OVERVIEW OF INDIAN OCEAN TROPICAL TUNA FISHERIES

Author: IOTC Secretariat

Introduction

Tropical tunas species, i.e., bigeye tuna (*Thunnus obesus*; BET), skipjack tuna (*Katsuwonus pelamis*; SKJ) are amount the most valuable species globally, and two species (yellowfin and skipjack tunas) are in top 10 of the most caught marine species, contributing around 6.4% of world capture fisheries production (FAO 2024). Catches of the tropical tunas, show steady increase in the last decades, peaked in 2019 with over 5 million metric tonnes (t), and remained around 4.8 million metric tonnes from 2020 FAO global capture production database. Western-Central Pacific Ocean attributed for over 51% of total tropical tunas catches in recent years, with only 23% from the Indian Ocean (**Fig. 1**).

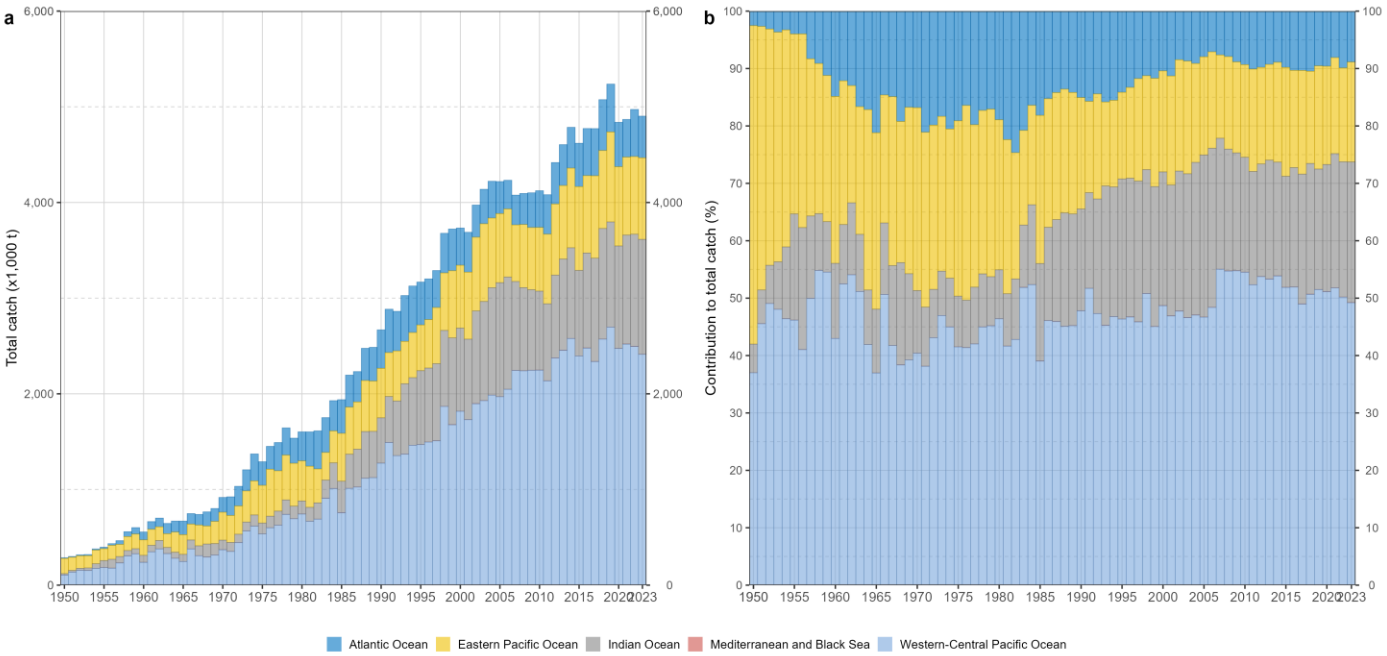

Figure 1: Annual time series of cumulative retained catches (metric tonnes; t) of tropical tuna by ocean basin for the period 1950-2023. Source: FAO (FISHStatJ)

The overarching objective of this summary is to provide participants at the 27th Session of the IOTC Working Party on Tropical Tunas (WPTT27) with a review of the status of the information available on Indian Ocean tropical tunas and their associated fisheries. The document provides an overview of the data sets available in the IOTC Secretariat databases as of June 2025, 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 tropical tuna fisheries over the last seven decades.

Materials - more on the description and the new forms

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). Particularly, as required by IOTC Res. 15/02 and Resolution 24/06 on a ban on discards of bigeye tuna, skipjack tuna, yellowfin tuna, and non-targeted species caught by vessels in the IOTC record of authorisation that operate in the IOTC area of competence.

The Secretariat is improving the information providing to CPCs to enhance the quality of data reporting. The new online IOTC Reporting guidelines and online detailed IOTC forms, are the latest guiding tools developed by the Secretariat, and at the disposal of all countries operating in the Indian Ocean. The use of the forms for data submission will facilitate data curation and management by the Secretariat.

Retained (nominal) catch data

Retained catches, which refer to fish landing weight, FAO Catch and landings, correspond to the total retained catches (in live weight) per year, Indian Ocean major area, fleet, and fishing gear (IOTC Res. 15/02). The retained catch data reporting requirements are described in 1RC form webpage and can be reported through IOTC form 1RC template.

Changes in the IOTC consolidated data sets of retained 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.

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 and Resolution 24/06. Nonetheless, descriptions of the discarded data requirements are explained in 1DI form webpage, and data can be submitted through 1DI form template. The final data should be extrapolated to represent the total level of discards by fisheries, fleet, species concerned, including turtles, cetaceans, and seabirds for the year.

Nevertheless, discard data reported to the Secretariat through the 1DI form template 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. 24/04) 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). The latest regional observer scheme resolution, makes provision for CPCs to supplement the on-board observer data with Electronic Monitoring System (EMS) on board vessels to improve the coverage.

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 reporting requirements for the catch and effort are described in 3CE form webpage, if for submission of all fisheries through the 3CE form template. Otherwise for updated submissions, descriptions in 3CE form update, and submission through 3CE form update webpage. Furthermore, CPCs with surface fisheries should collect and report geo-reference on the use of fish aggregating devices (FADs), depending on the type of FAD used. Activities related to anchored FADs the requirements are described in 3DA form webpage and submission through the 3DA form template. Whereas for activities on drifting floating objects, detailed description of the requirements are in 3DA form webpage, and submission through 3DA form template

To enhance the reporting of efforts from support vessels assisting industrial purse seiners, CPCs should utilize the 3CE form template, which includes the necessary fields for recording geo-referenced effort data.

Size-frequency data

The size composition of catches can be derived from individual body length or weight data collected at sea and during the unloading of fishing vessels. Detailed descriptions of the reporting requirements for size frequency data are available on the 4SF form webpage, which outlines for the full data submission process for all fisheries and species through the 4SF from template. Additionally, CPCs can provide updated information for various reasons, as specified on the 4SF form upate webpage, and submit the updated data using the 4SF form update template. This new format allows CPCs to report several aspects related to size frequency, as requested by IOTC Res. 15/02, including data type, whether the catch was retained or discarded, the source of data (logbook, research institutions, or observers), and the sex of the species.

Socio-economic data

Fisheries are essential to ensure food security and support economic growth of the rim countries of the Indian Ocean. This is particularly true for small island developing states (SIDS) which strongly depend on the blue economy. In this context, socio-economic statistics are key to inform decisions on the management of fisheries and assess their performance and economic contribution to the countries (Bennett 2021). The analysis of the socio-economic data in fisheries management are proven useful particularly in setting-up fishing quota, as indicated in the TCAC document (IOTC 2024) in the Indian Ocean.

Furthermore, the recent Working party of Socio-Economic (WPSE02) recommended some Socio-economic some fisheries indicators to be considered by the Scientific Committee, to be collected by CPCs.

Regional Observer Scheme

(IOTC Res. 24/04) *"On a Regional Observer Scheme"* 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"*. The revised resolution further provide alternative data collection methods to meet the required coverage of 5% (para 4). Human observer may be *complemented or substituted by means of an EMS* and the *the EMS shall be complemented by port sampling and/or other Commission approved data collection methods*. The requirements for ROS data collection and reporting are defined in the ROS data fields and reference codes.

The Secretariat provides an annual update on the status, coverage, and data collected as part of the ROS during the SC, and Update on the implementation of the ROS provide the latest status of the ROS data reported. 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.

Despite the fact that ROS programme started over 10 years ago, the Secretariat has not been able to have a comprehensive repository for the data collected and submitted for several reasons:

(i) variation in the data submitted;

(ii) reporting of summarised ROS data;

(iii) data reporting format (word, pdf, excel summary table);

(iv) constant/frequent review of the data reporting requirements.

The ROS database at the Secretariat stored only a fraction of the ROS data reported, due to the issues mentioned above. to date the database only holds data for the period between 2005 and 2021 from 7 fleets: EU,France, Japan, Sri Lanka for longline fisheries and EU,Spain, EU,France, Republic of Korea, Mauritius, Seychelles for purse seine fisheries, with a total of 29,745 sets from 1,700 trips recorded.

Tagging data

Tag release and recovery data gathered in the framework of the Indian Ocean Tuna Tagging Programme (IOTTP), which encompass data gathered during the Regional Tuna Tagging Project – Indian Ocean (RTTP-IO) and data gathered during a series of small-scale tuna tagging projects in Maldives, India, Mayotte, Indonesia and by other institutions, e.g., the Southeast Asian Fisheries Development Center (SEAFDEC) and the National Research Institute of Far Seas Fisheries (NRIFSF), with the support of IOTC. In 2012, the data from past projects implemented in Maldives in the 1990s were added to the tagging database at the Secretariat.

Morphometric data

Calls to CPCs the help improve the morphometric data are made on several occasion, more recently, the Secretariat is mandated to prepare a collection form to harmonized biological data collect by CPCs. The available morphometric information for tropical tuna species are limited and not available for all measurement types conversion. (**Table 1**) show the length-weight relationships estimated for tropical tuna in the Indian Ocean collected through fisheries monitoring programs and research projects. The relationships are assumed to be dependent on fishing gear. For bigeye and yellowfin tuna, an average conversion factor of 1.13 borrowed from ICCAT is used to convert gilled-and-gutted weights into round weights without any information on the source of the data used to compute it.

Table 1: Summary of IOTC reference length-weight power relationships available for Indian Ocean tropical tunas. FL = fork length (cm); RD = round weight (kg); GG = gilled-and-gutted weight (kg). GN = gillnet; BB = baitboat; PS = purse seine; LL = longline; OT = Other gears; ALL = all gears

Code	Species	Equation	a	b	MinFL	MaxFL	Gears	Reference
BET	Bigeye tuna	RD = a*FL^b	2.2170e-05	3.012110	29.5	174	GN,BB,PS	Chassot et al. 2016
BET	Bigeye tuna	GG = a*FL^b	1.5921e-05	3.041541	70.0	187	LL,OT	Geehan and Pierre 2013
YFT	Yellowfin tuna	RD = a*FL^b	2.5490e-05	2.966700	29.0	166	GN,BB,PS	Chassot et al. 2016
YFT	Yellowfin tuna	GG = a*FL^b	9.4007e-06	3.126844	72.0	177	LL,OT	Geehan and Pierre 2013
SKJ	Skipjack tuna	RD = a*FL^b	4.9700e-06	3.392920	30.0	73	ALL	Chassot et al. 2016

Methods

The release in the public-domain of the IOTC curated data sets for tropical tunas, as per the confidentiality rules set in IOTC Res. 12/02, is done following some processing data steps which are briefly summarized below.

Data processing

The Secretariat has recently developed tools enabling CPCs to conduct preliminary checks on the data, ensuring the accuracy of reference codes and completeness before submission. Once the Secretariat received the submissions additional control checks are performed, as detailed below. First, standard controls and checks are performed to ensure that 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 ones are found to be incomplete.

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

a. When retained 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 global capture production 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 Secretariat (2018);

c. Finally, a disaggregation process is performed to break down the catches by species (**Table 2**) and gear (**Table 3**) when these are reported as *aggregates* of multiple species or gears. In short, the process derives the proportion of catches for each IOTC species and / or gears using a combination of data from strata where these are reported separately and reverting on proxy gears and fleets and on a spatial-temporal substitution scheme when required.

Table 2: List of species groups that include one or more tropical tuna species

Species code	Species name	Species scientific name	BET	SKJ	YFT
AG10	Skipjack tuna and kawakawa	*Katsuwonus pelamis; Euthynnus affinis*		✓	
AG35	Yellowfin tuna and skipjack tuna	*Thunnus albacares; Katsuwonus pelamis*		✓	✓
TUN	Tunas nei	*Thunnini*	✓	✓	✓
TUS	True tunas nei	*Thunnus spp*	✓	✓	✓
TUX	Tuna-like fishes nei	*Scombroidei*	✓	✓	✓

Table 3: List of gear aggregates with their component gear codes (limited to gear aggregates that have reported catches of tropical 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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Third, and applying only to the five major IOTC species (albacore, bigeye tuna, skipjack tuna, yellowfin tuna, and swordfish), geo-referenced catches are raised to the best scientific estimates of retained catches using all available information, including expert knowledge, and by either leveraging data from proxy fleets or adopting substitution schemes when the spatio-temporal information is not available for a given stratum.

For this reason, the raised catches data sets represent the best scientific estimates of the geo-referenced catches given the information available to the Secretariat and the issues with data availability and data quality affecting several fisheries. Raised data comprise estimated catches both in weight and number and stratified by year, month, fleet, gear, school type (when available) and 5°x5° grid, covering the entire time series for which retained catches are available. The average weight of each species can be computed directly from the raised weights and numbers for each stratum, with the accuracy of the results being directly proportional to the availability and quality of the original geo-referenced catch and size-frequency data.

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 measurements are provided with size bins exceeding the maximum width considered meaningful for the species (IOTC Secretariat 2020a).

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 Secretariat 2020a). 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.

Last, a specific process is applied to the tagging data collected for the three tropical tuna species, to specifically filter dubious records, correct for potential tag loss, and adjust for under-reporting of recaptures (IOTC Secretariat 2020b).

Data quality

A scoring system has been implemented to assess the quality of the retained catch, catch-effort, and size-frequency data available at the Secretariat for all IOTC species. The determination of the score varies according to the 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 retained catches such as under-reporting and misreporting.

Table 4: Key to IOTC quality scoring system

<table>
<tr><th>Data set</th><th>Criterion</th><th>By species</th><th>By gear</th></tr>
<tr><td rowspan="3">Retained catch</td><td>Fully available</td><td>0</td><td>0</td></tr>
<tr><td>Partially available</td><td>2</td><td>2</td></tr>
<tr><td>Fully estimated</td><td>4</td><td>4</td></tr>
<tr><td rowspan="4">Catch and effort</td><td>Available according to standards</td><td>0</td><td>0</td></tr>
<tr><td>Not available according to standards</td><td>2</td><td>2</td></tr>
<tr><td>Low coverage (<30% logbooks)</td><td colspan="2">2</td></tr>
<tr><td>Not available</td><td colspan="2">8</td></tr>
<tr><td rowspan="4">Size frequency</td><td>Available according to standards</td><td>0</td><td>0</td></tr>
<tr><td>Not available according to standards</td><td>2</td><td>2</td></tr>
<tr><td>Low coverage (<1 fish per tonne caught)</td><td colspan="2">2</td></tr>
<tr><td>Not available</td><td colspan="2">8</td></tr>
</table>

Results

Retained catches

Historical trends (1950-2023)

Historical catches of the 16 IOTC species, show a steady increase, depending on species group, reaching maximum total catch of over 2.01 million t in 2023, but slightly decreasing in the last year to 2.01 million t (**Fig. 2a**). Catches of tropical tunas, remain the highest 1950 and 2023, despite some variations. The changes occurred as a result of the dynamics within of the fisheries sector, such as:

(i) Changes in target species;

(ii) Shifts in fishing grounds (weather effect);

(iii) effect of management and conservation measures on certain species;

(iv) development and innovation in the fisheries section, and

(v) market dynamic (prices, demand).

Although the overall catches of IOTC species dropped slightly in 2023, catches of tropical tuna species remain similar to 2022 catch level, around 1.21 million t, corresponding to 60% of catches of all IOTC species combined (**Fig. 2b**).

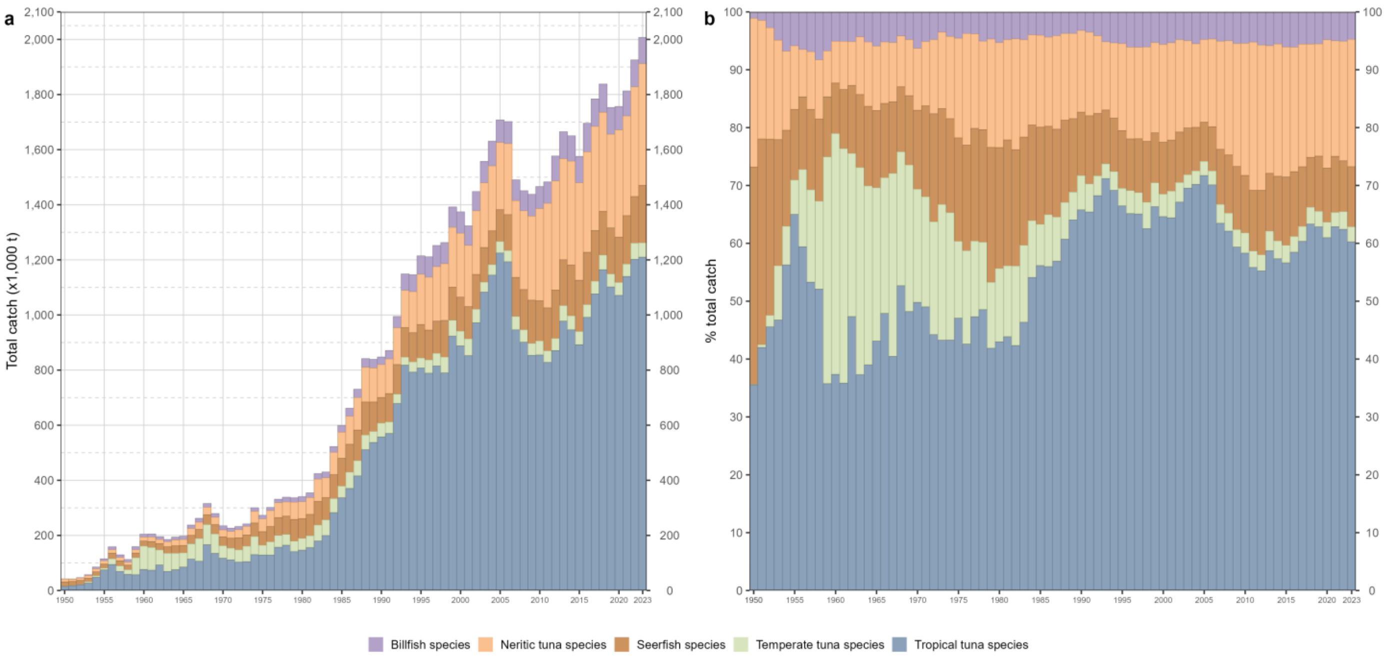

Figure 2: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of all IOTC tuna and tuna-like species by species category for the period 1950-2023

Catches of tropical tunas in the Indian Ocean show a sharp increase from the early to mid-1980s, following the arrival of purse seiners from the Atlantic Ocean and the quick development of the industrial purse seine fishery. Eventually, purse seine catches showed a constant increase until the mid-2000s, when annual total catches from all fisheries of the three tropical tuna species combined exceeded 1.22 million t in 2005 (**Fig. 3a**).

While yellowfin tuna dominated tropical tuna catches prior to the 1970s, its contribution decreased from over 60% in the mid-1950s to around 40% of the total catches in the early 1980s, a value that has remained fairly stable over the last four decades (**Fig. 3b**). Annual catches of yellowfin tuna increased from around 28,000 t during the 1950s to around 431,000 t in the last five years for which data is available. More details in [IOTC-2025-WPTT27-07d - YFT data](https://www.iotc.org/documents/WPTT/26/03d.

The contribution of skipjack tuna to total tropical tuna catches shows an almost continuous increase over time, from less than 30% of the totals in the mid-1950s to over 50% in recent years (**Fig. 3b**). In absolute terms, annual catches of skipjack tuna increased from around 14,000 t during the 1950s to around 626,000 t in the last five years. More details in [IOTC-2025-WPTT27-07c - SKJ data](https://www.iotc.org/documents/WPTT/26/03c.

Bigeye tuna has generally been the species that contributed the least to total tropical tuna catches (**Fig. 3b**). In fact, its contribution shows a steady decline from 30% in the late 1970s to 10% in recent years. Annual catches of bigeye tuna increased from an average of around 7,000 t in the 1950s to an average of around 88,000 t between 2019 and 2023, with peak in catches well exceeding 110,000 t since 1994 and during the 2000s and in 2012 - 2013 (see IOTC-2025-WPTT27-03b - BET data for additional information).

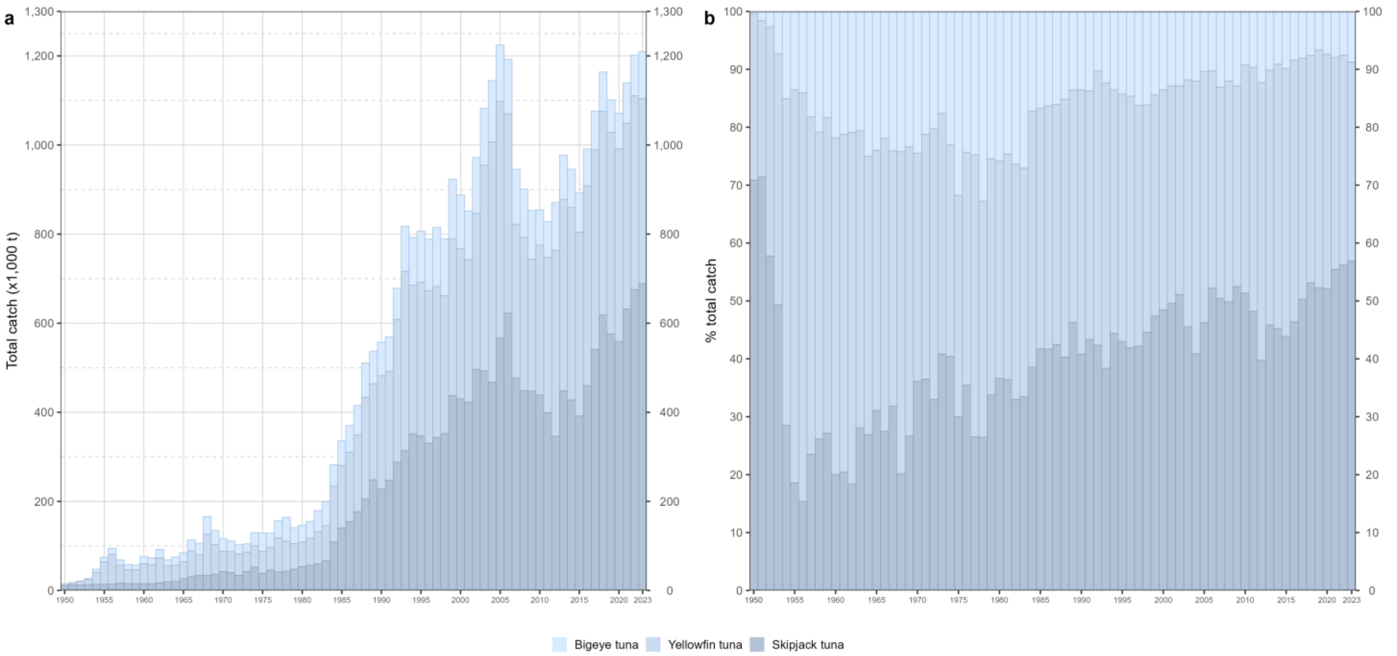

Figure 3: Annual time series of cumulative retained absolute (a) and relative (b) catches (metric tonnes; t) of Indian Ocean tropical tuna by species for the period 1950-2023

The majority of tropical tuna has been caught by industrial fisheries from the mid-1980s throughout the 1990s and 2000s, contributing to about 64% of the total catch over that period (**Fig. 4**). In the same years, total catches of tropical tuna taken by Indian Ocean artisanal fisheries increased steadily, reaching annual values of around 425,000 t in recent years.

Following the major decline in catches by industrial fisheries in the late 2000s, catch levels of artisanal and industrial fisheries remained comparable at about 459,000 t per year between 2010 and 2015, when a new increase in industrial catches saw their contribution reaching 63% of the total tropical tuna catch, i.e., about 720,000 t as recorded between 2019 and 2023 (**Fig. 4**).

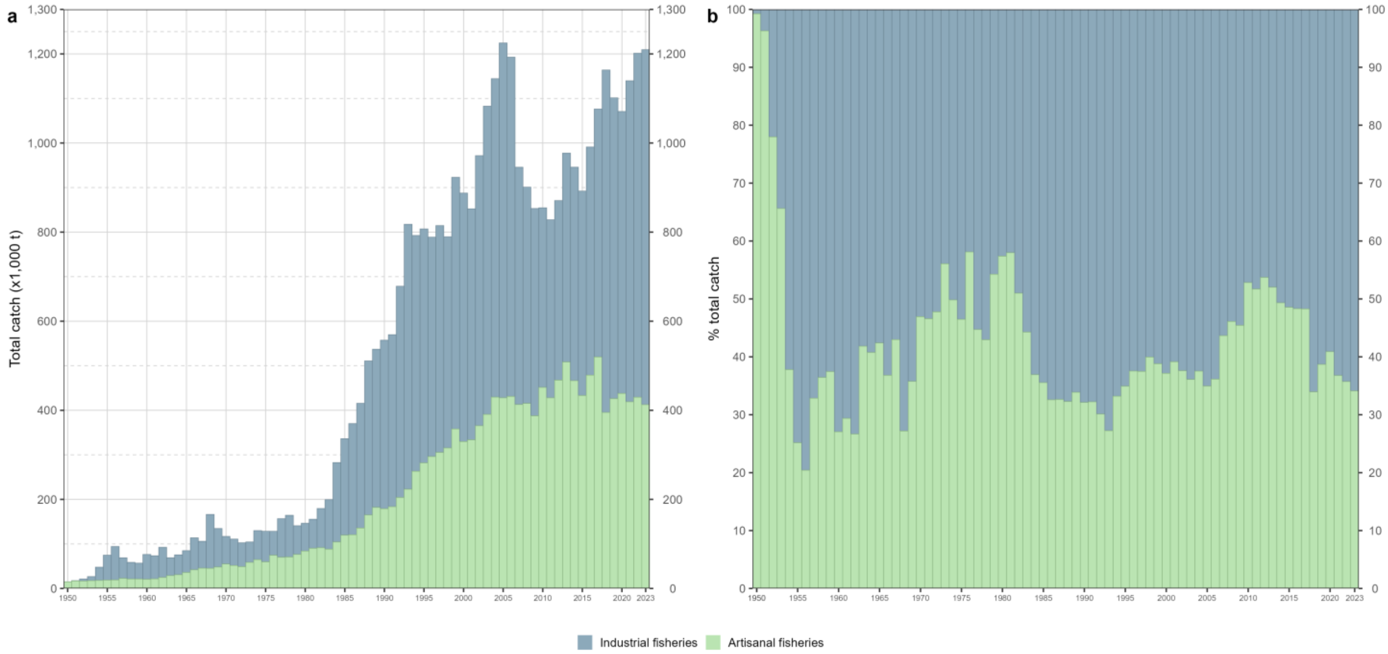

Figure 4: Annual time series of retained catches (metric tonnes; t) of Indian Ocean tropical tuna by fishery type for the period 1950-2023

The contribution of different fisheries to total tropical tuna catches has undergone significant changes over time, reflecting the development, expansion, or decline of these fisheries between 1950 and 2023. Tropical tuna species were primarily caught by coastal fisheries, which comprised a large and diverse array of operations. The increase in catches was largely influenced by: (i) distant longline fisheries that began in the mid-1950s, and (ii) the growth of purse seine fisheries in the 1980s. The surge of interest in purse seine fisheries in the Indian Ocean from the late 1980s led to a sudden increase in tropical tuna catches starting in 1986.Catches from industrial fisheries remained high throughout the 1990s and 2000s. However, from 2009 onward, tropical tuna catches began to decline, a trend attributed to piracy, which reduced operations of distant water fleets and shifted the focus to targeting neritic species by large coastal vessels (**Fig. 5a**). As more coastal vessels became operational, the contribution from coastal fisheries rose to approximately 50% between 2009 and 2015. In recent years, catches from industrial fisheries have increased again, driven by new operational strategies, with significant catches from purse seine vessels operating on floating objects (FOBs) (**Fig. 5b**).

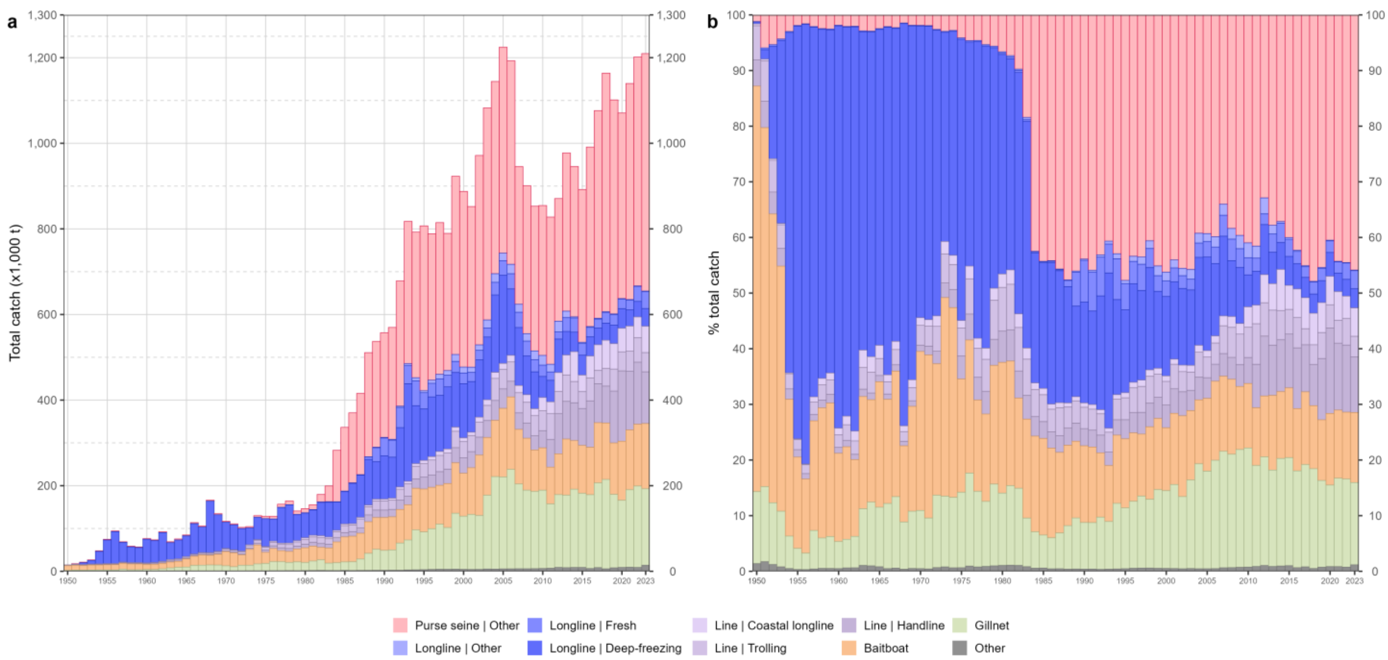

Figure 5: Annual time series of retained catches (metric tonnes; t) of Indian Ocean tropical tuna by fishery for the period 1950-2023

Main fishery features (2019-2023)

In recent years between, 2019 and 2023, purse seine fisheries, encompassing large industrial vessels fishing on FOBs and in free swimming school mode, as well as coastal surrounding nets, contributed approximately 44% of the total tropical tunas catches. Catches from line fisheries, including handline, trolling and coastal longline, have also seen an increase, accounting for21% in recent years (**Table 5**). In contrast, industrial longline fisheries recorded the lowest catches, despite the fact that tuna caught by longline methods are often regarded as higher quality (The challenges of purse seine versus longline tuna fishing 2012).

Table 5: Mean annual catches (metric tonnes; t) of Indian Ocean tropical tuna by fishery between 2019 and 2023. LS = schools associated with floating objects; FS = free-swimming schools

Fishery	Fishery code	Catch	Percentage
Purse seine	PS	505,705	44.2
Gillnet	GN	175,782	15.4
Baitboat	BB	138,913	12.1
Line | Handline	LIH	137,678	12.0
Line | Coastal longline	LIC	56,711	5.0
Line | Trolling	LIT	48,940	4.3
Longline | Deep-freezing	LLD	40,970	3.6
Longline | Fresh	LLF	28,952	2.5
Other	OT	9,842	0.9
Longline | Other	LLO	1,137	0.1

Catches of tropical tuna species have been recorded from most fleets in the Indian Ocean, regardless of the type of fisheries. Coastal fleets utilizing diverse fishing gear, contributed significantly to the overall tropical tuna catch. In recent years, Indonesia accounted for approximately 17% of the total tropical tunas catches across multiple fisheries during the period 2019-2023, with the majority coming from purse seine fisheries (industrial and coastal). The EU.Spain and Seychelles, two leading industrial purse seine fleets, contributed 13% and 11% respectively in recent years. Maldives, known for its pole and line fisheries caught 13%. Notably, Iran's gillnet fisheries is the principal gillnet fisheries catching tropical tunas (**Fig. 6**).

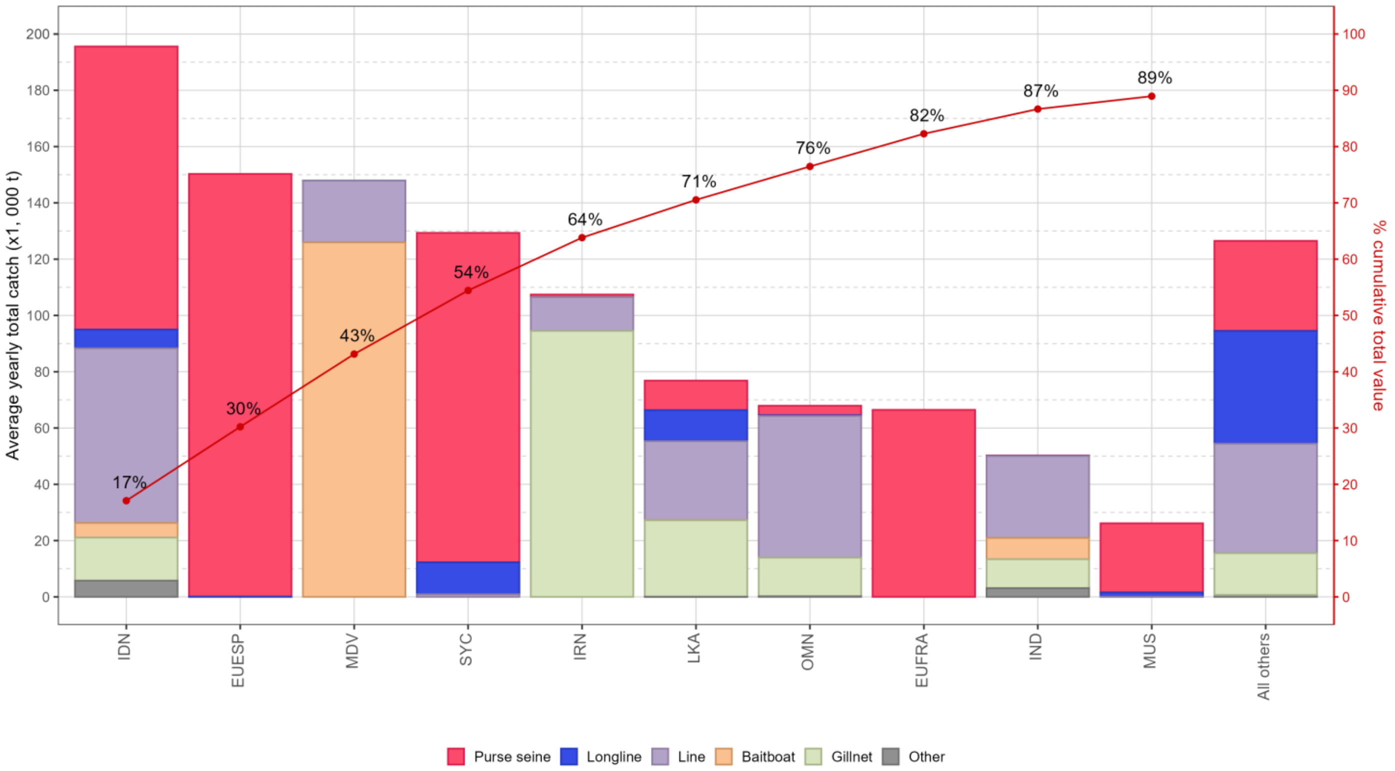

Figure 6: Mean annual catches (metric tonnes; t) of Indian Ocean tropical tuna by fleet and fishery group between 2019 and 2023, with indication of cumulative catches by fleet.

Detailed catch contribution by fishery and fleet are illustrated in **Fig. 7** and **Fig. 8** for recent temporal trends in retained catch of tropical tuna between 2019 and 2023. Overall, catch levels vary significantly across fishery groups with the main fleets within each fishery group showing different inter-annual changes in catches.

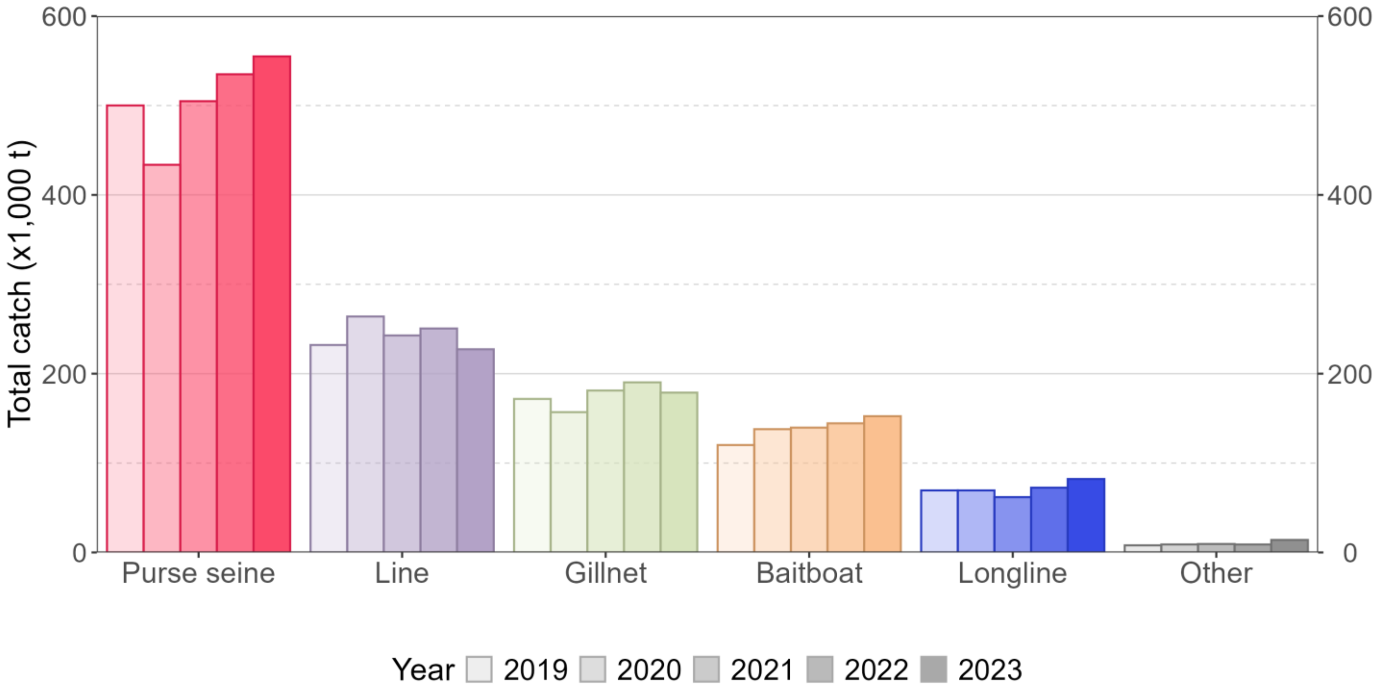

Figure 7: Annual catch (metric tonnes; t) trends of Indian Ocean tropical tuna by fishery group between 2019 and 2023

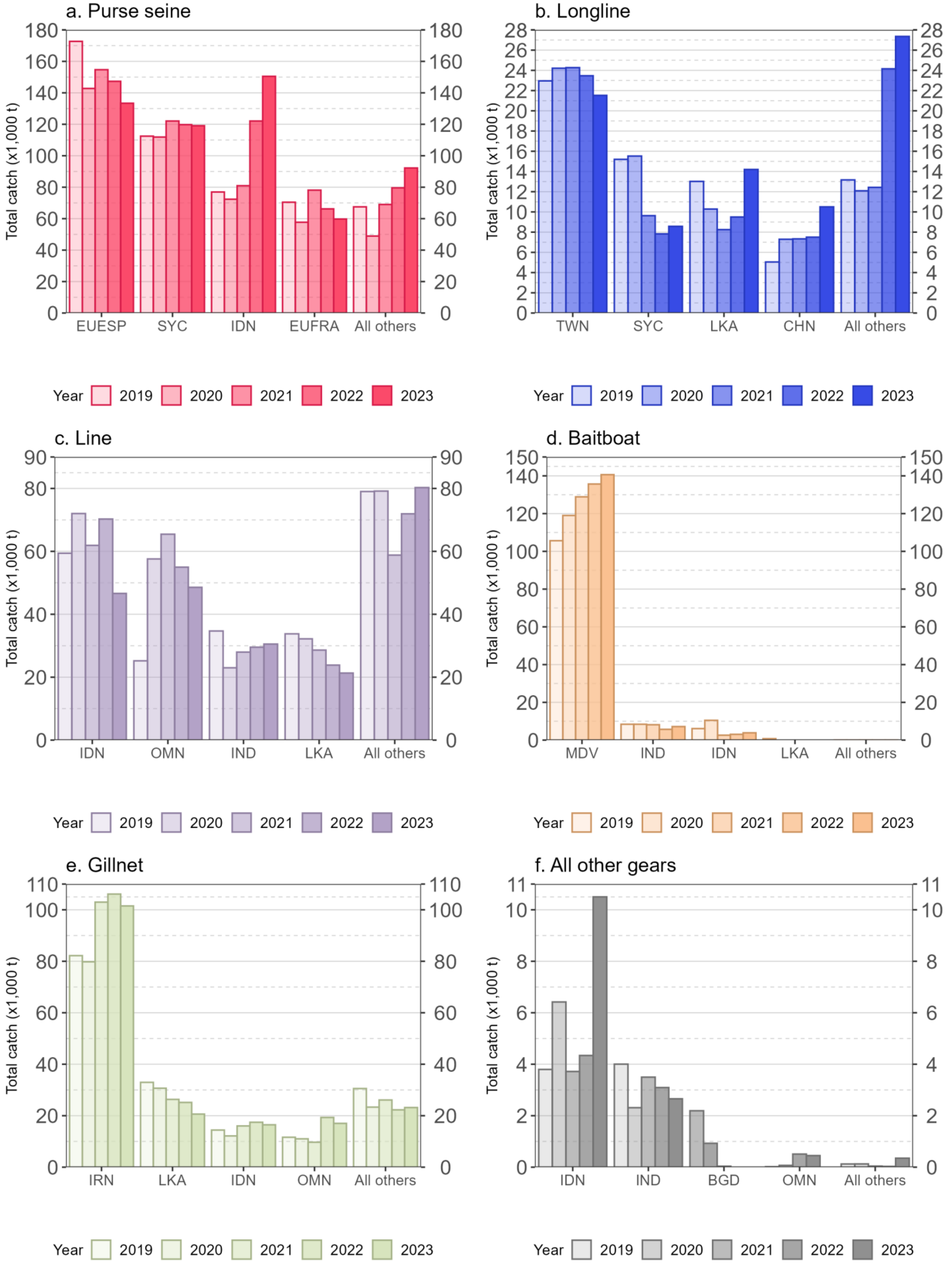

Figure 8: Annual catch (metric tonnes; t) trends of Indian Ocean tuna by main fishery group and fleet between 2019 and 2023

Reporting quality of retained catch data

The quality of data reported by industrial fisheries generally meets standard requirements, although some newer fleets targeting tropical tunas have struggled to fully comply with these reporting standards. However, the catches from these newer fleets remain low compared to those of more established industrial fleets. On a positive note, coastal fisheries with high catches of tropical tunas are enhancing the quality of their reported data. In recent years several CPCs in the Indian Ocean are piloting various electronic monitoring systems, and alternative data collection systems to enhance data the quality of fisheries data recorded from small-scale fisheries (Martin 2023). Various factors ranging from operation to socio-econimic influence the quality of data, though which, the slow improvement in the quality of data from small-scale is attributed to most of the factors.

Fig. 9 illustrates the trend in the quality of retained catches of tropical tuna. Compared to other species groups, retained catch data for tropical tuna are well reported. With over 80% of the tropical catches are from industrial fisheries, which are well monitored through logbooks and recording systems, there is minimal uncertainty regarding industrial retained catches. In contrast, the percentage of fully or partially reported catches from coastal fisheries decreased to 68%, down from 68% in 2023. Consequently, the overall percentage of tropical tuna catches fully or partially reported to the Secretariat stood at 68% in 2023.

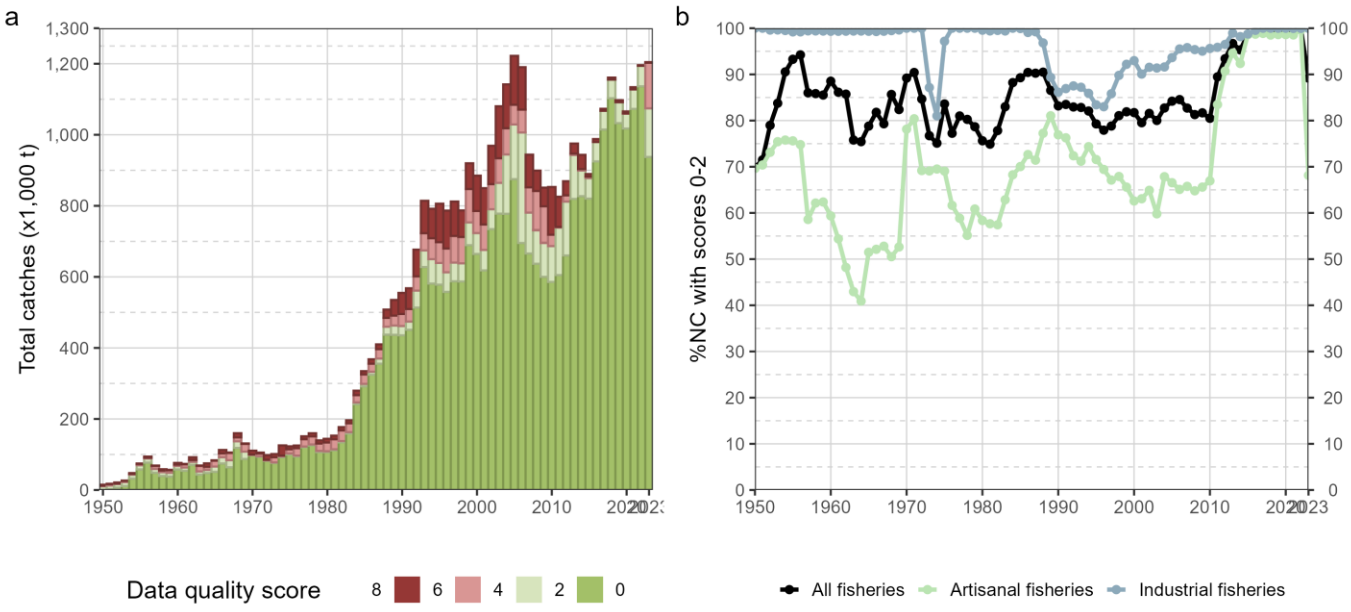

Figure 9: (a) Annual retained catches (metric tonnes; t) of Indian Ocean tropical tuna estimated by quality score and (b) percentage of retained catch fully or partially reported to the IOTC Secretariat for all fisheries and by type of fishery, in the period 1950-2023

Since the implementation of a catch limit on yellowfin tuna to rebuild the stock since 2017 (Res. 17/01), concerns have been raised about potential misreporting and high-grading in some fisheries (IOTC Secretariat 2019, Medley et al. 2021). Notably, the 21st session of the WPTT highlighted how the relative composition of tropical tuna species reported for the year 2018 by the purse seine fleet from EU,Spain showed a higher proportion of bigeye tuna than in previous years (IOTC 2019). Furthermore, other study revisited the catch data of large fishing fleets in the Indian Ocean, focusing on the species composition, concluding that there there is possibility of overestimating yellowfin tuna catches in the past (Abascal et al. 2024).

Spatial distribution of reported efforts

The spatial distribution of effort for tropical tuna species caught in the Indian Ocean exhibits temporal variation across different fisheries. While industrial fisheries had limited operations in the early decades, detailed spatial-temporal data are available, indicating fishing activities throughout the entire Indian Ocean. In contrast, spatial-temporal data for coastal fisheries are scarce.

Longline fisheries

Historical spatial effort distribution shows that Japanese deep-freezing longline fisheries primarily operated in the Southeast Indian Ocean, with some activities extending into the Western Indian Ocean. Efforts from other types of longline fisheries were recorded in the Western Indian Ocean starting in the 1970s, coinciding with an increase in Japanese efforts in the region.

By the 1990s, spatial distribution patterns indicated a shift in the main fisheries, as more vessels from Taiwanese deep-freezing longline operations began to operate throughout the Indian Ocean (**Fig. 10**).

In recent years, there have been notable changes in the main longline fisheries. Since 2019, fresh tuna longline fisheries have become the primary operators, primarily concentrated in the Southwest Indian Ocean, while gradually expanding their presence across other regions (**Fig. 11**).

By decade (1950-2009)

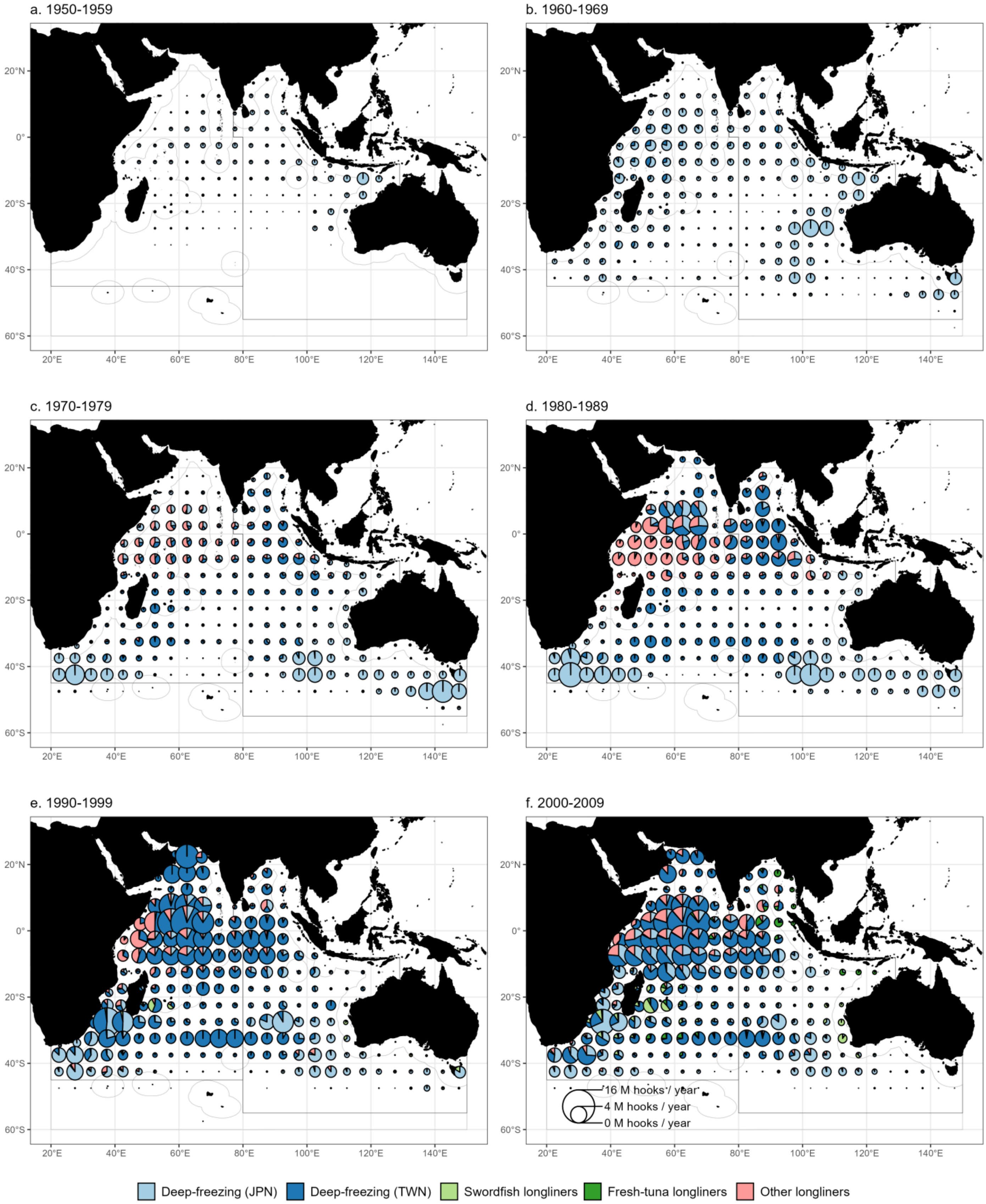

Figure 10: Mean annual effort (millions hooks deployed) exerted by industrial longline fleets by decade, 5°x5° grid, and fleet. Data source: [time-area effort dataset for longline fisheries]() (Res. 15/02)

By last years (2019-2023) and decade (2010-2019)

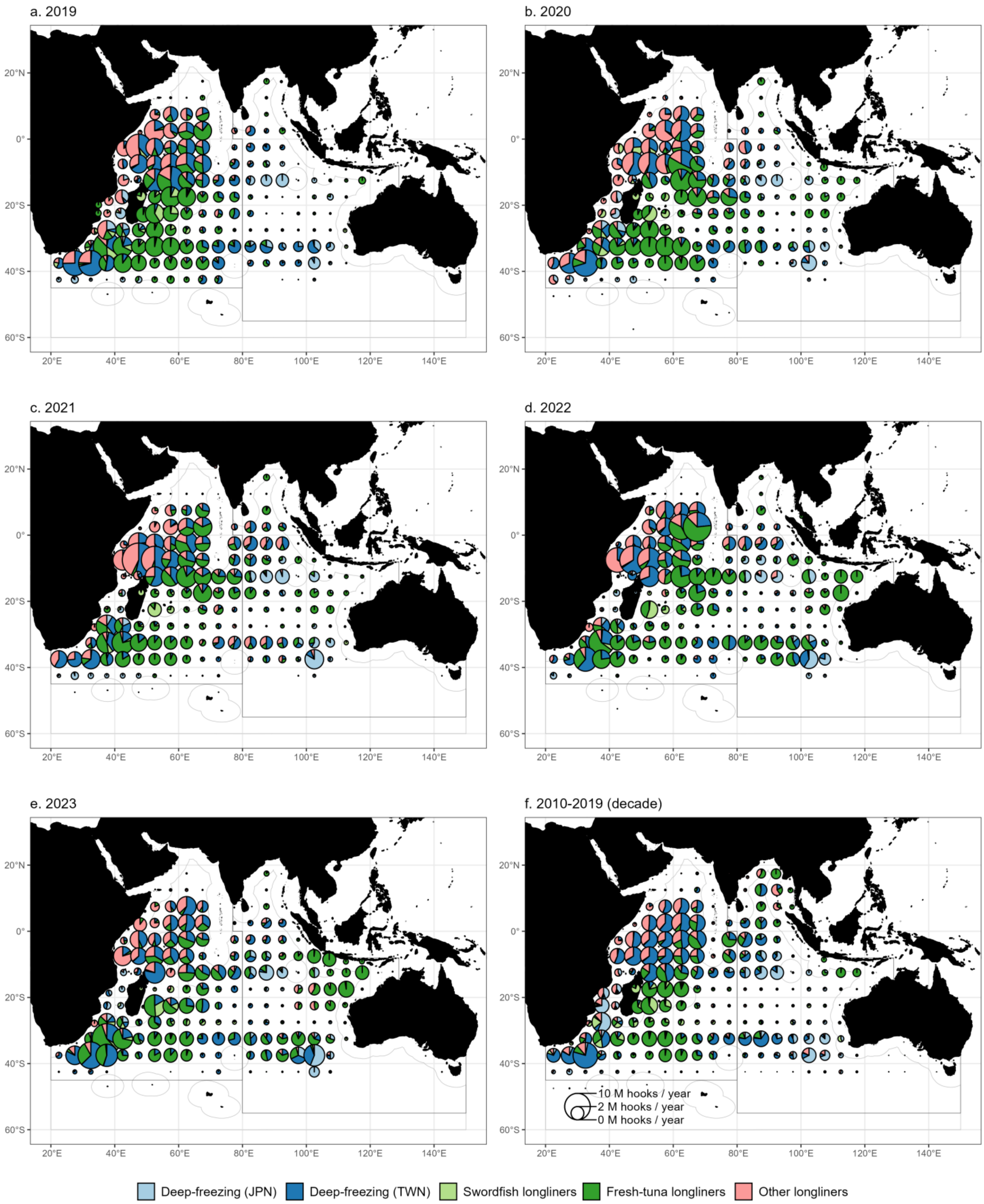

Figure 11: Mean annual effort (millions hooks) exerted by industrial longline fleets by year / last decade, 5°x5° grid. and fleet. Data source: time-area effort dataset for longline fisheries (Res. 15/02)

Purse seine fisheries

Spatial geo-referenced effort data from purse seine fisheries have been reported since the 1980s, coinciding with the emergence of these fisheries in the Indian Ocean. The distribution of effort indicates that the Western Indian Ocean serves as the primary fishing ground for purse seine fisheries, particularly for European and affiliated fleets. Other purse seine fisheries displayed similar distribution patterns in the earlier decades, although the effort levels varied (**Fig. 12**).

In recent years, European purse seine fisheries have maintained a high level of effort in the Western Indian Ocean (**Fig. 13**). However, there have been notable changes in distribution patterns for other purse seine fleets, particularly an increase in effort in the Eastern Indian Ocean, attributed to Indonesia's growing industrial purse seine activities (**Fig. 14**)

All, by decade (1980-2009)

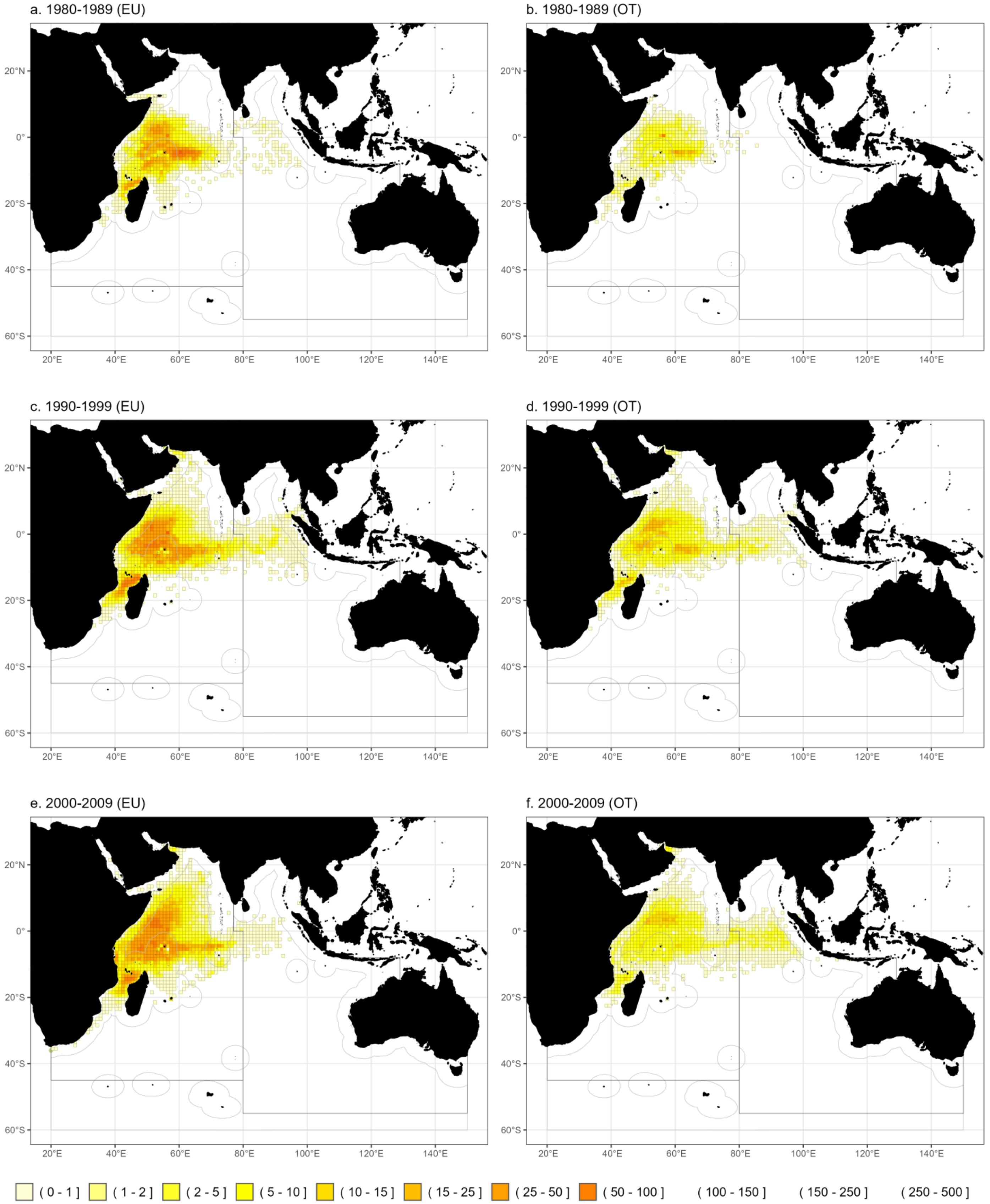

Figure 12: Mean annual effort (fishing days) exerted by the industrial purse seine fleets of the European Union and comparable fleets (EU) vs. all other flags (OT) by decade, 1°x1° grid, and fleet. Data source: [time-area effort dataset for purse-seine fisheries]() (Res. 15/02)

European Union, by last years (2019-2023) and decade (2010-2019)

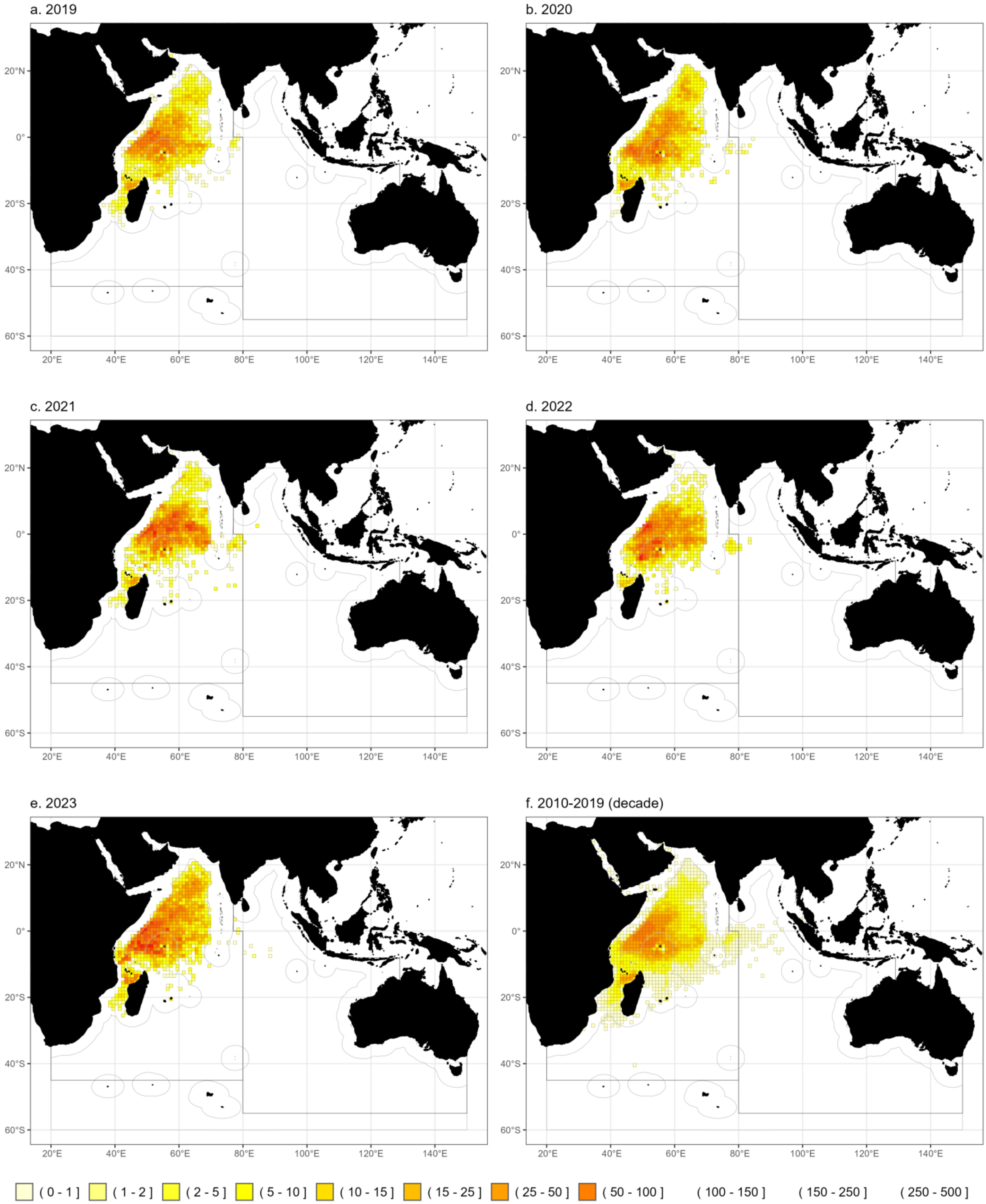

Figure 13: Mean annual effort (fishing days) exerted by the industrial purse seine fleets of the European Union and comparable fleets (EU) by year / decade and 1°x1° grid. Data source: [time-area effort dataset for purse-seine fisheries](#) (Res. 15/02)

All others, by last years (2019-2023) and decade (2010-2019)

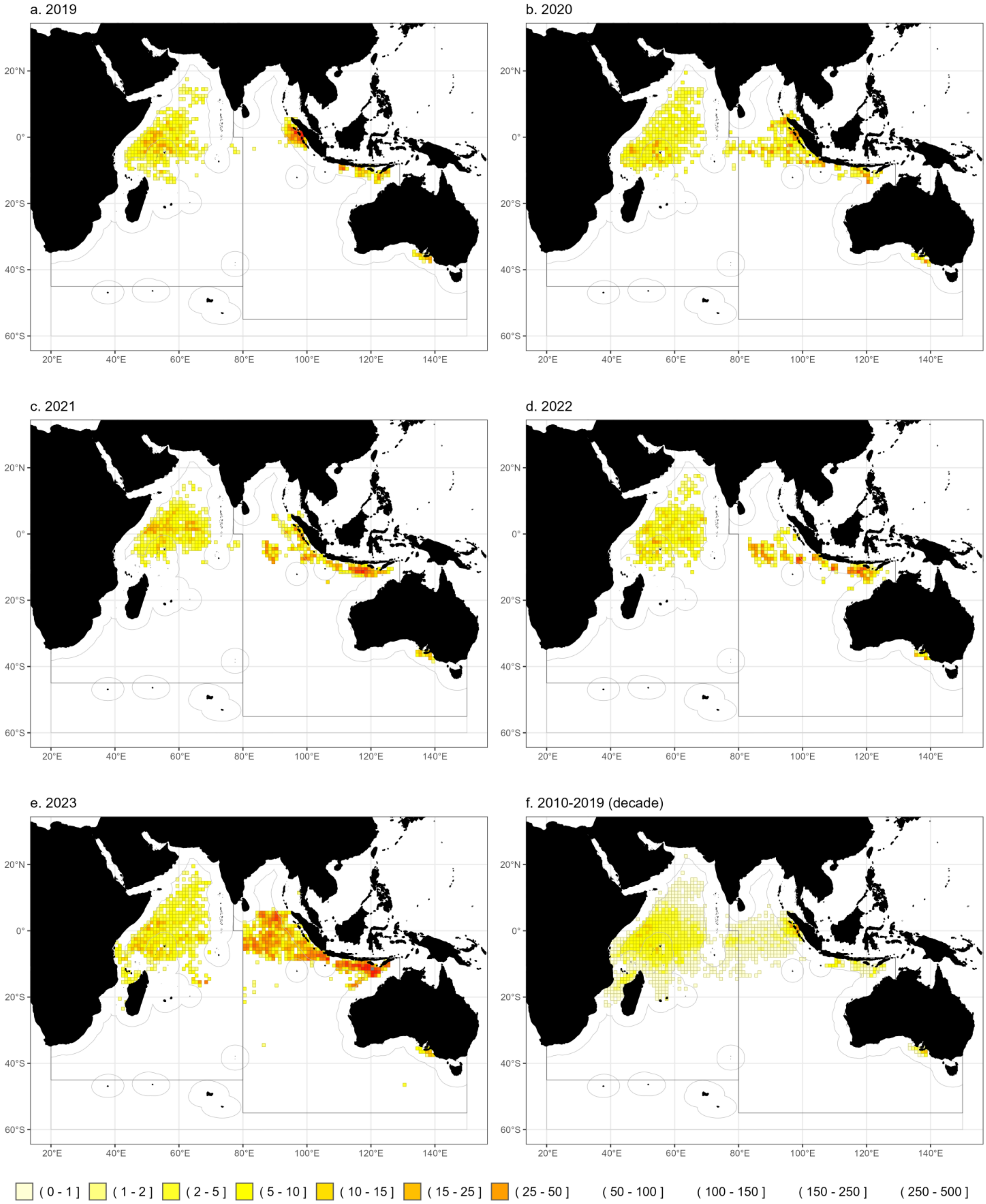

Figure 14: Mean annual effort (fishing days) exerted by purse seine fleets from other flags (OT) by year / decade and 1°x1° grid. Data source: [time-area effort dataset for purse-seine fisheries] (Res. 15/02)

Spatial distribution of reported catches

Geo-referenced catch data distribution for all fisheries indicates that, in addition to longline fisheries, pole-and-line fisheries were prominent in the early years around the Maldives. From the 1980s onward, purse seine fisheries reported high catches in the Western Indian Ocean, along with gillnet fisheries particularly in the Northern Indian Ocean (**Fig. 15**).

Recent spatial catch distribution illustrates an emerging trend among several coastal fisheries, particularly line and gillnet fisheries since 2019. In comparison to the 2010 decade, gillnet fisheries have seen a reduction in catch distribution, while spatial catch data from line fisheries have increased. These shifting patterns is attributed to the conversion of gillnet vessels or seasonally adapted for line fishing, specifically targeting yellowfin tuna (**Fig. 16**).

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

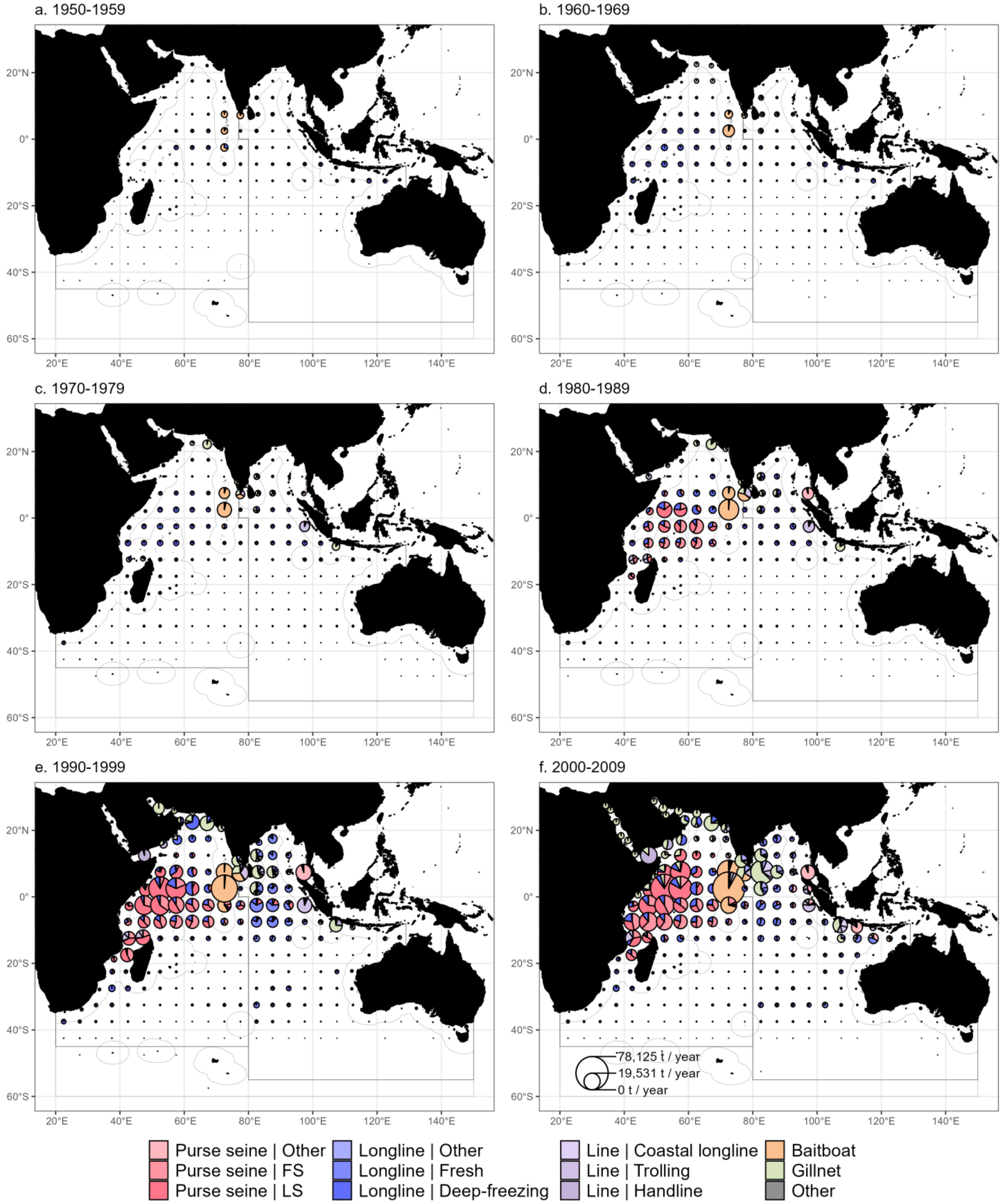

Figure 15: Estimated mean annual time-area catches (metric tonnes; t) of Indian Ocean tropical tuna by decade, 5°x5° grid, and fishery. Data source: tropical tuna raised time-area catches

Geo-referenced catches by fishery, last years (2019-2023), and decade (2010-2019)

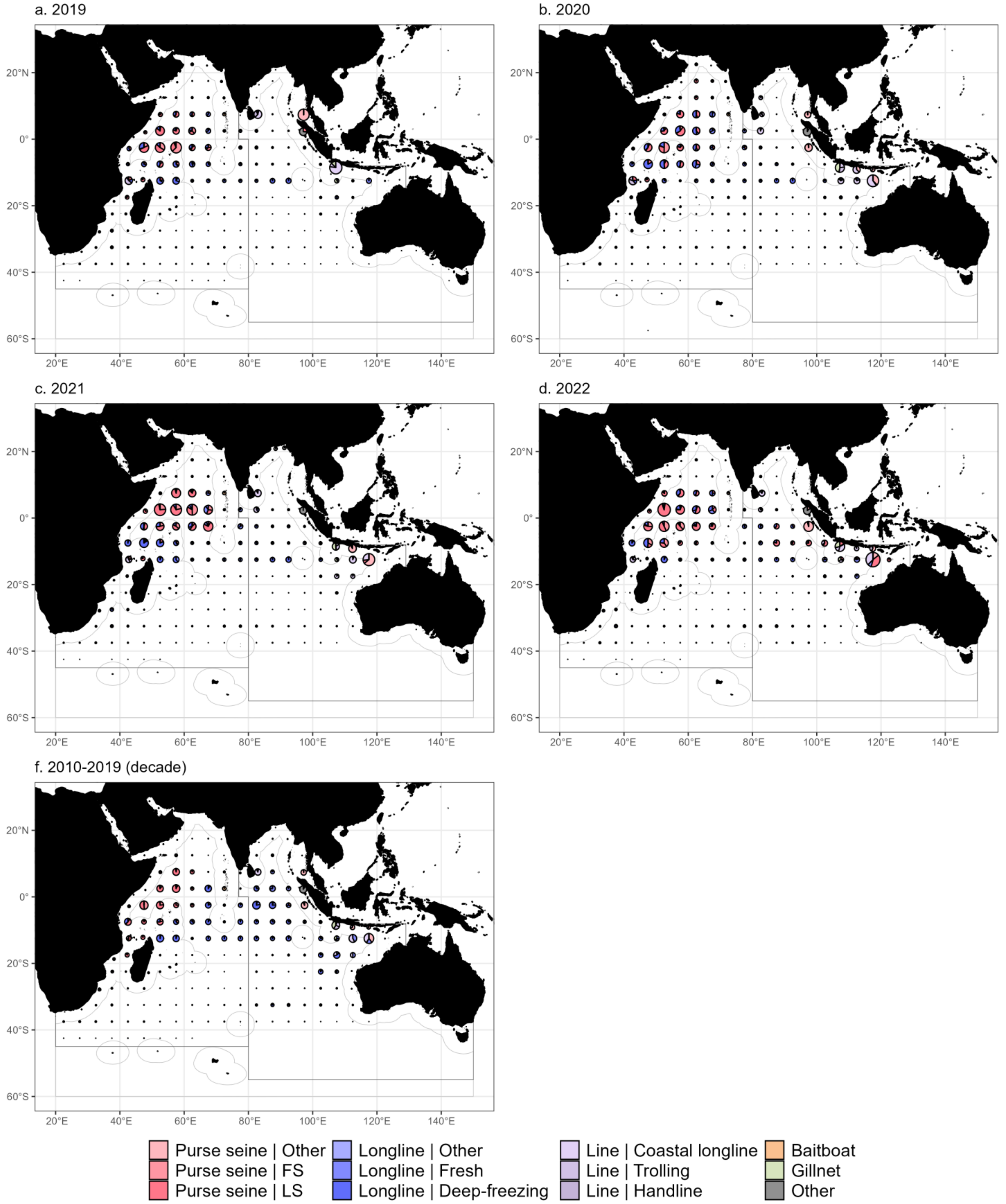

Figure 16: Estimated mean annual time-area catches (metric tonnes; t) of Indian Ocean tropical tuna by year / decade, 5°x5° grid, and fishery. Data source: Tropical tuna raised time-area catches

Reporting quality of catch and effort data

Coastal fisheries still face challenges in accurately recording geo-referenced catch data, as evidenced by the limited availability of geo-spatial data for these fisheries. Notably, CPCs with large coastal fisheries that predominantly catch tropical tunas are exploring various tools and alternative methods to enhance their geo-referenced data collection (Martin 2023).

There are notable variations in the availability of geo-referenced data from both industrial and coastal fisheries compared to the retained catch of tropical tunas in the past. In recent years, there has been significant improvement in the quality of geo-referenced data from industrial fisheries (i.e., scores 0-2; **Table 4**), reflecting effective data collection through logbook systems as mandated by IOTC Resolution 15/01. In 2023, the availability of geo-referenced catch data from industrial fisheries reached 98%. In contrast, the availability of geo-referenced data from coastal fisheries remains low at 54%. The overall availability in 2023 was at 91%, an increase compared to 2022, which as at 93% (**Fig. 17**).

Nevertheless, the same IOTC Resolution 15/01 (para. 11) calls for the progressive implementation, among developing coastal states, of proper data collection mechanisms for coastal fisheries, and therefore improvements in data collection and reporting quality from these fleets are expected in the future.

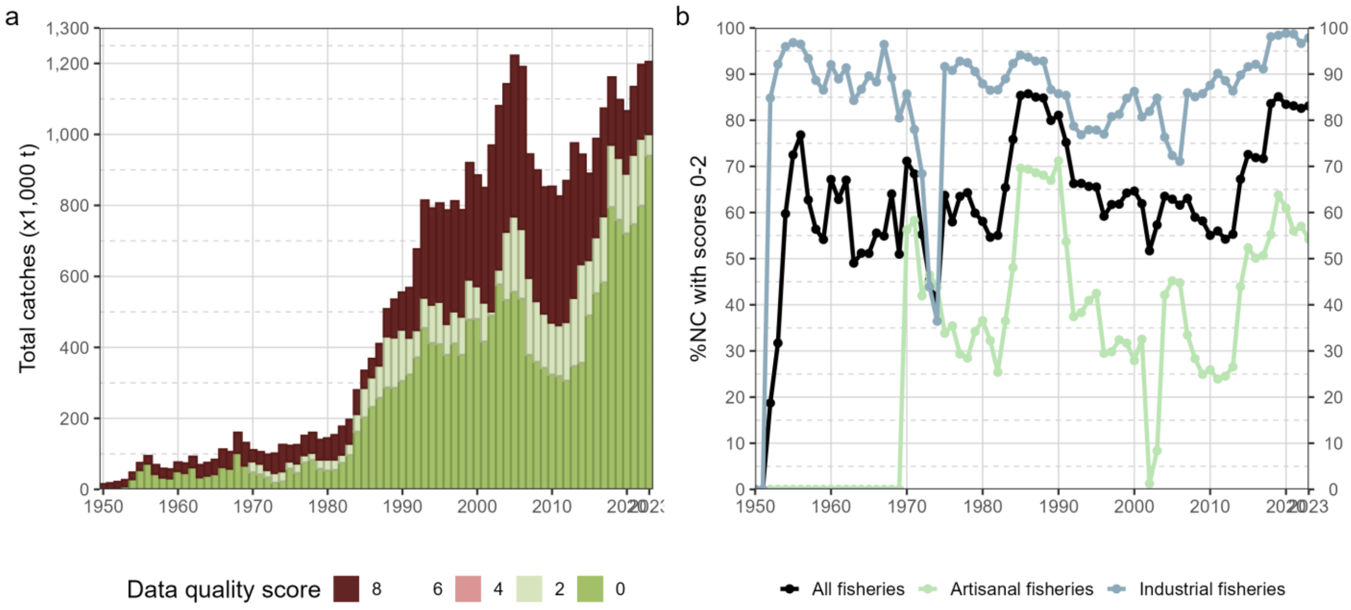

Figure 17: (a) Annual retained catches (metric tonnes; t) of Indian Ocean tropical tuna estimated by quality score and (b) percentage of geo-referenced catches reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 for all fisheries and by type of fishery, in the period 1950-2023

Size-frequency

Reporting quality of size-frequency data

The trends in the quality of size frequency data available are somewhat similar to those for geo-referenced catch data, exhibiting significant variation in availability. While industrial fisheries targeting tropical tuna are generally known for their robust data collection systems, several fleets have struggled to report size frequency data as mandated by IOTC Resolution 15/01.

The availability of size frequency data began in the 1980s, despite retained catches of tropical tuna dating back to the 1950s. Industrial fisheries, including longline fleets from Taiwan, China, and Japan, as well as industrial purse seine fisheries, collected some size frequency data, though coverage of retained catches was partial. In recent years, the availability of size data has slightly improved, particularly from fleets with observers on board, as these observers record fish sizes and provide the information to their respective institutions. 2023, the percentage of retained catch data for which good size data were available at the Secretariat was 59%.

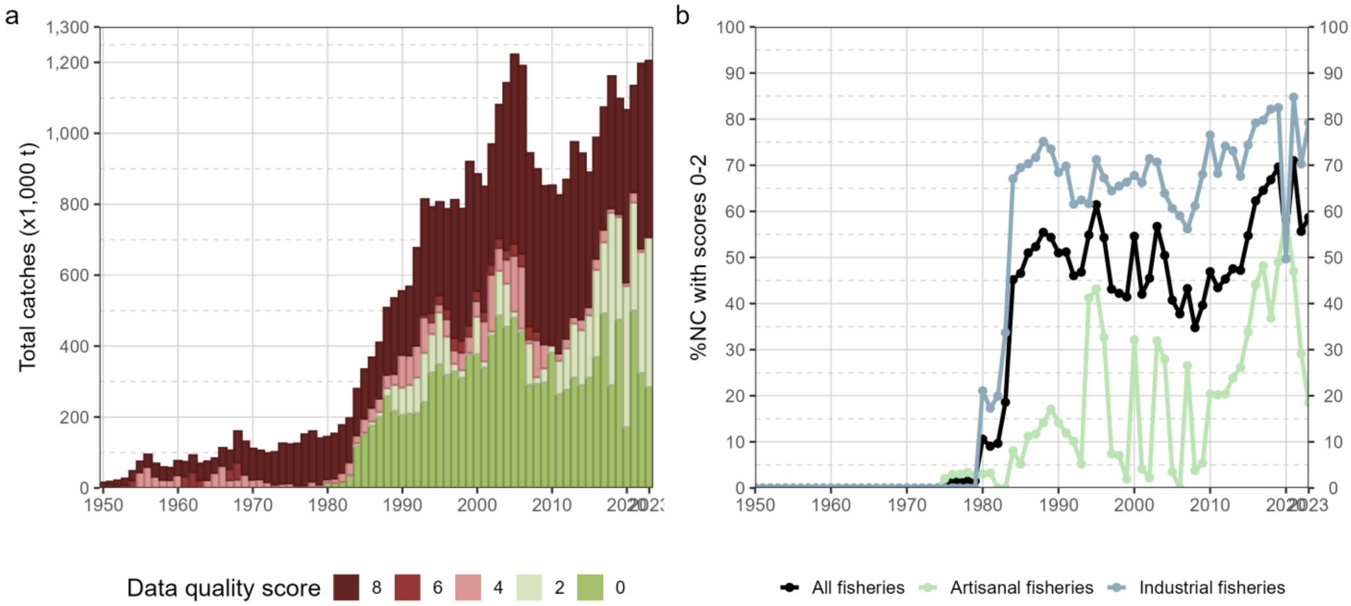

Figure 18: Annual retained catches (metric tonnes; t) of Indian Ocean tropical tuna estimated by quality score (barplot) and percentage of geo-referenced size-frequency data reported to the IOTC Secretariat in agreement with the requirements of Res. 15/02 (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950–2023

Appendix I: Monthly time series of tropical tuna import prices, 2000-2022

Frozen purse seine, Thai import prices (canning grade)

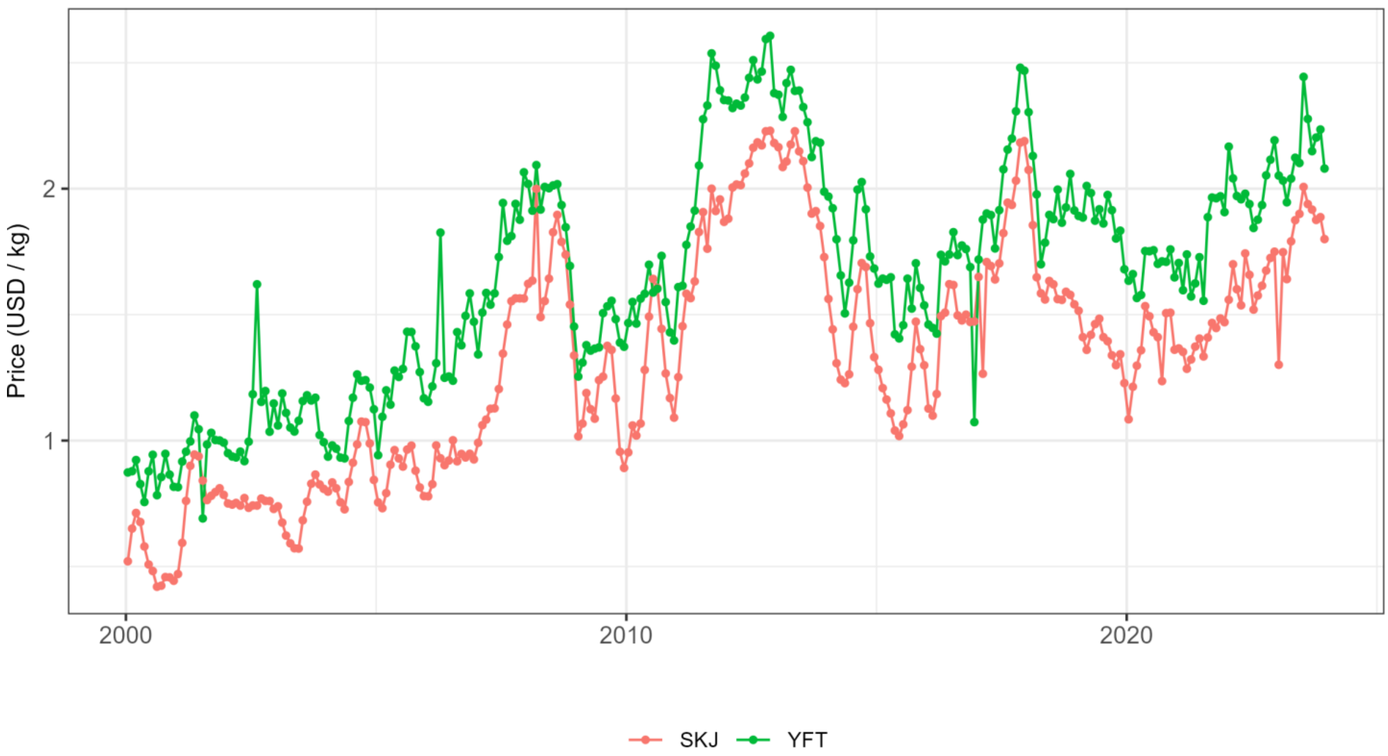

Figure 19: Monthly time series of import prices (USD/kg) in Thailand for canning-grade frozen skipjack and yellowfin tunas during the period 2000-2023. Data sourced from Thailand customs, compiled, and curated by the FFA Fisheries Development Division (Ruaia et al. 2020)

Frozen longline, Japanese import prices (sashimi grade)

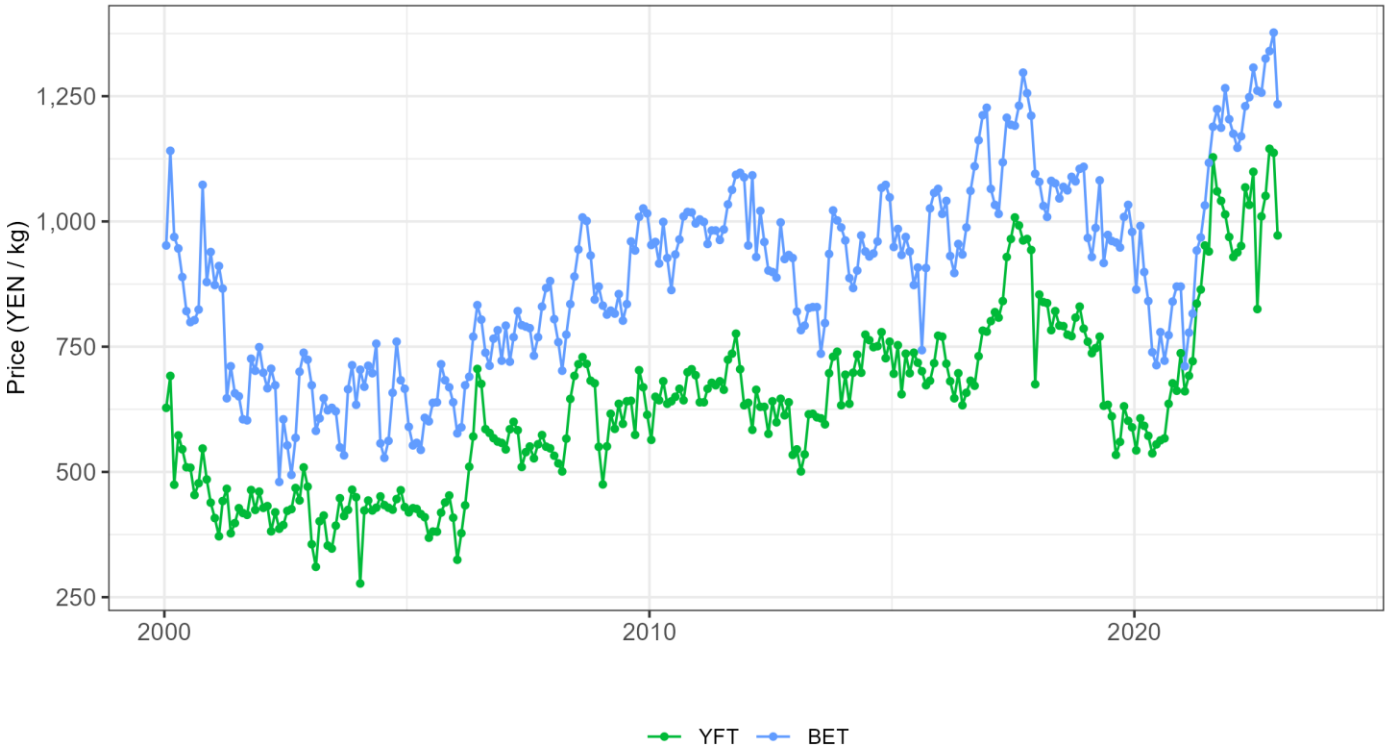

Figure 20: Monthly time series of import prices (YEN/kg) in Japan for sashimi-grade frozen during the period 2000-2023. Data sourced from Japanese customs, compiled, and curated by the FFA Fisheries Development Division (Ruaia et al. 2020)

Fresh longline, Japanese import prices (sashimi grade)

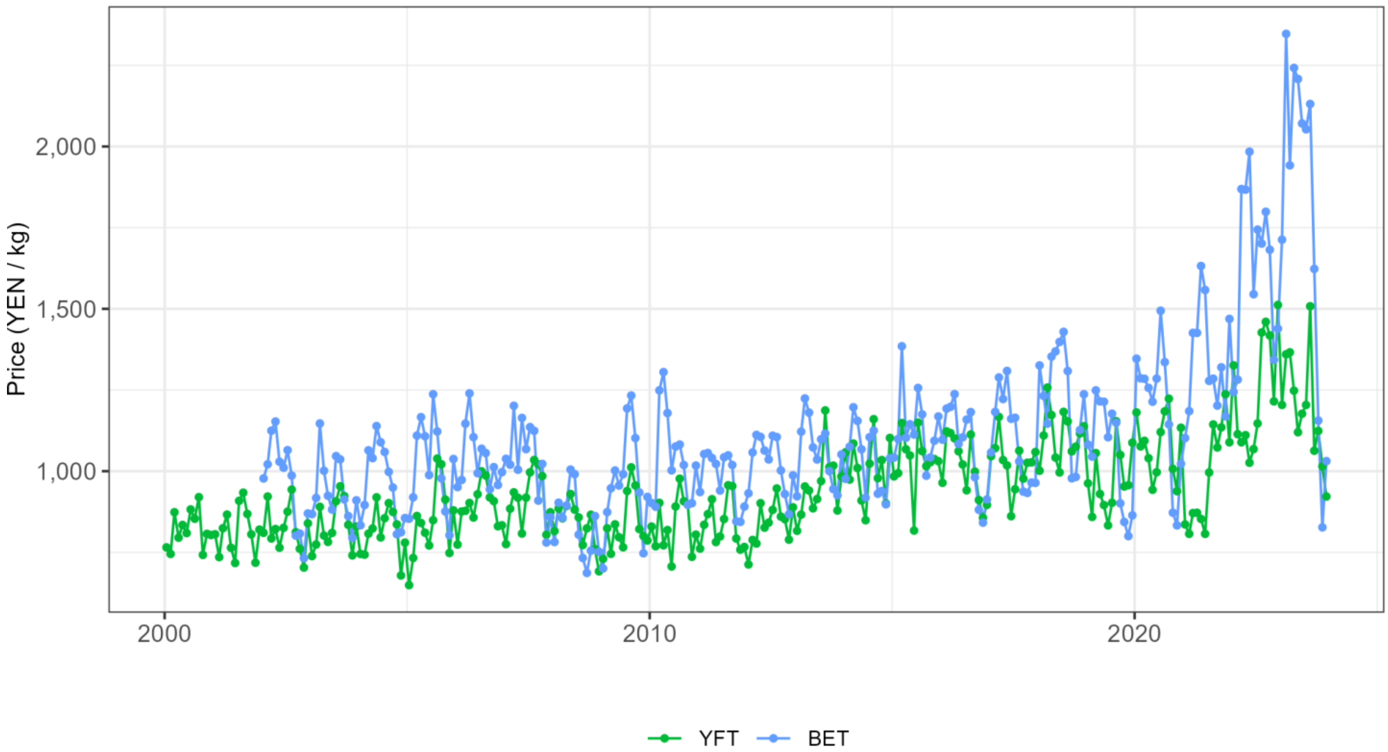

Figure 21: Monthly time series of import prices (USD/kg) in Thailand for canning-grade frozen during the period 2000-2023. Data sourced from Japanese customs, compiled, and curated by the FFA Fisheries Development Division (Ruaia et al. 2020)

Fresh longline, US import prices (sashimi grade)

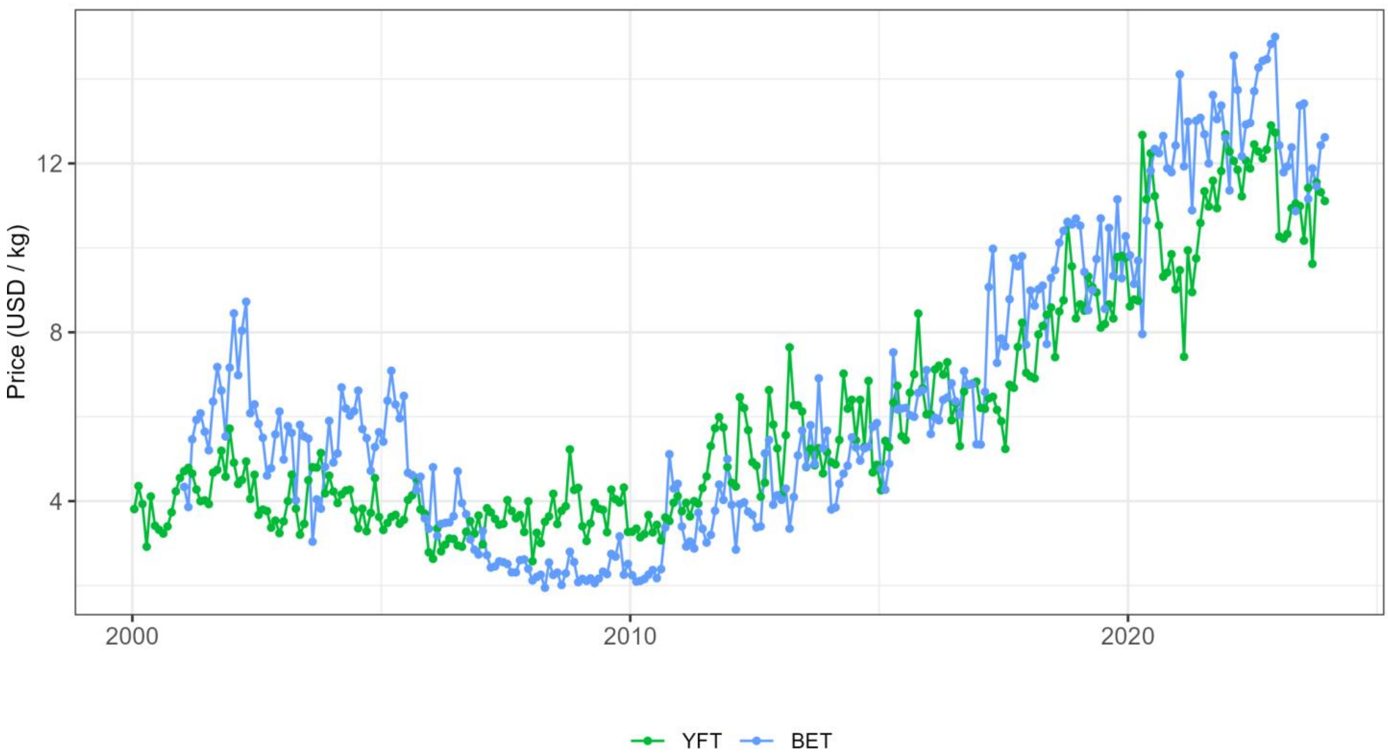

Figure 22: Monthly time series of import prices (USD/kg) in Thailand for canning-grade frozen during the period 2000-2023. Data sourced from USA customs, compiled, and curated by the FFA Fisheries Development Division (Ruaia et al. 2020)

Appendix II: Monthly time series of crude oil prices, 2000-2023

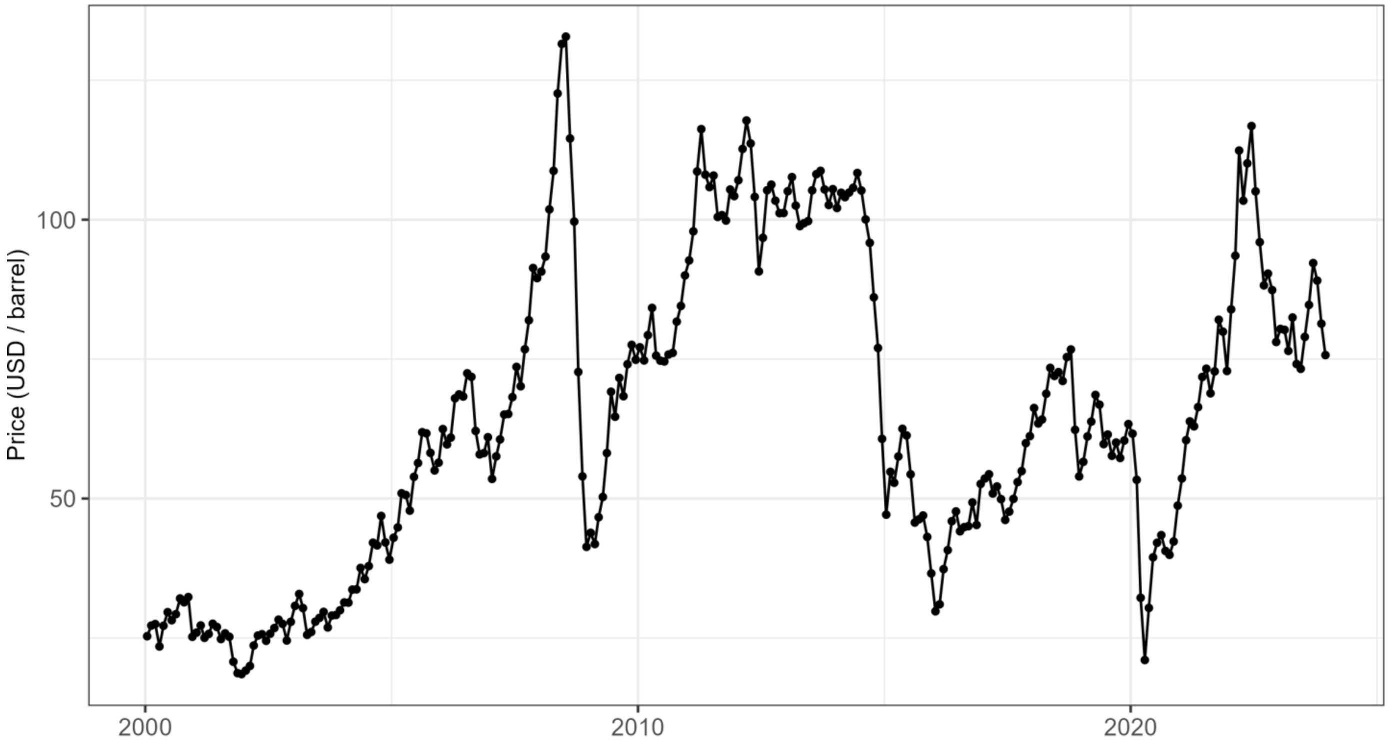

Figure 23: Monthly time series of crude oil spot price (USD/barrel) during the period 2000-2023. Data sourced from the spot prices of Brent, Dubai, and West Texas, compiled, and curated by the FFA Fisheries Development Division

References

Abascal F, Kaplan D, Gaertner D, Ramos M, Duparc A, Depetris M, Baez JC (2024) Scientific catch estimation for the global FAD tropical tuna purse seine fishery in the Indian Ocean IOTC. Virtual meeting

Alverson DL, Freeberg MH, Murawski SA, Pope JG (1994) A global assessment of fisheries bycatch and discards. FAO, Rome, Italy.

Bennett NJ (2021) Socio-Economic Monitoring and Evaluation in Fisheries. Fisheries Research.

Chassot E, Lucas J, Assan C, Lucas V, Issac P, Geehan J (2016) Review of the size-frequency data collected from Seychelles industrial longliners during 2007-2015. IOTC, Victoria, Seychelles, 28-30 November 2016, p 18p

FAO (2024) The State of World Fisheries and Aquaculture 2024 : Blue Transformation in action. FAO.

Geehan J, Pierre L (2013) Biological data on tuna and tuna-like species gathered at the IOTC Secretariat: Status report (update). IOTC, Ninth session of the IOTC Working Party on Data Collection; Statistics, p 23

IOTC (2014) Report of the 10th Session of the IOTC Working Party on Data Collection and Statistics. IOTC, Eden Island, Seychelles, 2-4 December 2014.

IOTC (2019) Report of the 21st Session of the IOTC Working Party on Tropical Tunas. IOTC, Donostia-San Sebastian, Spain, 21-26 October 2019.

IOTC S (2024) TCAC Chairs draft proposal for an Allocation Regime v7 - TC & Annotated IOTC. Bangkok, Thailand

IOTC Secretariat (2019) Alternative approaches to the revision of official species composition for the Spanish log-associated catch-and-effort data for tropical tuna species in 2018. IOTC, Karachi, Pakistan, 27 - 30 November 2019, p 27

IOTC Secretariat (2020a) Review of detected anomalies in size frequency data submitted to the Secretariat. IOTC, Online meeting, 30 November - 3 December 2020, p 8

IOTC Secretariat (2018) Revision to the IOTC scientific estimates of Indonesia's fresh longline catches. IOTC, Victoria, Seychelles, 29 November - 1 December 2018, p 14

IOTC Secretariat (2020b) Tag data processing for IOTC tropical tuna assessments. IOTC, Online meeting, 22 - 24 June 2020, p 12

Kelleher K (2005) Discards in the world's marine fisheries. An update. FAO, Rome, Italy.

Martin S (2023) Alternative methods to improve data collection in IOTC coastal fisheries: Progress, pitfalls and priorities IOTC. Mumbai, India

Medley P, Defaux V, Huntington T (2021) Exploratory analysis of tropical tuna longline selectivity and its implications for stock assessment. IOTC, Online meeting, 10 - 14 May 2021, p 13

Moreno G, Herrera M, Pierre L (2012) Pilot project to improve data collection for tuna, sharks and billfish from artisanal fisheries in the Indian Ocean. Part II: Revision of catch statistics for India, Indonesia and Sri Lanka (1950-2011). Assignment of species and gears to the total catch and issues on data quality. IOTC, Victoria, Seychelles, 10-15 December 2012, p 6

The challenges of purse seine versus longline tuna fishing (2012) Fish Information and Services.