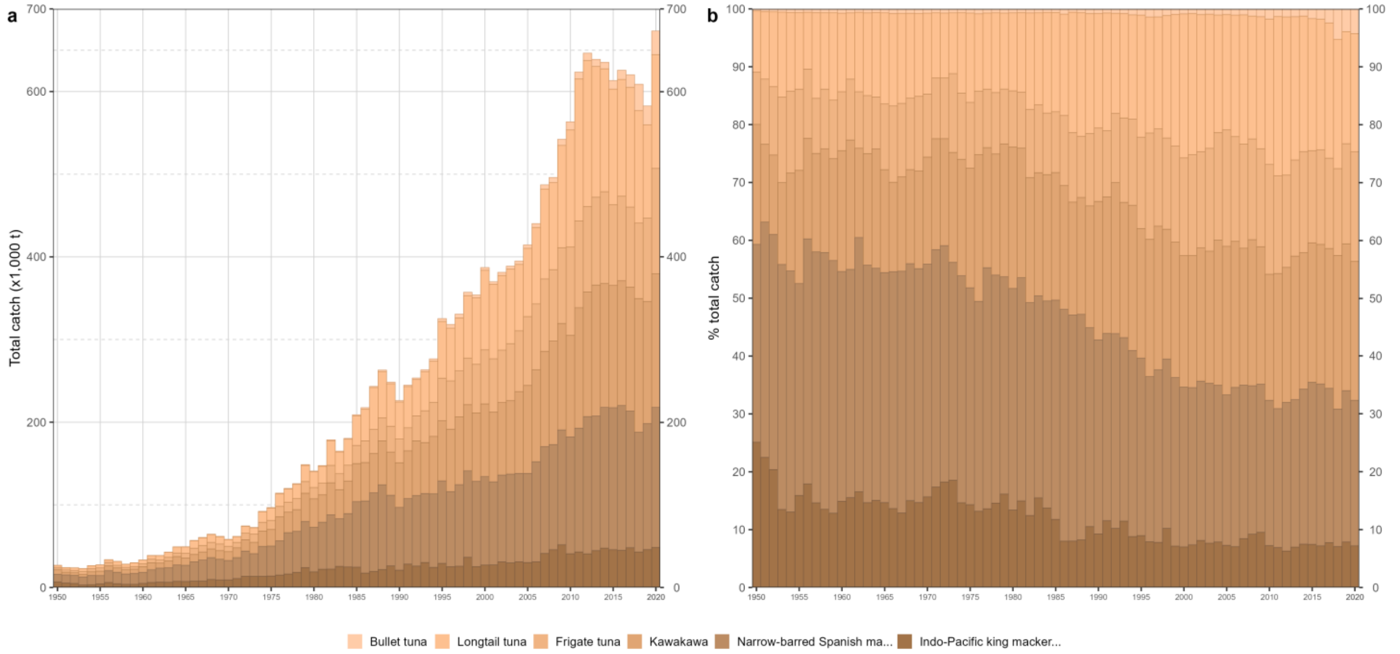

Figure 4: Annual time series of (a) cumulative nominal absolute and (b) relative catches (t) of IOTC neritic tunas and seerfish by species for the period 1950-2020

Each of the six IOTC neritic tuna and seerfish species showed an increasing trend in nominal catches over time until recent years (**Fig. 5**). Following a period of steady increase for almost seven decades, the cumulative nominal catch of all species reached a peak at 646,000 t in 2012, before declining down to 583,000 t in 2019. This decrease - which concerned longtail tuna, frigate tuna, and (to a lesser extent) narrow-barred Spanish mackerel - has been essentially driven by the reduction of the catches of gillnetters from I.R. Iran and Pakistan and small-scale purse seiners from Malaysia (see Recent fishery features).

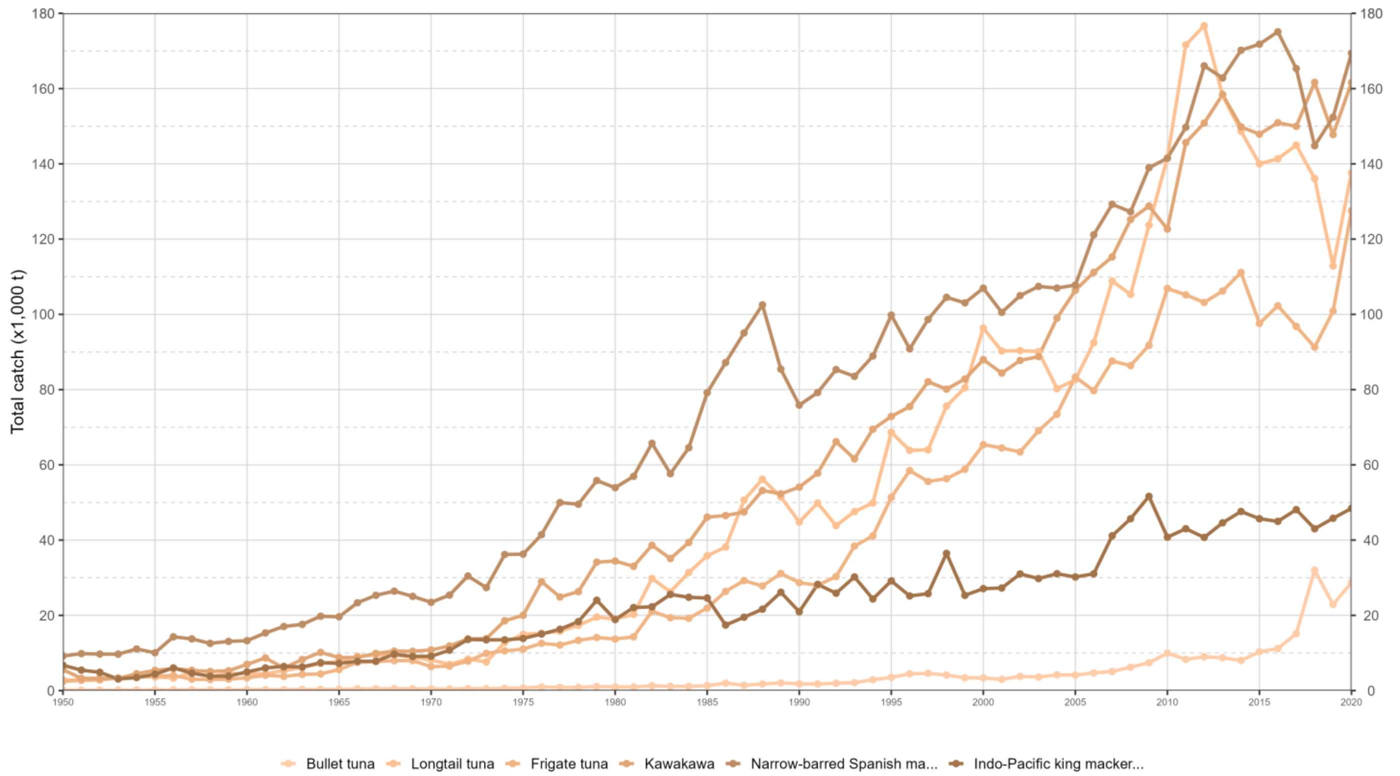

Figure 5: Annual time series of nominal catches (t) of IOTC neritic tunas and seerfish by species for the period 1950-2020

Recent fishery features (2016-2020)

In recent years (2016-2020), total annual nominal catches of the IOTC neritic tuna and seerfish species were about 622,000 t, with gillnet, line (including handline, coastal longline and trolling), and purse seine fisheries contributing to 55.1%, 18.6%, and 15.3% of all catches, respectively (**Table 5**).

Table 5: Mean annual nominal catches (t) of the IOTC neritic tunas and seerfish between 2016 and 2020

Fishery	Fishery code	Catch	Percentage
Gillnet	GN	342,543	55.1
Purse seine | Other	PSOT	95,127	15.3
Other	OT	65,845	10.6
Line | Coastal longline	LIC	43,727	7.0
Line | Trolling	LIT	41,305	6.6
Line | Handline	LIH	31,153	5.0
Baitboat	BB	1,489	0.2
Longline | Deep-freezing	LLD	575	0.1
Longline | Fresh	LLF	388	0.1
Longline | Other	LLO	0	0.0

Between 2016 and 2020, the mean annual catches of the IOTC neritic tunas and seerfish have been dominated by a few CPCs, to the point that almost 70% of all catches was accounted for by three distinct fleets: Indonesia and India, which are characterized by a large diversity of coastal gears and fisheries, and I.R. Iran, where gillnet represents the large majority of the catches (**Fig. 6**).

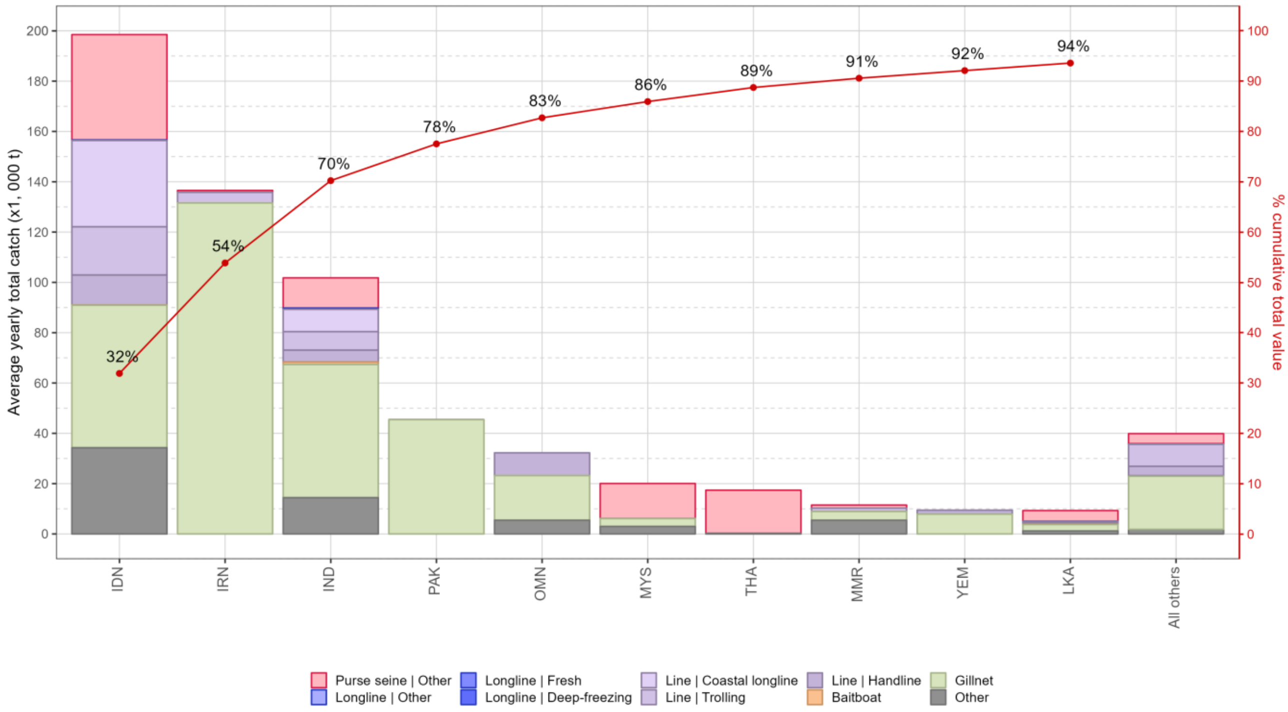

Figure 6: Mean annual catches (t) of the IOTC neritic tunas and seerfish by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

Over that period, the total gillnet catches showed a substantial decline between 2016 to 2019 before increasing in 2020 (**Fig. 7**). In 2020, the total catches of IOTC neritic and seerfish species from gillnet fisheries was 342,000 t. Catches from line fisheries increased in recent years to reach 144,000 t while purse seine catches remained at relatively stable levels at around 110,000 t between 2018 and 2020 (**Fig. 7**).

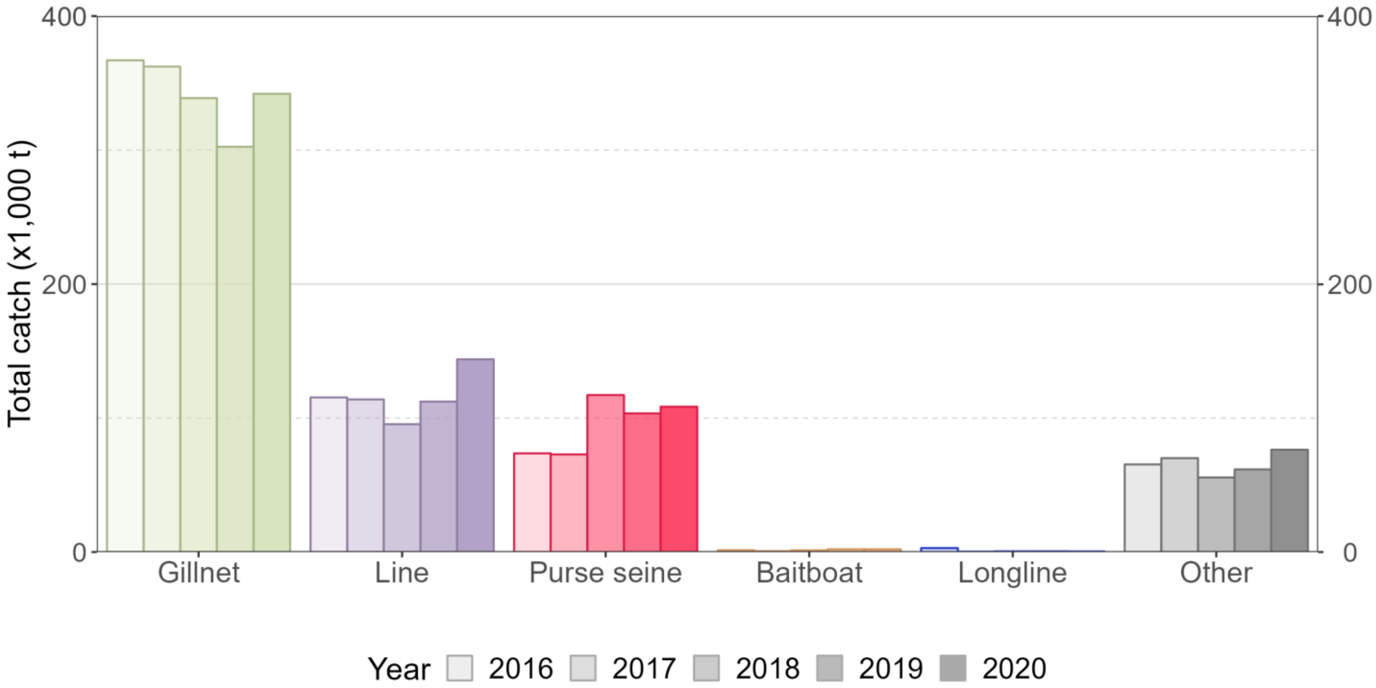

Figure 7: Annual catch trends (t) of IOTC neritic tunas and seerfish by fishery group between 2016 and 2020

The decline in gillnet catches has been particularly marked in Pakistan between 2017 and 2019, in relation with an extended fishing closure, volatility in sale price and reduced demand from the Iranian market, and poor environmental conditions that prevailed in 2019 (Moazzam 2021). Besides, catches of neritic and seerfish species decreased for Sri Lanka, India, and Bangladesh. By contrast, Oman, Indonesia, Malaysia, and I.R Iran reported an increase in catch of neritic and seerfish species in 2020 as compared to 2019 for their gillnet fisheries (**Fig. 8a**). Similarly, line fisheries of Indonesia and Oman showed a substantial increase of catch between 2019 and 2020 (**Fig. 8b**).

Purse seine fisheries also recorded an increase in catch of neritic and seerfish for the year 2020, which was mostly driven by Thailand that recently contributed to more than one fourth of the purse seine catch of all IOTC neritic species (**Fig. 8c**). This might be potentially due to the increase in size of the vessels operating in Thailand coastal waters, and indeed the number of boats with a gross tonnage (GT) capacity of over 150 increased from 17 in 2017 to 20 in 2020, while the number of smaller vessels described by a capacity of less than 20 GT decreased from 17 to 1 over the same period (Nootmorn et al. 2021). Catches of neritic species in longline and baitboat fisheries appear to be very low and dominated by India (**Fig. 8d-e**).

Finally, a large amount of catches (>70,000 t during the period 2016-2020) comes from the fisheries with other gears (e.g., beach seine, liftnet) that mostly occur in the coastal areas of Indonesia, India, Oman, and Myanmar. Between 2019 and 2020 catches of neritic and seerfish from other gears significantly increased in Oman and Indonesia while they showed a decline in India (**Fig. 8f**).

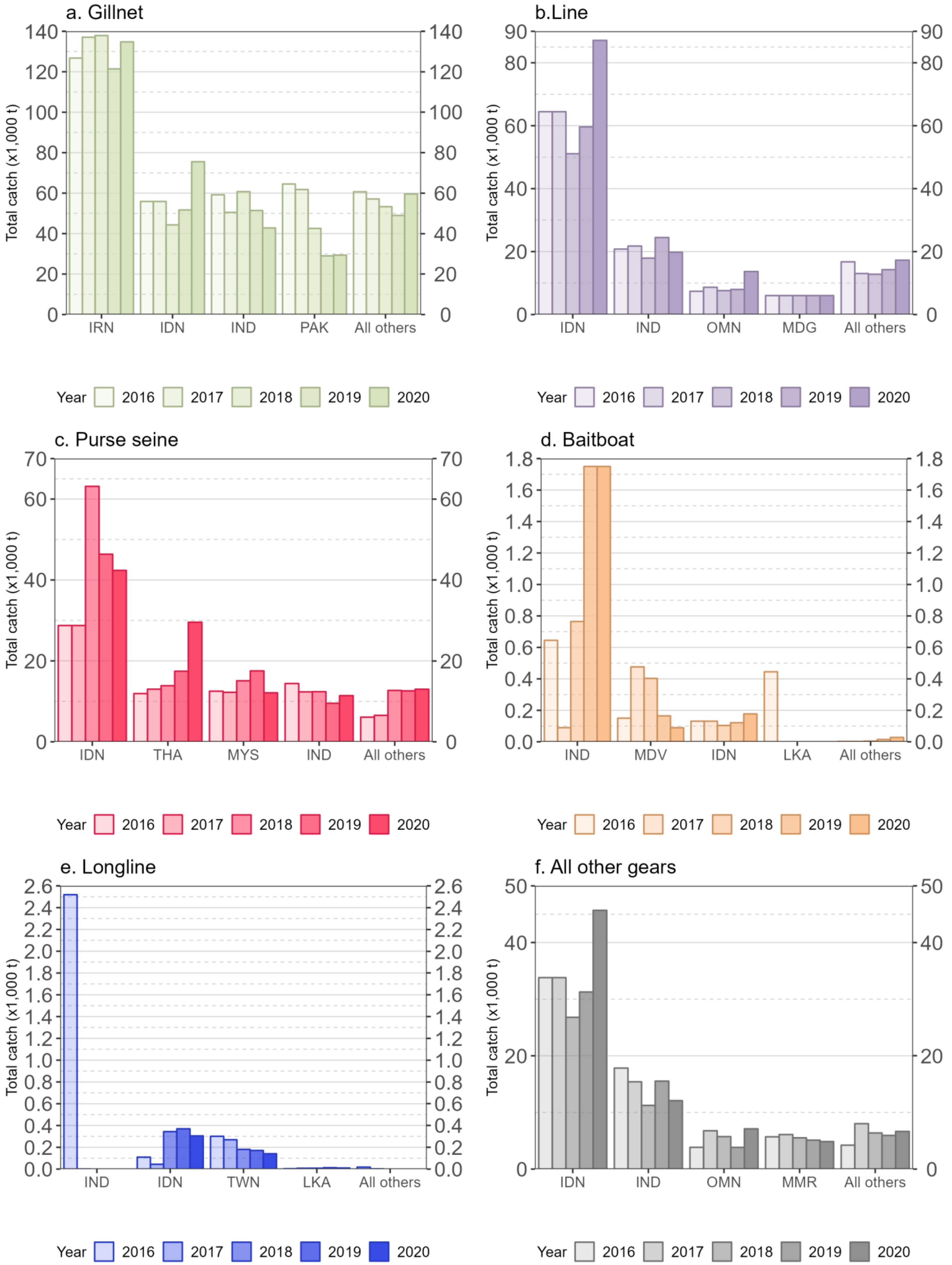

Figure 8: Annual catch trends (t) of IOTC neritic tunas and seerfish by fishery group and fleet between 2016 and 2020

Changes from previous WPNT

Relatively limited changes occurred in the time series of catches of neritic and seerfish species since the release of the data set of best scientific estimates of nominal catches covering the period 1950-2019 and prepared for the 12th session of the Working Party on Neritic Tunas held in July 2021 (WPNT11). The changes concerned the period 2012-2019 following data revisions submitted to the Secretariat by some CPCs as well as from updates in the time series of the FAO global capture production database. Except for 2012, these updates resulted in an overall decrease in total catches of neritic and seerfish species between 2013 and 2019 (**Fig. 9**).

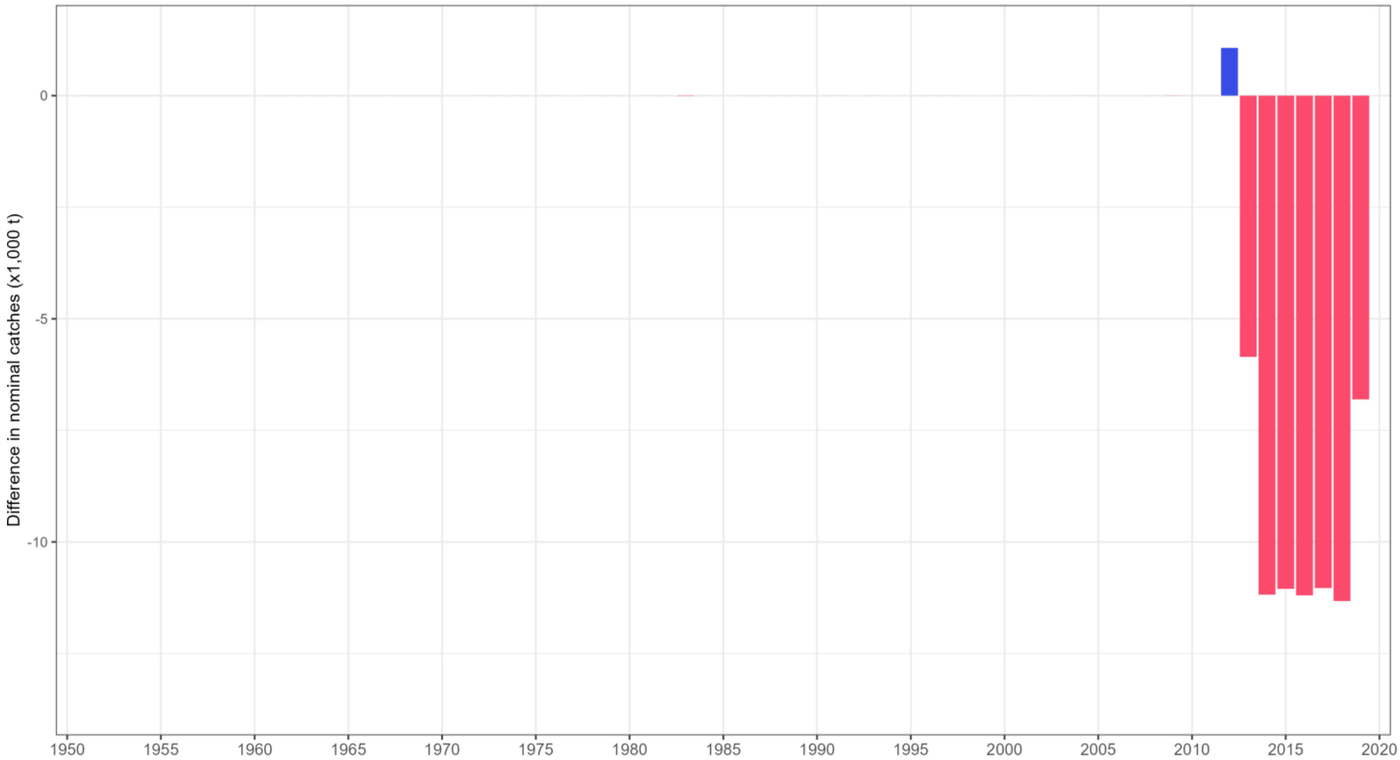

Figure 9: Differences in the available best scientific estimates of nominal catches (t) of neritic tuna and seerfish between this WPNT and its previous session (July 2021)

The decrease in catch is mostly attributed to non-member countries (United Arab Emirates, Egypt, and Jordan) that catch neritic and seerfish species in the coastal waters of the Indian Ocean. In 2020 United Arab Emirates revised their historical catches reported to FAO, which resulted in a significant decline of catches of narrow-barred Spanish mackerel by around 10,000 t annually from 2014 onwards. Communication from United Arab Emirates stated that the change in catch data was due to a recent regulation measure put in place to conserve narrow-barred Spanish mackerel. Some revisions were also included in the new data set for the period 2014-2019 for the fisheries of Mayotte, Mozambique, and Sudan, including the displacement of catches from the Western area to the Eastern area of the Indian Ocean due to improved reporting of geo-referenced catch data, such as in the case of Sri Lankan gillnet and purse seine fisheries (Appendix II).

Uncertainties in nominal catch data

Overall, total estimated catches for neritic species in the Indian Ocean are considered to be highly uncertain. The majority of catches of neritic species in the Indian Ocean are caught within the areas of national jurisdiction of the coastal states, typically by small-scale or artisanal fisheries, which creates considerable challenges in terms of collecting reliable information from the diversity of vessels and fisheries operating in coastal waters. Difficulties in data collection are further compounded by species misidentification, particularly of juvenile tunas, that can lead to dramatic changes in catches by species between years.

In addition, a common problem through the region is the aggregation of neritic species under a common label. Small or juvenile neritic tunas are often also treated commercially as the same species – particularly in the case of frigate and bullet tuna – which are often reported to the Secretariat as species aggregates or commercial categories and therefore require disaggregation in order to produce estimates by species. Recently, Thailand started to breakdown the catch of combined frigate and bullet tuna to individual species, whereby the catches of bullet tuna increased from about 3,000 t in 2018 to 15,000 t in 2020. Likewise, catches of narrow-barred Spanish mackerel and Indo-Pacific king mackerel are often combined and reported to the IOTC Secretariat as species aggregates of seerfish.

Annual changes in the composition of nominal catches by quality score provide some insight into the level of uncertainty of the data available at the IOTC Secretariat. The quality scores of the nominal catches of the six IOTC neritic tunas and seerfish reflect the amount of catches that has to be estimated by the Secretariat to account for non-reporting of data, estimation of species and gear composition in the case of reporting of aggregate gears and species, and outstanding issues in data quality for some major countries such as Indonesia and India. The percentage of nominal catches fully or partially reported to the Secretariat (i.e., with a quality score between 0 and 2) oscillates between 35% and 65% of the total catches over time, with an encouraging increasing trend since the mid-1990s until 2019 and 2020, when reporting quality decreased again, most likely as a consequence of the COVID pandemic (**Fig. 10**).

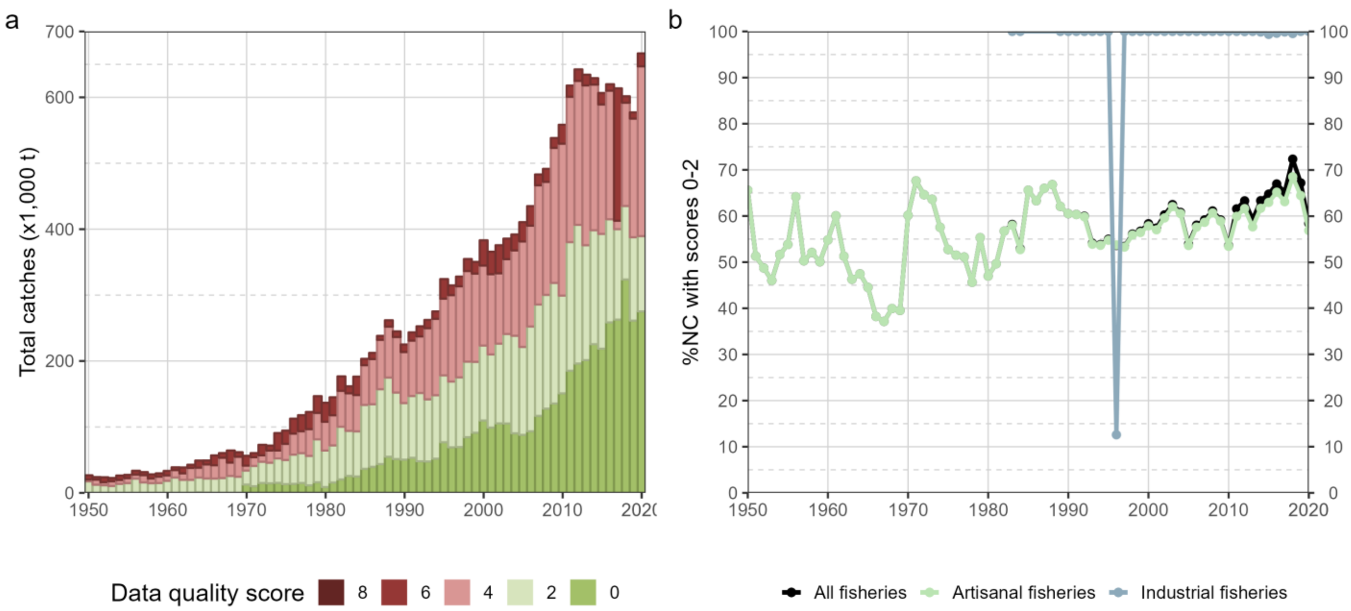

Figure 10: Annual nominal catches of IOTC neritic tunas and seerfish in metric tons (t) estimated by quality score (barplot) and percentage of nominal catch fully/partially reported to the IOTC Secretariat (lines with dots) for all fisheries, 1950-2020

In 2020, about 50% of the nominal catches were fully reported to the Secretariat while the rest had to be partially or fully estimated. Part of the nominal catches was derived from alternative sources of catch data for the CPCs and non-members of the IOTC that did not report data to the Secretariat (Appendix III). In addition, a re-estimation process was performed for the artisanal fisheries of Bangladesh, India, and Indonesia which are considered to be of low quality as well as to account for the reporting of catch data with species aggregates (Appendix III).

In recent years, development in the industrial purse seine fishery of Indonesia targeting neritic tunas resulted in an increase of reported catches. This is particularly evident for bullet tuna, which showed a sharp increase from a few hundred tons to more than 16,000 t between 2017 and 2018. However, reported catches of bullet tuna dropped substantially to about 5,400 t in 2019 and less than 1,400 t in 2020. This high variability seems related to the lack of clear distinction between Indonesian small-scale (gear code PSS) and large-scale purse seiners (gear code PS). In fact, information on vessel length reported to the Secretariat through the IOTC Active Vessels' List (IOTC Res. 10/08) indicates that many of the purse seiners reported as artisanal have a length overall larger than 24 m and should therefore be considered as industrial. A collaboration between Indonesia and the Secretariat is ongoing to improve knowledge on the fleet structure and composition and better understand the rationale behind the volatility in reported catches for some Indonesian fisheries.

Discards

Overall, discarding is considered to be limited in coastal fisheries targeting neritic tunas and seerfish where there is a demand from canneries and local markets. By contrast, discarding has been found to occur in industrial fisheries that target tropical tunas and billfish but the bycatch volumes, which are seldom recorded in the logbooks nor monitored in ports, are considered to be small (Huang & Liu 2010, Amandè et al. 2012). In the case of Western Indian Ocean purse seine fisheries, the bycatch of neritic tunas has been shown to be essentially caught in association with drifting floating objects and estimated to be less than 2 t per 1,000 t of tropical tuna landed, amounting to a mean annual bycatch of about 600 t of fish during 2011-2017 (Ruiz et al. 2018).

Information collected through national fisheries observer programs and currently available in the ROS database is limited due to the non-compliance of several CPCs with IOTC Res. 11/04 and further accentuated by the various non-standard formats used for data collection and reporting by CPCs, which prevent the inclusion of several data submissions into the ROS database. Furthermore, due to the CoViD-19 pandemic, monitoring by observers was limited in 2020 and 2021, with some CPCs not recording any scientific observer program in 2020.

Information available in the ROS regional database on interactions of IOTC fisheries with neritic tunas and seerfish during the period 2005-2020 indicates that discarding of neritic species is negligible in longline fisheries but common in purse seine fisheries and affecting frigate tuna, kawakawa, and bullet tuna to a lesser extent (**Fig. 11**). Interestingly, observations of interactions of neritic tunas with the industrial purse seine fishery show the large extent of the distribution of frigate tuna, kawakawa, and bullet tuna across the whole Western Indian Ocean, notwithstanding the fact that these species were generally thought to be restricted to coastal areas.

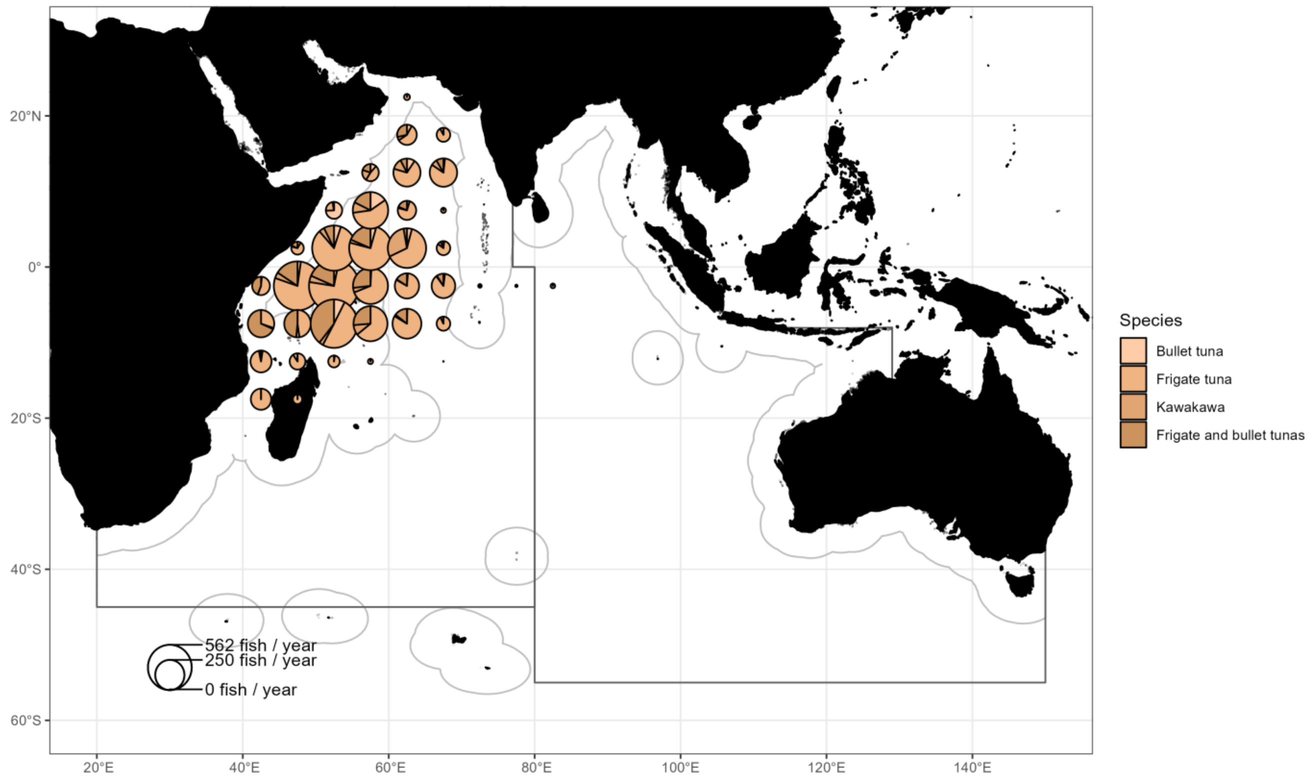

Figure 11: Distribution of interactions of neritic tunas with Western Indian Ocean purse seine fisheries as available in the ROS regional database

The status (i.e. *alive* or *dead*) of the neritic tunas discarded at sea in purse seine fisheries is currently not available in the ROS regional database due to the data exchange format used by the national institutes in charge of the observer programs, but most tunas discarded at sea are thought to be dead after release. Also, the current observer protocols only focus on discards while a component of the bycatch of neritic tunas may be retained for some international markets.

Size data collected at sea by scientific observers show that frigate and bullet tunas caught with purse seine have a similar fork length range (25-60 cm) with a median of about 38-40 cm. Kawakawas are generally larger, with a median size of 45.5 cm, reaching up 70 cm in fork length (**Fig. 12**).

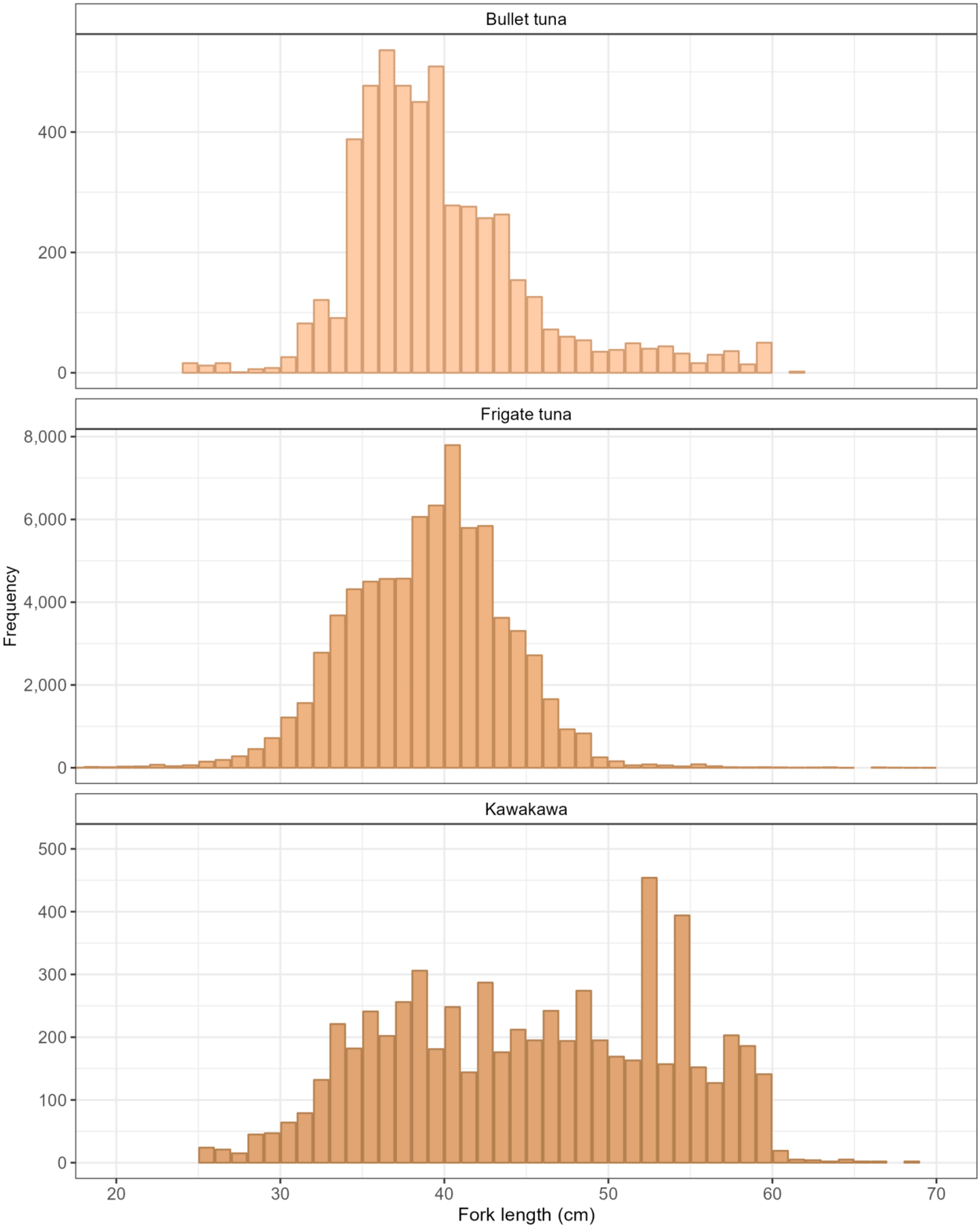

Figure 12: Size frequency distribution of neritic tunas caught in Western Indian Ocean purse seine fisheries as available in the ROS regional database

Spatial distribution of catch and effort

Geo-referenced catch and effort data are not available or only available for a very limited time frame for several major fisheries catching neritic species in the Indian Ocean. Furthermore, time series of effort are generally inconsistent as different units of effort (e.g., trips, days) may be used over time. In particular, Indonesia and India have accounted for around half of the total catches of neritic species in the Indian Ocean in recent years while little information is available on the distribution of catch and effort for all their fisheries. Indonesia has started reporting time-area catches for some of its artisanal and industrial fleets since 2018 but the coverage appears to be very low (i.e., less than 5%) and not representative of the fishing grounds (see below). No geo-referenced catch and effort data have been reported for any of the coastal fisheries of India since 1981, although India reported about 100,000 t of fish caught in recent years. Furthermore, no geo-referenced data have been submitted to the Secretariat by Pakistan and Oman since 1991 and 2013, respectively, despite the significant contribution of the fisheries of these two CPCs to the total catches or neritic species in recent years (**Fig. 6**).

By contrast, I.R. Iran has collected a consistent time series of catch and fishing effort since 2007 through a port sampling program for their coastal and offshore gillnet fisheries. Following an IOTC Data Compliance mission conducted in late-2017, I.R. Iran has begun to report catch and effort data in accordance with the requirements of Resolution 15/02, which led to an improvement in the availability of time-area catches for Iranian gillnetters – one of the main fisheries accounting for catches of neritic tunas. In addition, a first attempt was made to derive time series of CPUE for longtail tuna, kawakawa, frigate tuna, and narrow-barred Spanish mackerel for the period 2008-2017 (Fu et al. 2019). The fishing effort reported for Iranian gillnetters is however expressed in fishing trips while the fleet is composed of more than 1,200 vessels in the size range from less than 15 m to more than 30 m length overall, which are characterized by trips of significant different length. Days at sea can be partly derived from trip-level data collected by the Iranian Fisheries Organization but they may include some bias (Fu et al. 2019). Further collaboration with I.R. Iran would be instrumental to further analyze the catch and effort data available from their gillnet fishery so as to support the development of stock assessment models for the neritic tunas and seerfish of the Indian Ocean.

Geo-referenced effort

Very little information is available on the fishing effort exerted by Malaysian purse seiners that caught about 14,000 t of IOTC neritic species in recent years. The effort is only available since 2019 and limited to one 5°x5° square grid (**Fig. 13a**). Similarly, the spatial distribution of effort for Indonesian purse seiners is restricted to a few recent years and scattered in a few 1°x1° grids along the coasts of Indonesia although the national purse seine fleet is composed of more than 150 vessels larger than 24 m length overall (**Fig. 13b**). More effort data are available from the purse seine fisheries of Thailand and Sri Lanka but the time series remain short (**Fig. 13c-d**).

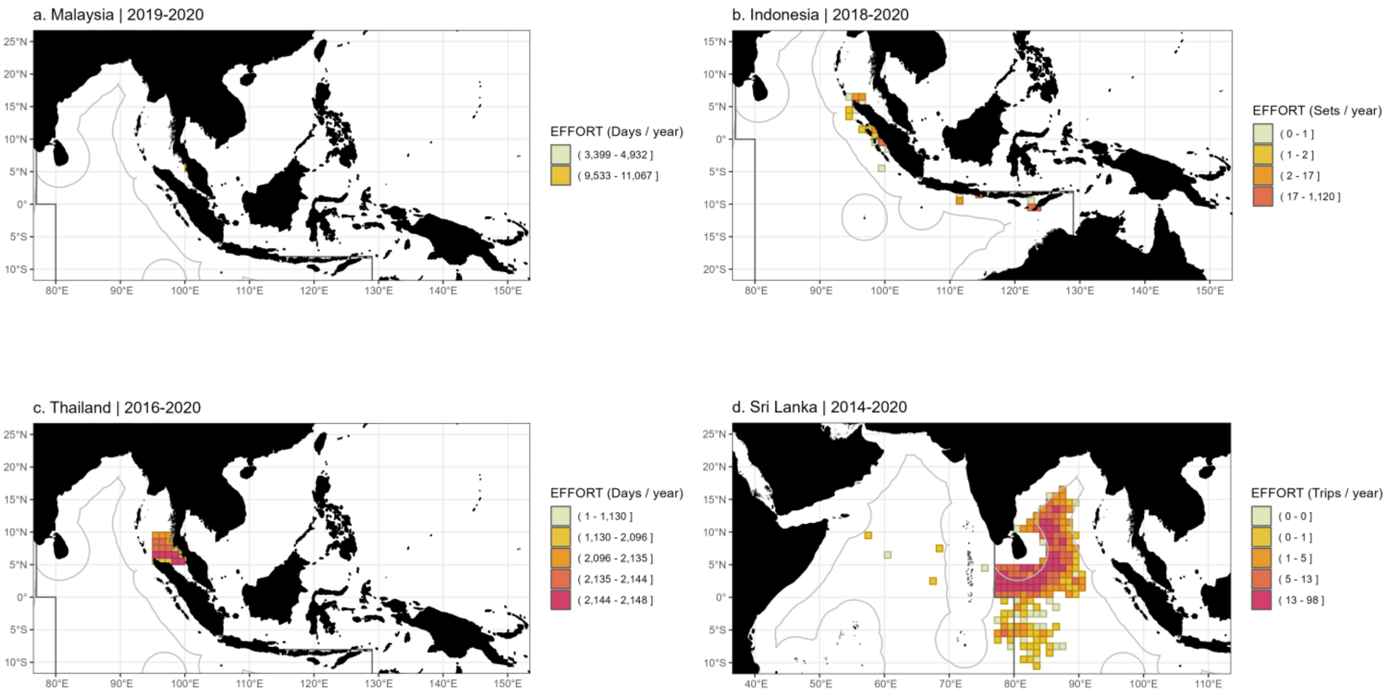

Figure 13: Distribution of fishing effort available at the IOTC Secretariat for purse seine fisheries catching IOTC neritic tunas and seerfish from (a) Malaysia (2019-2020), (b) Indonesia (2018-2020), (c) Thailand (2016-2020), and (d) Sri Lanka (2014-2020)

Effort available from line fisheries is also restricted in time or space for Comoros and Oman while the effort for Indonesia is only available from 2019 (**Fig. 13a-c**). Only effort data from Maldives seem consistently reported since 2013 but the catches of neritic tunas and seerfish in this fishery are almost negligible (**Fig. 13d**).

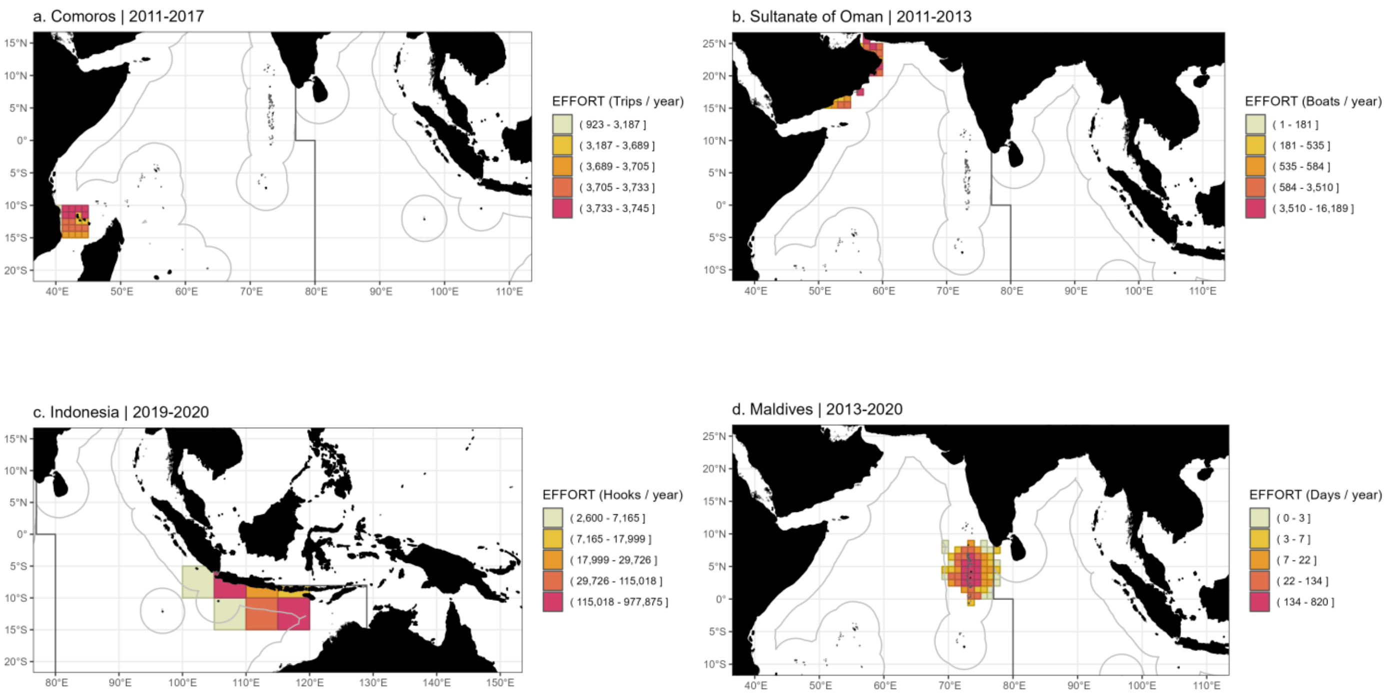

Figure 14: Distribution of fishing effort available at the IOTC Secretariat for line fisheries catching IOTC neritic tunas and seerfish from (a) Comoros (2011-2017), (b) Sultanate of Oman (2011-2013), (c) Indonesia (2019-2020), and (d) Maldives (2013-2020)

Effort data for the gillnet fisheries of I.R. Iran and Sri Lanka are described by a better coverage than for purse seine and line fisheries. The effort from Iranian gillnetters is based on a large sample of vessels and covers a large area of the northwestern Indian Ocean between 2007 and 2020 (**Fig. 15a**). The spatial distribution of the effort of the Sri Lankan gillnetters is also good in time and space (**Fig. 15b**). However, many Sri Lankan gillnetters used in the past a combination of gillnet and longline over a same fishing trip, with no accurate information collected of the composition of the catch by gear type. This might prevent the use of the nominal CPUE time series for deriving abundance indices for the species caught in this fishery.

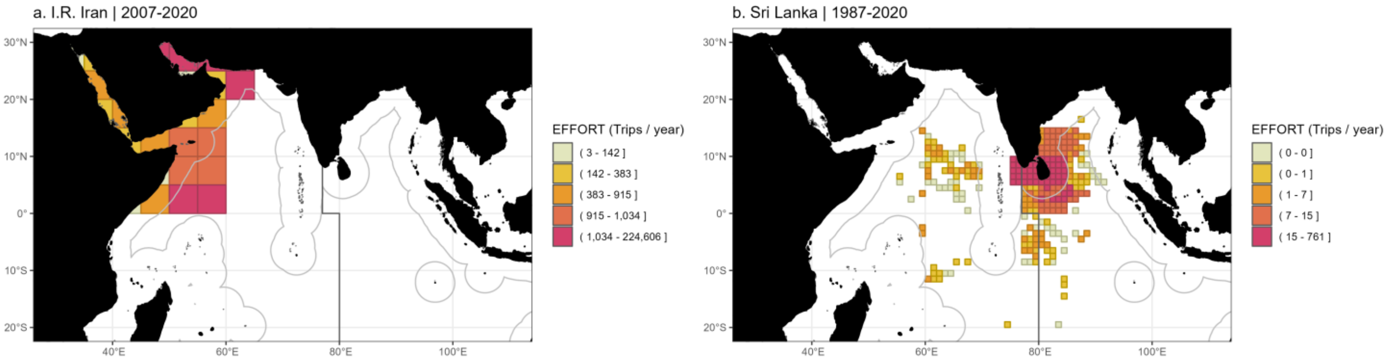

Figure 15: Distribution of fishing effort available at the IOTC Secretariat for gillnet fisheries catching IOTC neritic tunas and seerfish from (a) I.R. Iran (2007-2020) and (b) Sri Lanka (1987-2020)

Geo-referenced catches

Decadal maps of mean annual catch show the lack of spatial information available on the catches of the six IOTC neritic tuna and seerfish species over the decades 1970-2000 (**Fig. 16**).

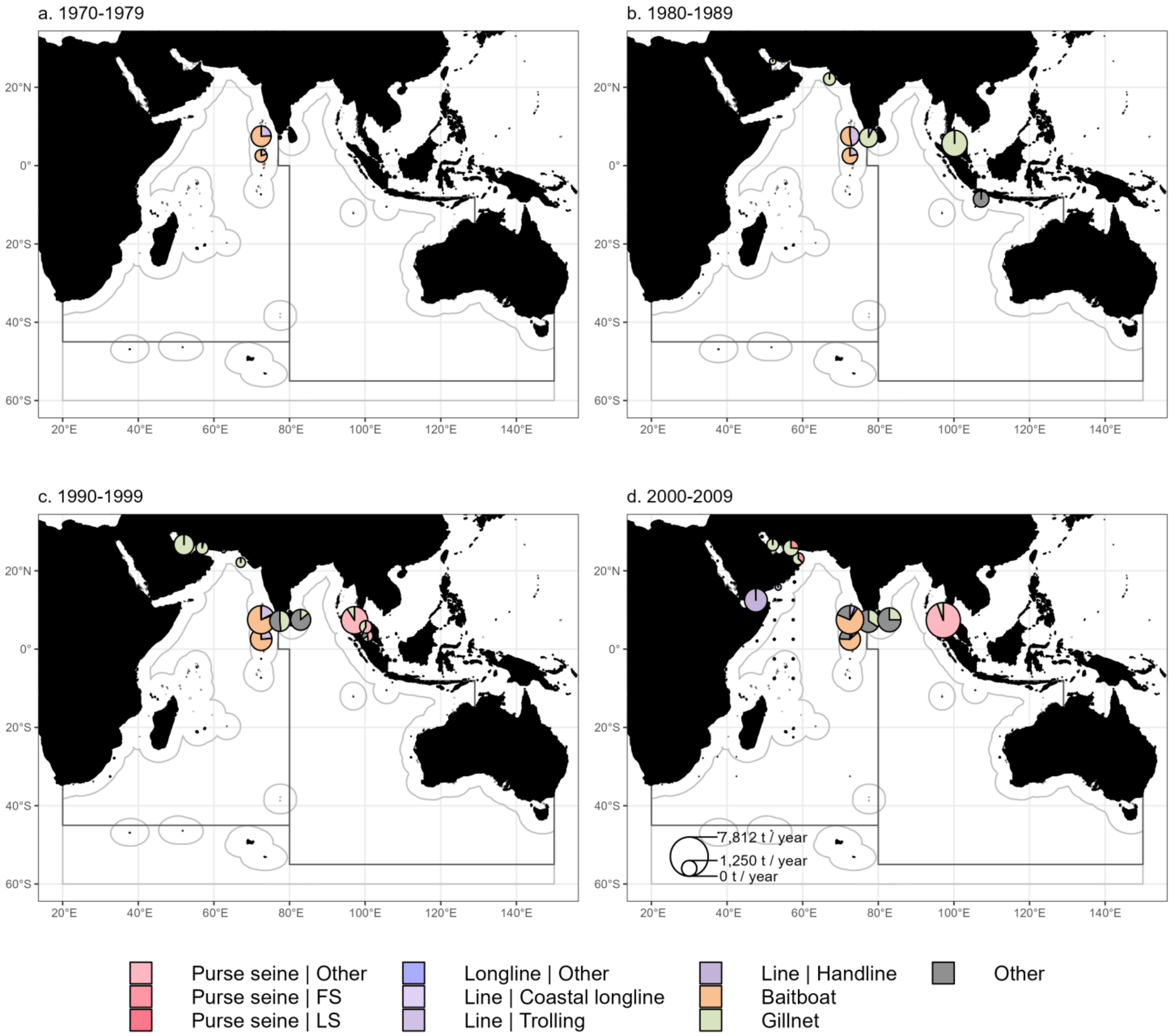

Figure 16: Mean annual time-area catches (t) of IOTC neritic tuna and seerfish species by decade, 5x5 grid, and fishery as reported to the Secretariat

More information on the fishing grounds of IOTC neritic species have become available over the last decade (**Fig. 17**). The perception of the spatial extent of the fisheries is however biased by the limited geo-referenced data reported by major fishing nations such as Indonesia, India, Pakistan, and Oman.

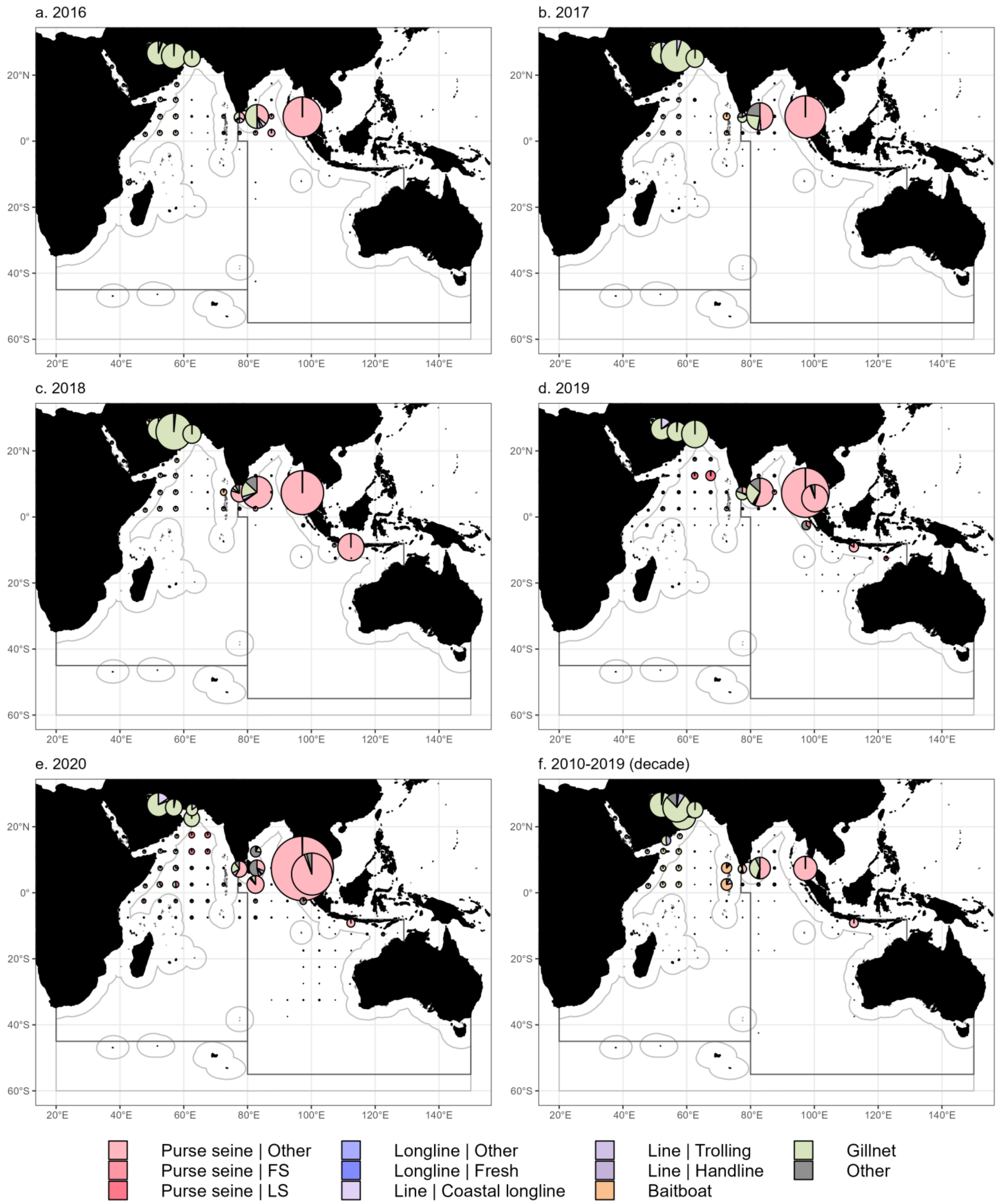

Figure 17: Mean annual time-area catches (t) of IOTC neritic tuna and seerfish species by year / decade, 5x5 grid, and fishery as reported to the Secretariat

Uncertainties in catch and effort data

Overall, the reporting quality of the geo-referenced catch and effort data submitted to the Secretariat is very low due to the lack of data for most of the main fisheries catching neritic tunas and seerfish in the Indian Ocean (**Fig. 18a**). However, the quality has been showing an increasing trend since the mid-2000s in relation with the increasing reporting of data by some major fishing nations such as I.R. Iran, Thailand, and Sri Lanka. The percentage of nominal catches for which some geo-referenced catch and effort data are available (scores 0-2; **Table 4**) reached 40% in 2020 (**Fig. 18b**).

Many issues are identified with the catch and effort data of coastal fisheries in particular:

- changes in effort unit over time (e.g., Thailand);
- low sampling coverage (e.g., Indonesia);
- incomplete hand lines and/or troll lines data reported to the Secretariat (e.g., Comoros until 2018, Madagascar 2017-2020);
- poor quality where the basic data requirements are not met (e.g., India);
- use of trip as effort unit in fisheries described by a large range of sizes of vessels that may spend different periods at sea.

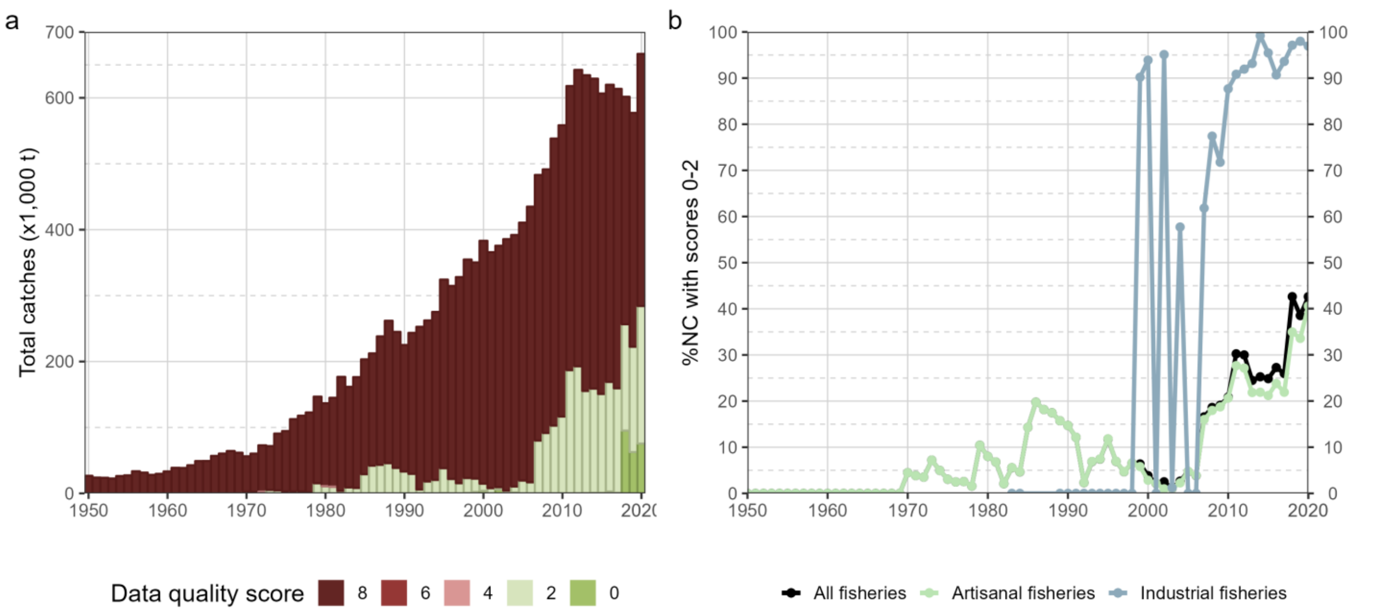

Figure 18: Annual nominal catches (t) of neritic tuna and seerfish estimated by quality score (barplot) and percentage of geo-referenced catches reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950-2020

Size composition of the catch

Samples availability

The number of fish sampled for size neritic and seerfish is dominated by gillnet fisheries which represent 77.5% of all size data available in the IOTC database. Some size samples are also available for purse seine (1985-2020), baitboat (1983-2020), and troll line (1983-2020) fisheries, although in smaller numbers than for gillnet fisheries, while very few samples are available for all other fisheries (**Fig. 19**). It is interesting to note that some size data have been available from the 1980s, mostly from projects conducted under the Indo-Pacific Tuna Programme (IPTP), with some samples collected in Indonesia, Maldives, and Malaysia from the early 1980s and later on in Sri Lanka, I.R. Iran, and Pakistan.

Very few samples have been collected by coastal fisheries in recent years. For instance, Sri Lanka was annually sampling on average 194,000 fish between 1985 and 1993 when they have been measuring less than 7,000 samples between 2016 and 2020. On the contrary, I.R. Iran has been increasing the number of neritic fish sampled in recent years, reaching an annual number of 94,000 between 2016 and 2020.

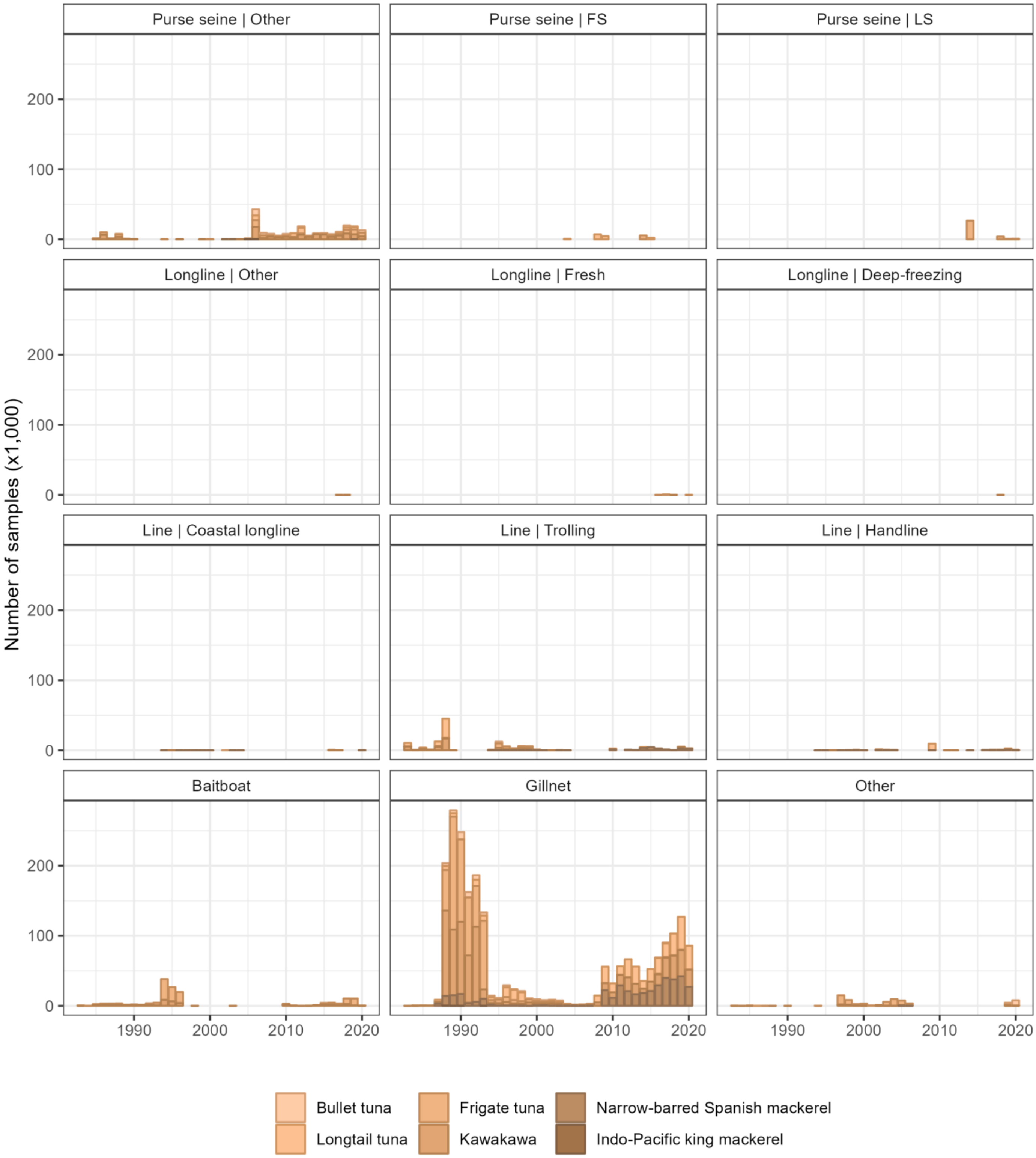

Figure 19: Annual number of size samples available at the IOTC Secretariat by fishery and neritic species. FS = free-swimmign school; LS = school associated with floating object

The number of size samples by species is very unbalanced and not representative of the importance of each species in the nominal catches (**Fig. 20**). About two thirds of all samples are available for kawakawa (33.81%) and frigate tuna (31.29%). Samples for narrow-barred Spanish mackerel only represent 14.38% of the samples when this species has been the most abundant in the catch over the last four decades, i.e., it represented almost 30% of all catches of neritic species between 1980 and 2020. Only 554 fish samples are available for Indo-Pacific kingfish when more than 1.3 million tons of catch have been reported for this species since 1980.

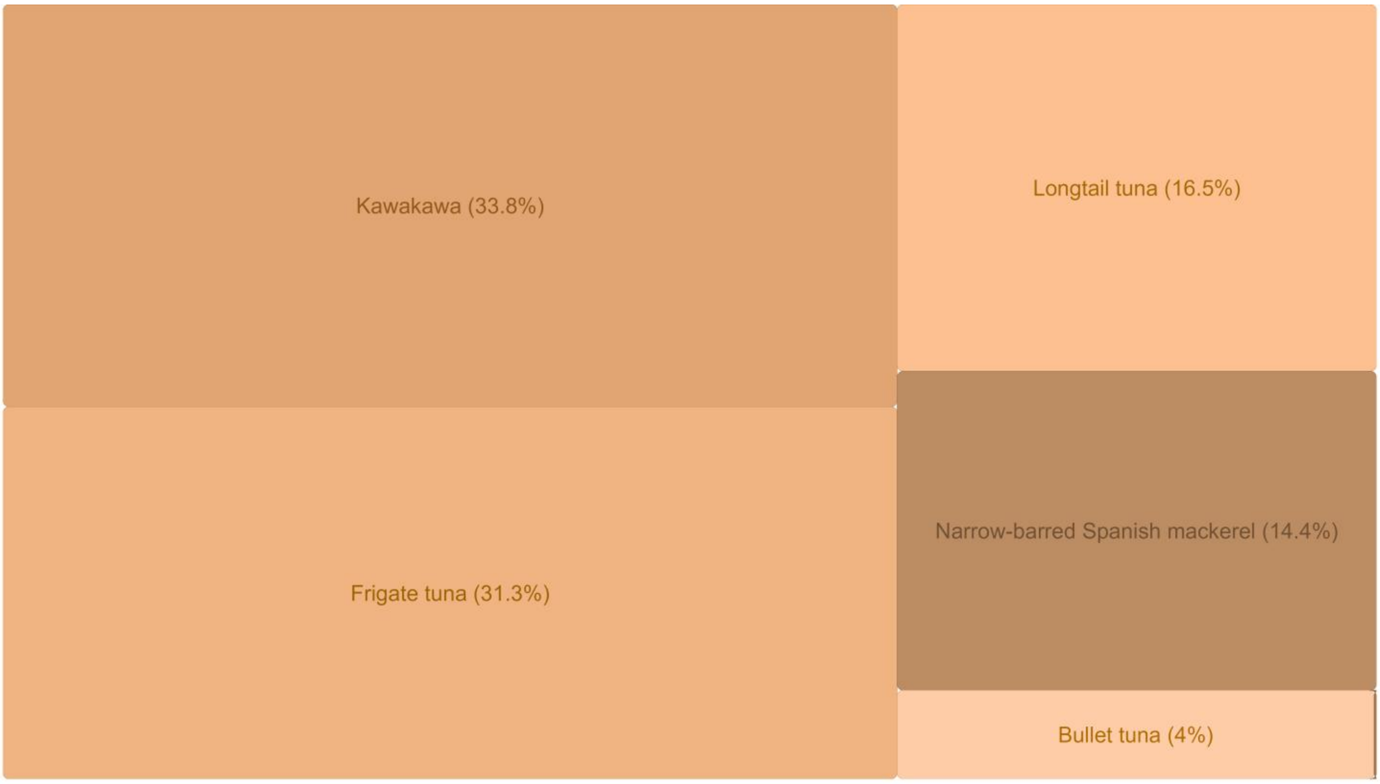

Figure 20: Percentage of size samples by species for all standard size data available at the IOTC Secretariat

Size distribution by species and fishery

The aggregated size frequency distributions should be considered with great caution as they do not account for spatio-temporal changes in sampling (e.g., fishing grounds) and may be biased due to the variability in sampling between CPCs. Overall, the available data provide some general information on the size composition of the catch, suggesting substantial differences in size in the catch between species and fisheries. Bullet tunas which are mostly caught in purse seine fisheries appear to be taken at the smallest size, with a median fork length of about 25.5 cm (**Fig. 21**). Information on size composition available from other fisheries catching bullet tuna suggests sizes in the range 25-33 cm fork length. Frigate tunas caught are in the same size range as bullet tuna (25-33 cm) when caught in coastal purse seine fisheries while they appear to be larger when caught in line fisheries (median of about 36 cm fork length) or in high seas purse seine fisheries, with the largest frigate tunas reaching more than 50 cm fork length when caught on free-swimming schools. Kawakawa are taken at larger sizes, with a size interquartile comprised between 32 and 50 cm fork length. The largest kawakawa are taken in coastal longline fisheries (median fork length of 46.5 cm) while the smallest ones are caught in coastal purse seine fisheries (median fork length of 27.5 cm). Finally, narrow-barred Spanish mackerels are described by similar median sizes across fisheries, with the interquartile range being comprised between 75 cm and 100 cm fork length.

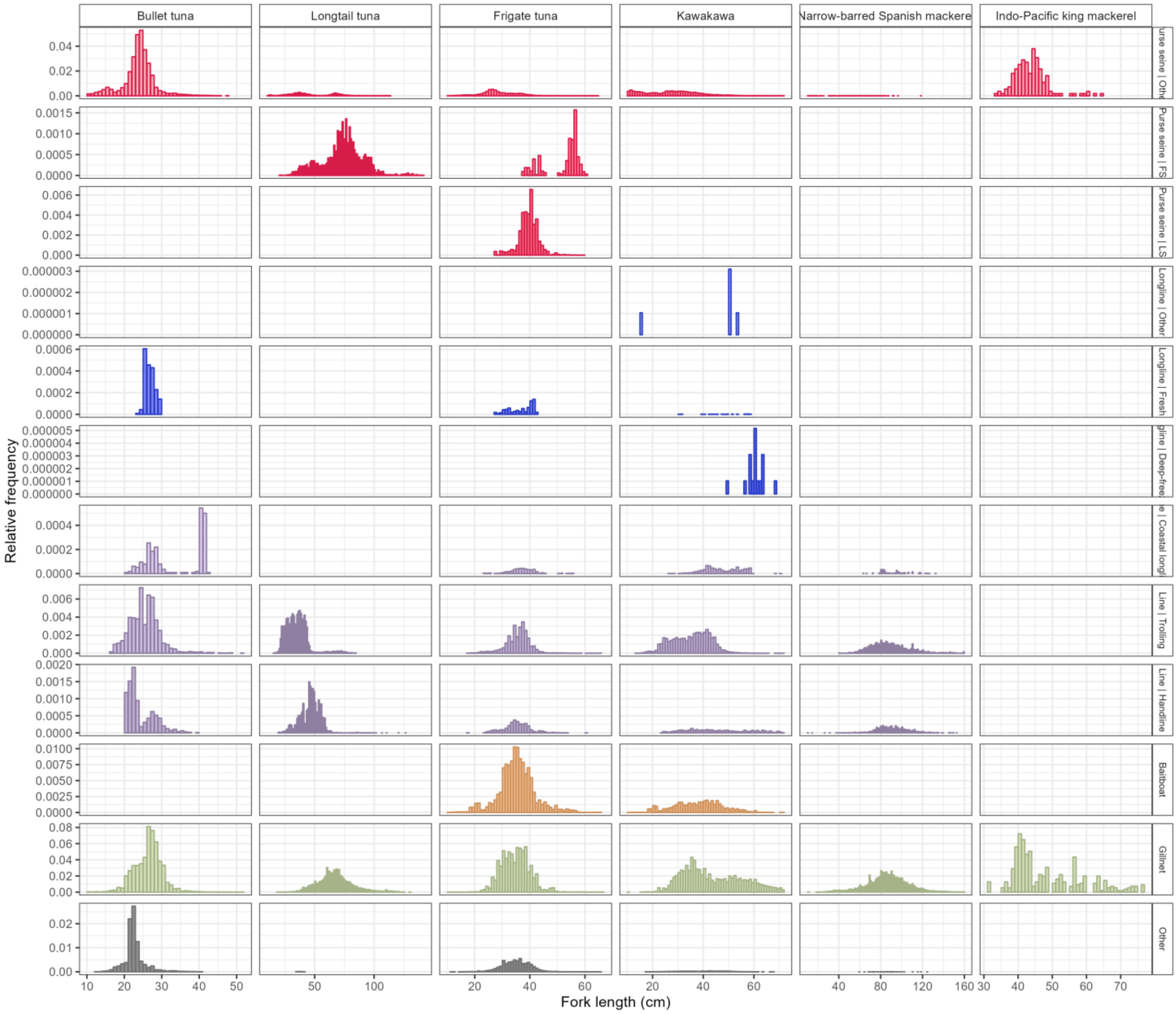

Figure 21: Relative fork length frequency distribution of IOTC neritic tuna and seerfish species (except for Indo-Pacific king mackerel) aggregated across all samples available at the IOTC Secretariat by fishery, excluding longline fisheries

Besides the regular data submission by the CPCs, the Secretariat also holds size frequency data collected at sea by scientific observers, which provide size information on neritic tunas taken in industrial purse seine fisheries (See section Discard).

Uncertainties in size-frequency data

The reporting quality of size frequency data is the lowest among all IOTC species groups. The overall quality – as measured by the percentage of nominal catches with size data of quality scores between 0-2 – of size data available for neritic tunas and seerrfish is poor. Almost no size data are available prior to the 1980s and the fraction of data of acceptable quality between 1980 and 2020 averages around 6% (**Fig. 22a**).

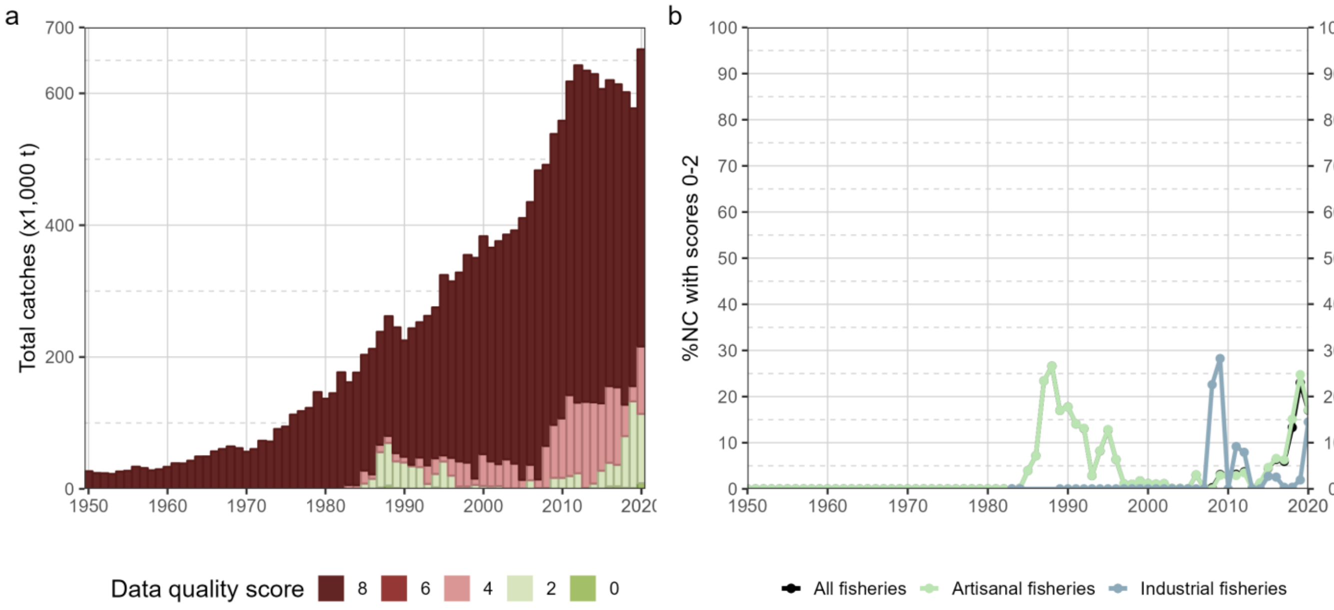

Figure 22: Annual nominal catches (t) of IOTC neritic and seerfish species estimated by quality score (barplot) and percentage of geo-referenced size-frequency data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950–2020

Size frequency data are often not reported by the IOTC standards and as such cannot not be processed and included in the database. Recently the Secretariat has put more emphasis on complying with IOTC reporting requirements, such as including appropriate spatial information and recommended size bins for tuna and tuna-like species. In some instance however, some data are included in the database but cannot be used due to poor quality. In particular, several size data sampled from neritic and seerfish species have been reported with large size bins and/or sizes exceeding known maximum length of the species (e.g., size frequency data from Madagascar artisanal fisheries). Such data are filtered out in the IOTC processing generating the species-specific standard size data sets (see section Methods).

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Appendix

Appendix I: Time series of price for neritic tunas and seerfish in Oman

Monthly market prices expressed in Omani Rials (OR) of longtail tuna, frigate tuna, kawakawa, and narrow-barred Spanish mackerel have been reported to the Secretariat by the Sultanate of Oman since late 2015 for each of its 11 governorates. No information is available on the source of price data which may have been collected from the sale value at landings in local markets and/or from prices of export to Omani neighboring countries.

Price information gives the value rank for each of the four species. Narrow-barred Spanish mackerel is the most expensive species with an average value of 3.20 OR (~8.25 USD) between 2016 and 2020. Longtail tuna comes second with a mean value of 1.55 OR (~4 USD) between 2016 and 2020 when kawakawa and frigate tuna are described by lower sale prices, i.e., 0.81 OR (~2.1 USD) and 0.62 OR (1.6 USD), respectively. Fish prices show some quite large variability between months without any particular trend for narrow-barred Spanish mackerel while the price for the three neritic tunas has shown a susbtantial decline in 2020 as compared to previous years (**Fig. 23**).

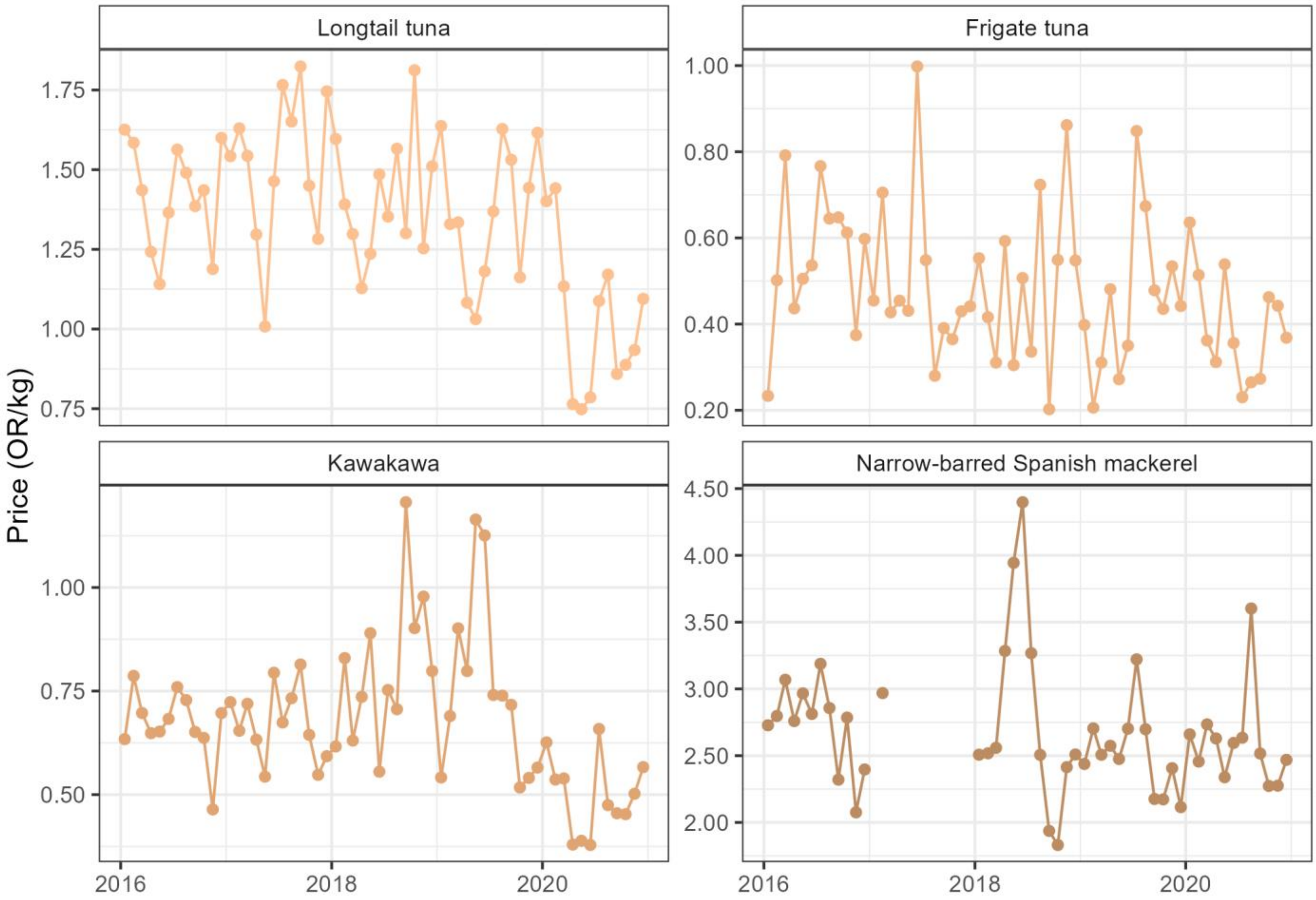

Figure 23: Monthly time series of price (Omani Rials; OR) for longtail tuna, frigate tuna, kawakawa, and narrow-barred Spanish mackerel in Oman between 2016 and 2020

Appendix II: Time series of fuel price

Figure 24: Monthly time series of crude oil spot price (USD/barrel) during the period 2000-2020. Data sourced from the spot prices of Brent, Dubai, and West Texas, compiled, and curated by the FFA Fisheries Development Division (Ruaia et al. 2020))

Appendix III: Best scientific estimates of nominal catches for 2020

Overall, nominal catches of neritic tunas and seerfish fully estimated in 2020 amounted to 122,512 t of fish for 17 distinct fleets, representing 18.2% of all catches of IOTC neritic species (**Table 6**).

First, nominal catches were estimated for the CPCs and non-members of the IOTC that did not report any catch for 2020. For IOTC members, nominal catches were repeated from previous year (2019) except for Eritrea and Sudan who have not reported any information to IOTC since their accession in 1994 and 1996, respectively (**Table 6**). Data for these two countries were extracted from the FAO global capture production database and further broken down by gear (**Table 6**).

Although Madagascar and Tanzania submitted catch data to the IOTC Secretariat for 2020, these showed high inconsistencies and were not deemed accurate for that reference year. In particular, Madagascar confirmed that their catch data have been collected through a sampling programme implemented since 2017, and concentrated mostly in the north of Madagascar (MPEB et al. 2021). More in general, catch data were found to vary substantially between fisheries and species over the years.

For Tanzania, catch data as available from different sources (i.e., national reports and various data sets submitted to the Secretariat) show large discrepancies in magnitude and composition, supporting the temporary repetition of catch levels from 2019 in lack of more accurate estimates.

For non-members of the IOTC, catches were preferentially extracted from the FAO global capture production database and further broken down into distinct species and gears, when necessary, based on knowledge of the fisheries operating in each of the countries (**Table 6**).

Recently some of these countries revised the time series of catch data submitted to FAO: this revision greatly affected fishery statistics for the United Arab Emirates, whose reported total annual catches of narrow-barred Spanish mackerel were significantly reduced by about 10,000 t between 2014 and 2020 (Appendix IV). Although catches of neritic tunas and seerfish from Jordan are small, the country also recently revised the time series of catch from 2012 onwards.

Table 6: Data source and final estimates of catches (t) of IOTC neritic tuna and seerfish species in 2020 for non-members (NM) and members (MP) of the IOTC that did not report catches for the year 2020. RAW_CATCH includes catches of species aggregates with part of them being assigned to species other than neritic tunas and seerfish

Fleet code	Fleet	Status	Source	Catch
ARE	United Arab Emirates	NM	FAO	8,552
BHR	Bahrain	NM	IOTC	77
DJI	Djibouti	NM	FAO	833
EGY	Egypt	NM	FAO	1,318
ERI	Eritrea	MP	FAO	515
JOR	Jordan	NM	FAO	32
KWT	Kuwait	NM	FAO	145
MDG	Madagascar	MP	IOTC	6,021
MMR	Myanmar	NM	FAO	10,223
MOZ	Mozambique	MP	IOTC	10,035
QAT	Qatar	NM	FAO	3,051
SAU	Saudi Arabia	NM	FAO	7,855
SDN	Sudan	MP	IOTC	170
TMP	East Timor	NM	IOTC	0
TZA	Tanzania	MP	IOTC	3,362
YEM	Yemen	MP	FAO	9,067
ALL	All fleets	-	-	61,256

Second, a re-estimation process was performed for the artisanal fisheries of Bangladesh, Malaysia, India, and Indonesia which are considered to be of low quality. In Bangladesh no fishery specifically targets tuna, and all nominal catches reported as *mackerel* have been assumed to be composed of narrow-barred Spanish mackerel (COM; 59%) and Indo-Pacific king mackerel (GUT; 41%), exclusively caught with gillnets since 1986. In 2020, catches from Bangladesh were estimated to be 75 t and 52 t for narrow-barred Spanish mackerel and Indo-Pacific king mackerel, respectively.

For Malaysian coastal fisheries, nominal catches reported for neritic tunas are considered accurate but seerfish catches have only been reported for narrow-barred Spanish mackerel while both narrow-barred Spanish mackerel and Indo-Pacific king mackerel have been shown to occur in the landings. Except for handline that was only reported in 1962, the current data processing applies a fixed proportion (by gear) to each of the two species (COM-GUT) over time: 82% and 18% for troll line, 69% and 31% for gillnet, 89% and 11% for small purse seine, 63% and 37% for trawling. In 2020, the nominal catches of narrow-barred Spanish mackerel and Indo-Pacific king mackerel were estimated to 4,202 t and 2,022 t, respectively.

For India and Indonesia, the current re-estimation process builds on a review requested by the IOTC Scientific Committee in the early 2010s, aiming at producing a temporary revision of the artisanal catches time series from these two countries, to be maintained until measurable improvements in data collection and reporting to the IOTC were detected (Moreno et al. 2012).

In the case of Indian coastal fisheries, the re-estimation process does conserve the total catches reported for each of the six IOTC neritic tuna and seerfish species, but modifies the gear composition of the catch by Indian Ocean major area for the following gears: beach seine, gillnet (GILL), hook and line (HOOK), small purse seine (PSS), ring nets (RIN), trawl (TRAW) and troll line (TROL). In 2020, the total catches reported by India for the IOTC neritic tuna and seerfish species were about 88,000 t, with more than half of them taken in the gillnet fishery.

In the case of Indonesian coastal fisheries, a fixed proportion of total catch for each species and fishing gear is used to derive the catches of each of the IOTC neritic tuna and seerfish species based on samples of catch composition available for the period 2003-2011 (Moreno et al. 2012). In 2020, about 251,000 t of fish were estimated to be caught in Indonesian fisheries for these six species.

Appendix IV: Changes in best nominal catches from previous WPNT

Table 7: Changes in best scientific estimates of average annual nominal catches (t) of neritic tuna and seerfish species by year, fleet, fishery group and main Indian Ocean area, limited to absolute values higher than 10 t. Data source: best scientific estimate of nominal catches as estimated annually from 2012 to 2019 for the preceeding statistical year (https://www.iotc.org/meetings/12th-working-party-neritic-tunas-wpnt12data/03-NC)

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
2019	ARE	Gillnet	Western Indian Ocean	6,760	16,898	-10,139
		Line	Western Indian Ocean	1,080	2,702	-1,621
	EGY	Baitboat	Western Indian Ocean	14	0	14
		Gillnet	Western Indian Ocean	580	608	-28
	EUMYT	Line	Western Indian Ocean	13	0	13
	JOR	Gillnet	Western Indian Ocean	49	93	-45
	LKA	Gillnet	Eastern Indian Ocean	2,222	1,599	623
		Gillnet	Western Indian Ocean	13	636	-623
		Line	Eastern Indian Ocean	299	216	83
		Other	Eastern Indian Ocean	1,025	779	246
		Purse seine	Eastern Indian Ocean	3,887	3,516	371
		Purse seine	Western Indian Ocean	1	372	-371
	MOZ	Gillnet	Western Indian Ocean	1,557	358	1,199
		Line	Western Indian Ocean	2,144	1,360	784
		Other	Western Indian Ocean	1,150	1,216	-66
		Purse seine	Western Indian Ocean	5,184	2,067	3,117
	SDN	Gillnet	Western Indian Ocean	140	156	-15
2018	ARE	Gillnet	Western Indian Ocean	7,163	16,898	-9,735
		Line	Western Indian Ocean	1,145	2,702	-1,557
	EUMYT	Line	Western Indian Ocean	21	0	21
	JOR	Gillnet	Western Indian Ocean	64	94	-30
	LKA	Gillnet	Eastern Indian Ocean	1,540	1,353	187
		Gillnet	Western Indian Ocean	4	191	-187
		Line	Eastern Indian Ocean	518	390	128
		Other	Eastern Indian Ocean	1,156	979	177
		Purse seine	Eastern Indian Ocean	6,773	4,994	1,778
2017	ARE	Gillnet	Western Indian Ocean	7,411	16,898	-9,487
		Line	Western Indian Ocean	1,185	2,702	-1,517
	JOR	Gillnet	Western Indian Ocean	69	96	-27
2016	ARE	Gillnet	Western Indian Ocean	7,273	16,898	-9,626

Year	Fleet	Fishery group	Area	Current (t)	Previous (t)	Difference (t)
		Line	Western Indian Ocean	1,162	2,702	-1,539
	EUMYT	Line	Western Indian Ocean	16	0	16
	JOR	Gillnet	Western Indian Ocean	65	95	-30
2015	ARE	Gillnet	Western Indian Ocean	7,411	16,898	-9,488
		Line	Western Indian Ocean	1,184	2,702	-1,517
	JOR	Gillnet	Western Indian Ocean	52	95	-43
	MOZ	Gillnet	Western Indian Ocean	2,319	611	1,708
		Line	Western Indian Ocean	1,725	3,433	-1,708
2014	ARE	Gillnet	Western Indian Ocean	7,321	16,944	-9,623
		Line	Western Indian Ocean	1,170	2,709	-1,539
	JOR	Gillnet	Western Indian Ocean	79	98	-19
	MOZ	Gillnet	Western Indian Ocean	2,189	711	1,478
		Line	Western Indian Ocean	2,042	3,520	-1,478
2013	ARE	Gillnet	Western Indian Ocean	7,724	12,717	-4,994
		Line	Western Indian Ocean	1,234	2,033	-798
	JOR	Gillnet	Western Indian Ocean	28	86	-58
2012	ARE	Gillnet	Western Indian Ocean	9,510	8,563	947
		Line	Western Indian Ocean	1,519	1,368	151
	EGY	Baitboat	Western Indian Ocean	11	0	11
	JOR	Gillnet	Western Indian Ocean	47	74	-27