A RECENT OVERVIEW OF THE LARGE-SCALE PURSE SEINE FISHERY OPERATING IN THE INDIAN OCEAN WITH DRIFTING FISH AGGREGATING DEVICES

IOTC Secretariat

Abstract

We describe the capacity and composition of the large-scale purse seine fishery of the western Indian Ocean using drifting fish aggregating devices (DFADS) over the last two decades. In 2023, the fishery has been composed of 48 purse seiners of about 90 m length overall, representing a total fish hold volume of 101,000 m^3. Purse seiners have shown a steady increase in length and capacity since the early 2000s and were assisted in 2023 by 13 support vessels of about 40 m length overall which are essentially devoted to the management of DFADs and the satellite-tracked buoys used for locating them and estimating the size of tuna aggregations. Several type of drifting FAD were report in 2023, following the new reporting format, allowing fleet to detail the dFAD fishing operations. An average of about 8,400 DFADs have been reported in 2023, in the absence of data from Oman, Tanzania, and Korea Rep. This figure is corroborated by the daily buoy position data available at the Secretariat since 2020.

The materials used for the FAD raft and tail, either plastic or metal, were to be reported, as required by the resolution. The results show that both materials are commonly used, but by different fleets. Information on the sizes of these components remains limited; however, improvements are expected as CPCs with purse seine fisheries become more familiar with the new reporting template and the requirements of the dFOB-related resolutions.

Information on FOB types also shows that many DFADs found at sea are not equipped with a buoy, calling for further studies to estimate the importance of the component of derelict DFADs that cannot be tracked remotely. Daily buoy positions show the high dynamics of activations-deactivations of buoys over the years and a marked seasonality linked to the oceanography of the Indian Ocean and the cessation of the fishing activities of some purse seiners before the end of each year due to the limits of catch implemented through IOTC Res. 21/01. The total number of buoys monitored in the fishery was around 9,000 in late 2024.

CPCs with purse seine fisheries are required to submit a DFAD management plan annually. However, this requirement is not fully met by all fleets. Exception to EU–Italy, which operates only one purse seine vessel, is covered under the management plan submitted by EU–France. Other CPCs are required to provide individual plans. It is important to note that there is currently no obligation to report on the implementation of these plans.

At CoC22, the Secretariat presented Summary of compliance with and collection of the drifting fish aggregating devices management plans, detailing which CPCs submitted their management plans. The document specifically summarized the plans submitted in relation to Annex II of Resolution 19/02.

Analysis of compliance with Annex III, which relates to data reporting, can be conducted using the new 3DA form, introduced in 2024. However, not all CPCs used the updated template. Only EU–France, EU–Italy, EU–Spain, Mauritius, and Seychelles submitted data using the new format and met the reporting requirements of Annex III.

The Republic of Korea used the older template and thus omitted some required reporting elements. Oman and Tanzania did not submit any data at all and are therefore non-compliant with the Annex III reporting obligations.

Introduction

The overarching objective of this paper is to provide participants at the 7th Working Group on FADs (WGFAD07) with a recent overview of the information available on the large-scale purse seine fishery operating in the Indian Ocean with drifting Fish Aggregating Devices (DFADs). The following paper aims to (i) describe the composition and characteristics of the large-scale purse seiners and support vessels involved in the fishery, (ii) provide information on the activities related to DFADs and the buoys that are used to track them at sea, and (iii) give estimates of the catches of the large-scale purse seine fishery in 2023.

Materials & Methods

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. The Commission approved the use of the IOTC reporting template as mandatory format to report data as of reporting cycle 2025, this includes the reporting of DFADs detailed statistics (IOTC Data Reporting Forms).

Fishery vessels and capacity

Monitoring of fishing vessels by IOTC are done in two levels:

- List of fishery vessels authorized to fish on the high seas of the IOTC area of competence through the Record of Authorized Vessels (RAV) established since 2003 (IOTC Res. 19/04).
- Active vessels list (AVL) by the 15th of February every year, i.e., the fishery vessels recorded in the RAV that were active in the IOTC area of competence during the previous year (IOTC Res. 10/08).

Information on vessel length overall (LOA; m), gross tonnage (GT), and fish hold volume (FHV; m^3) is reported to the Secretariat by the CPCs as part of these resolutions. FHV – i.e., the volume of well space in which tuna catch is stored onboard the purse seine vessels – can be used as an indicator of fishing capacity in absence of access to operational data and detailed vessel characteristics (Restrepo et al. 2020). Although data in the RAV and AVL go back to the late 1990s, both datasets may be incomplete and information on fishing gear, vessel type, as well as technical attributes may be missing or inconsistent over time. The number of active support vessels in the 2000s is uncertain but the quality of information progressively improved from 2004 with the implementation of logbooks (Delgado de Molina et al. 2004).Recently the Secretariat developed an application allowing CPCs to consult and update the list of IOTC Authorized Fishing Vessels and Carrier Vessels fishing for tuna and tuna-like species(e-RAV).

The reporting of DFAD-related data has evolved significantly following the implementation of resolution 19/02, which mandates the reporting of detailed daily activities by fishing vessels related to buoys and DFADs. To facilitate compliance, the Secretariat developed the 3DA-form, a standardized reporting template that captures all data requirements outlined in the resolution.

Data available from the 2023 statistical year differ notably from those of previous years, which had fewer and less detailed reporting obligations. Despite the expanded scope of data collection, key information on FAD types, fishing activities, and associated catches remains central to the reporting requirements.

Data for 2023 were compiled on a monthly basis and reported by CPCs operating purse seine fisheries that deploy DFADs. Notably, the number of CPCs with large purse seine vessels has increased in recent years. Historically, this group included the EU, the Republic of Korea, Seychelles, and Mauritius. However, three additional CPCs, Oman, Kenya, and Tanzania, have recently registered large purse seine vessels engaged in DFAD fishing.

First, we compiled the list of active large-scale purse seiners using DFADs as well as the auxiliary vessels that supported their fishing activities during the period 2004-2023. This data set does not include purse seine vessels from I.R. Iran and Indonesia that might operate on the high seas but do not deploy DFADs or use satellite-tracked buoys. We also removed the Japanese purse seiner NIPPON MARU as this was exclusively used for research and training. Second, we reviewed and consolidated the technical attributes of each vessel available from the AVL and RAV with information collated from several national and international vessel registries, namely the Ob7 Turbobat, the Spanish Registro General de la Flota Pesquera, and the registries from ISSF, Baltic shipping, PNA, ICCAT, WCPFC, and IATTC. The year of construction of each purse seiner was also collected to compute the age of the vessels.

Total retained catch data

The reporting of retained catches of species in the Indian Ocean, as mandated by IOTC Res. 15/02, requires that these catches be expressed in live weight equivalent and reported annually. This reporting encompasses several key aspects: the major fishing area within the Indian Ocean, the specific fleet involved, and the type of gear used. The preferred method for submission using IOTC Form 1RC.

Catch and effort data

Catch and effort data within the IOTC framework are detailed and stratified across various parameters, as specified by IOTC Res. 15/02. Typically sourced from logbooks, these data are aggregated and reported annually, delineated by year, month, grid area, fleet, gear type, school type, and species targeted.

Geo-referenced catch information is particularly emphasized, either in live-weight equivalent or fish numbers, and is reported to the IOTC Secretariat. To streamline this reporting process, the recommended IOTC Form 3CE has been designed. This form facilitates the submission of geo-referenced catch and effort data, capturing details such as the activities of support vessels that assist large-scale purse seiners.

Geo-referenced catches for the three principal market tropical tunas (bigeye tuna, skipjack tuna, and yellowfin tuna) were raised to the best scientific estimates of total 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 was not available for a given stratum. Based on the assumptions made in the procedure, the raised catch data set includes information on fishing mode for most catches reported for large-scale purse seine fisheries. We focus here on the fleets using DFADs during the period 2004-2022 (see section Fishery vessels and capacity).

FOB-related data

Specific information related to the use of drifting floating objects and anchored fish aggregating devices is reported separately. This data is submitted using IOTC Forms 3DA and 3AA respectively. These forms ensure that comprehensive information on fishing activities, including associated vessels and gear technologies, is available for effective management and conservation efforts within the Indian Ocean region. The 3DA form is developed based on all data elements specific to activities on FADs (Appendix I), including deployments and sets made on FOBs in each time-area stratum, along with corresponding species-specific catches (IOTC Res. 15/02 and 24/02). The current IOTC classification for FOBs derives from para. 6c of IOTC Res. 15/02, which combines the nature of the FOB, the type of tracking system, and the presence of net webbing hanging underneath (Appendix II). It is considered to be less than adequate and potentially confusing, and is therefore in the process of being reviewed (Grande et al. 2018; IOTC 2022). In addition, some categories of the current IOTC classification of FOB-related activities overlap, e.g., the code DH includes the retrieval of the DFAD which corresponds to the code DR (Appendix I). Furthermore, as the activities may concern both the raft and the buoy (“electronic equipment”), information on the type of FOB may be duplicated in the records.

Despite these limitations, the FOB-related data were first used to describe the extent of deployments during the period 2015-2022 and the composition of the FOBs deployed at sea during that period. Information on the presence of nets under the DFADs, which may pose a threat to Endangered, Threatened, and Protected (ETP) species through entangling and ghost mortality, was then derived from the type of FOB reported through encounters at sea. Information on retrievals from the sea was used to provide insight into the extent of reuse of the DFADs in the purse seine fishery.

The new 3DA reporting template offers greater insight into dFOB fisheries at the set level for each vessel. It includes detailed information such as: buoy type, identification, and associated activities; the type and use of dFOBs; the characteristics of the raft and tail; and catch data disaggregated by species and fate.The annual numbers of fishing sets on FOBs for each fleet were compiled from the effort data provided through IOTC form 3CE.

FOB-tracking data

IOTC CPCs with fishing vessels using drifting FOBs have the obligation to report daily information on all active FOBs monitored at sea with satellite-tracked buoys since January 1st 2020 (IOTC Res. 24/02). The information reported to the Secretariat shall follow the structure of reference codes embedded in IOTC form 3BU and contain the date of the month, the instrumented buoy ID, the assigned purse seiner, and one single daily position for each monitored buoy. The forms shall be compiled at monthly intervals and reported to the IOTC Secretariat with a time delay of at least 60, but no longer than 90 days from the end of the reference month.

Data coverage

This global data set covers the period from 01 January 2020 to 31 December 2024 and does not include any information for the six Kenyan-flagged purse seiners of around 50 m length overall which operated in the Indian Ocean between January 2020 and September 2021 despite some anecdotal evidence of the presence of electronic buoys on the vessels (**Appendix III**). Buoy data for one Korean purse seiner are being checked for the months of January-February 2023 and were not included in the present paper.

Shared buoys

As part of the fishing strategy of the purse seine companies, some buoys may be monitored by several vessels at the same time but information on buoys shared among purse seiners is not available for all fleets. Following the methodology defined by Maufroy and Goujon (2019) for dealing with multiple purse seiners monitoring the same buoys, each daily buoy position in the database was weighted by the number of purse seiners accessing the information.

Results & Discussion

Composition and characteristics of the fishery

Purse seine vessels

A total of 97 large-scale purse seiners using DFADs have been reported to have operated in the Indian Ocean during 2004-2023. Over that period, the annual number of operating vessels has varied from a maximum of 60 in 2006 to a minimum of 34 in 2011 at the peak of piracy threat (**Fig. 1**). The composition of the fishery has been dynamic over the last two decades, with several purse seiners joining the fishery from other oceans or newly built to replace the vessels that left or were decommissioned. Since 2004, 15 purse seiners have been constantly in operation in the Indian Ocean. In recent years, the number of purse seiners has remained stable at 47, with the fishery being mostly composed of EU and Seychelles purse seiners (**Fig. 1** and **Table A4**).

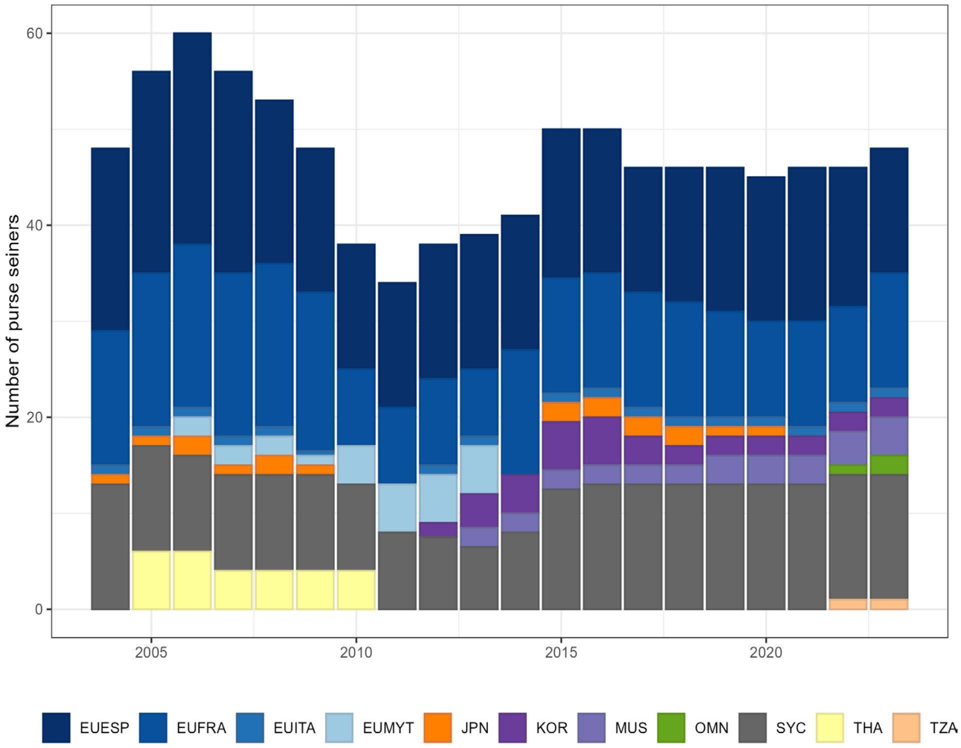


Fig. 1. Fleet composition of the Indian Ocean large-scale purse seine fishery. Number of large-scale purse seiners by fleet during the period 2004-2023. A weight of 0.5 was given to the vessels that changed flag during a given year

The composition of the fishery has changed over the last two decades and the mean length overall of the vessels has increased from 82 m in 2004 to 90 m in 2023 (**Fig. 2a**). As vessel length is highly correlated with GT and FHV (**Fig. A1**), the annual trends in the purse seiners' attributes are very similar, with a major increase observed between 2009 and 2011 that was mostly driven by the exit of the small purse seiners (<65 m) from the fishery (**Fig. 2b-c**). The mean GT has increased from 2,307 in 2004 to 2,824 in 2023 when the mean FHV increased from 1894 m^3 to 2,099 m^3 during the same period. In 2023, the total capacity of the fleet was about 100,800 m^3, in the same order of magnitude, but lower than the capacity of the Atlantic Ocean fleet estimated at about 106,000 m^3 in 2020 (Restrepo et al. 2020). The age structure of the fishery has also changed over time, with the mean annual age of the vessels increasing from about 14 years in 2004 to 15 years in 2013, before showing a sharp decline to 13 years in 2015 when 8 vessels built between 2014-2015 joined the fishery. Since then, the mean vessel age has increased and reached 19 years in 2023.

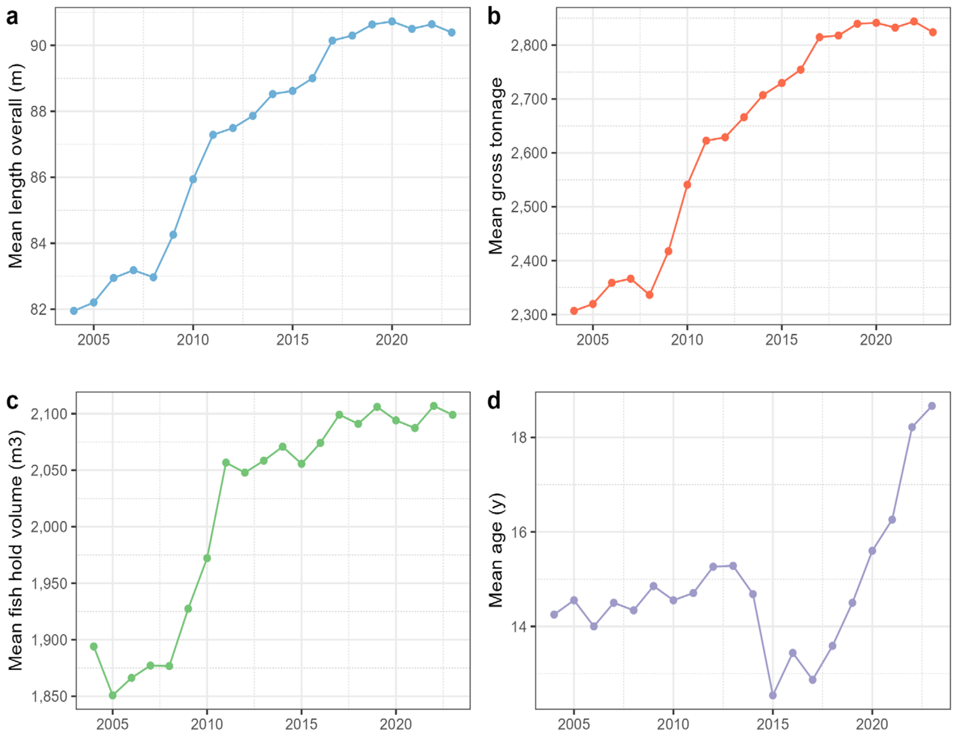


Fig. 2. Mean characteristics of the Indian Ocean large-scale purse seiners using DFADs. (a) Length overall (m); (b) Gross tonnage; (c) Fish hold volume (m^3); (d) Vessel age (y)

Support vessels

During 2004-2023, a total of 34 distinct support vessels have assisted the large-scale purse seiners in their fishing activities, mostly for managing buoys and DFADs (Arrizabalaga et al. 2001; Ramos et al. 2010; Assan et al. 2015). Initially derived from the conversion of old, decommissioned vessels from other fisheries, support vessels were eventually specifically designed and built to assist the purse seiners from the late 1990s. The number of support vessels available from the AVL during 2004-2006 appears to be under-estimated as 13-15 vessels were in operation at that time (Ramos et al. 2010). The number of vessels in activity decreased during 2009-2011 due to the piracy threat and re-increased thereafter to reach a maximum of 22 in 2016 (**Fig. 3**). In that year, the combined fleet of EU,Spain and Seychelles was composed of 20 support vessels that assisted 28 purse seiners, i.e., a ratio of 8 to 10. Following the assessment of the stock of yellowfin tuna as overfished, IOTC Res. 16/01 (entered into force in January 2017) and subsequent resolutions (17/01, 18/01, 19/01, and 21/01) imposed limits on the number of support vessels, which resulted in their number to decline to 13 in 2023.

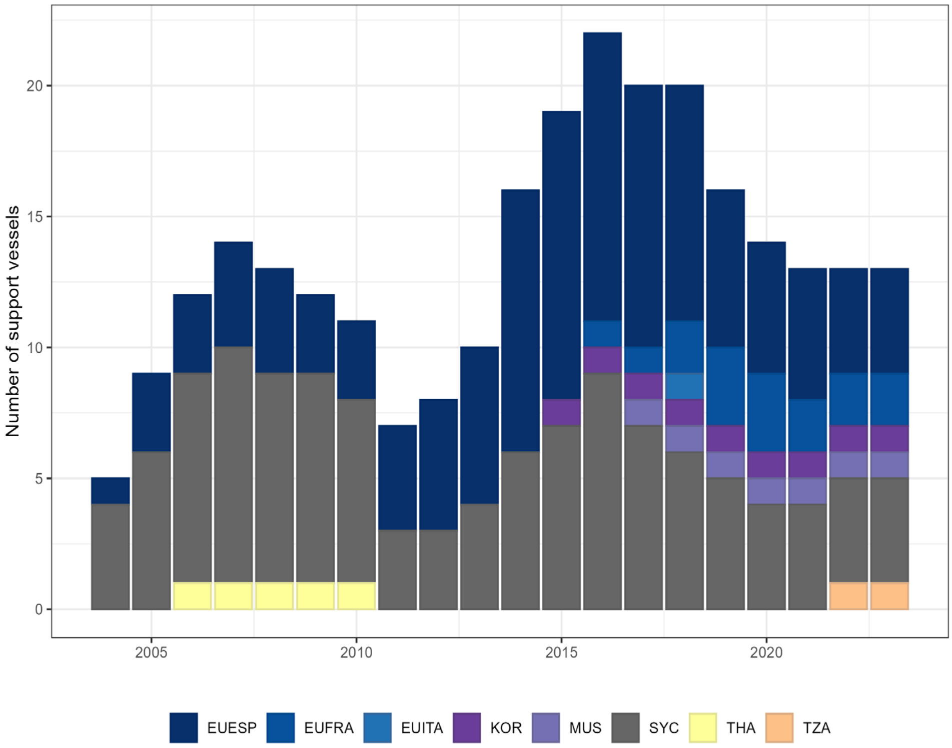
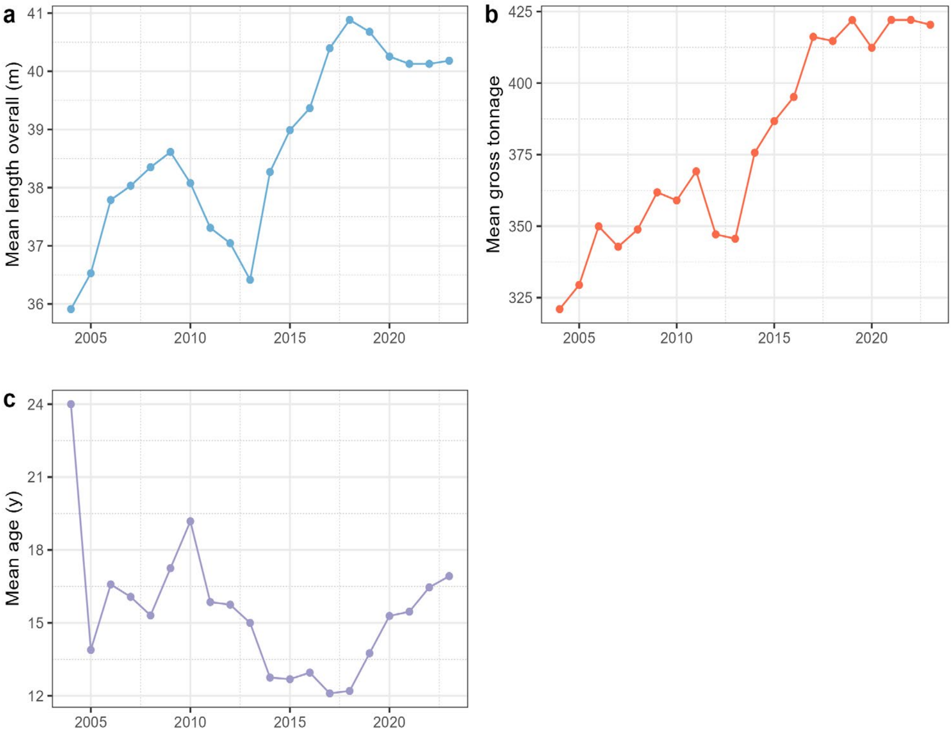


Fig. 3. Fleet composition of the Indian Ocean large-scale purse seine fishery. Number of support vessels by fleet during the period 2004-2023

Similarly to purse seiners, support vessels have increased in size over time. Their mean LOA and GT, which are highly correlated (**Fig. A2**), have shown increasing trends over the last decade, increasing from 36 m and 346 in 2013 to 40 and 420 in 2023 for LOA and GT, respectively (**Fig. 4a-b**). The mean age of the vessels has shown a decrease from 19 in 2010 to 12 in 2018 (**Fig. 4c**). In 2023, an average support vessel of the Indian Ocean large-scale purse seine fishery would be aged 17 years and characterized by a length overall of 40 m and a GT of 420.



FOB-related activities

Buoy deployment

The new dFOB template allows CPCs to report buoy-related activities in addition to traditional dFOB activities, in line with updated dFAD reporting requirements. However, not all CPCs were able to provide the full set of required information for purse seine operations in 2023. Several factors may explain these gaps, including: CPCs not receiving data from fishing companies; companies not submitting buoy activity information; a lack of knowledge about buoy location or identification; or CPCs being unaware of their obligation to report detailed buoy activities for purse seine operations. Despite these limitations, some data on buoy activity—beyond simple fishing position reports—were submitted in 2023. Reported buoy activities included deployment, loss, and transfer, while fewer reports were received for stranding, retrieval, and end-of-use events. Most buoys were reported as present, with identifiers and known positions provided (coded as “1”); only a small number were reported as unknown (coded as “UNK” or “0”). **Fig. 5** illustrates the flow of buoy information as reported by fleets. However, some inconsistencies were observed in CPC reporting:

• Buoy Present: Not all fishing vessels reported this information, though CPCs that did submit data confirmed the presence of buoys. • Buoy Position (if known): Position data were incomplete, particularly for buoys marked as lost or transferred. • Buoy Activities: Reported activities varied widely—from deployment to loss—with gaps for certain activity types.

Although CPCs regularly submitted buoy position data through the 3BU form, information in the new 3DA template suggests gaps in knowledge about buoy locations. These discrepancies appear linked to the nature of the vessel’s activities and the type of data provided. Notably, reports from EU–France and EU–Italy for 2023 purse seine operations highlighted inconsistencies in reporting buoy positions ((**Fig. 6**)).

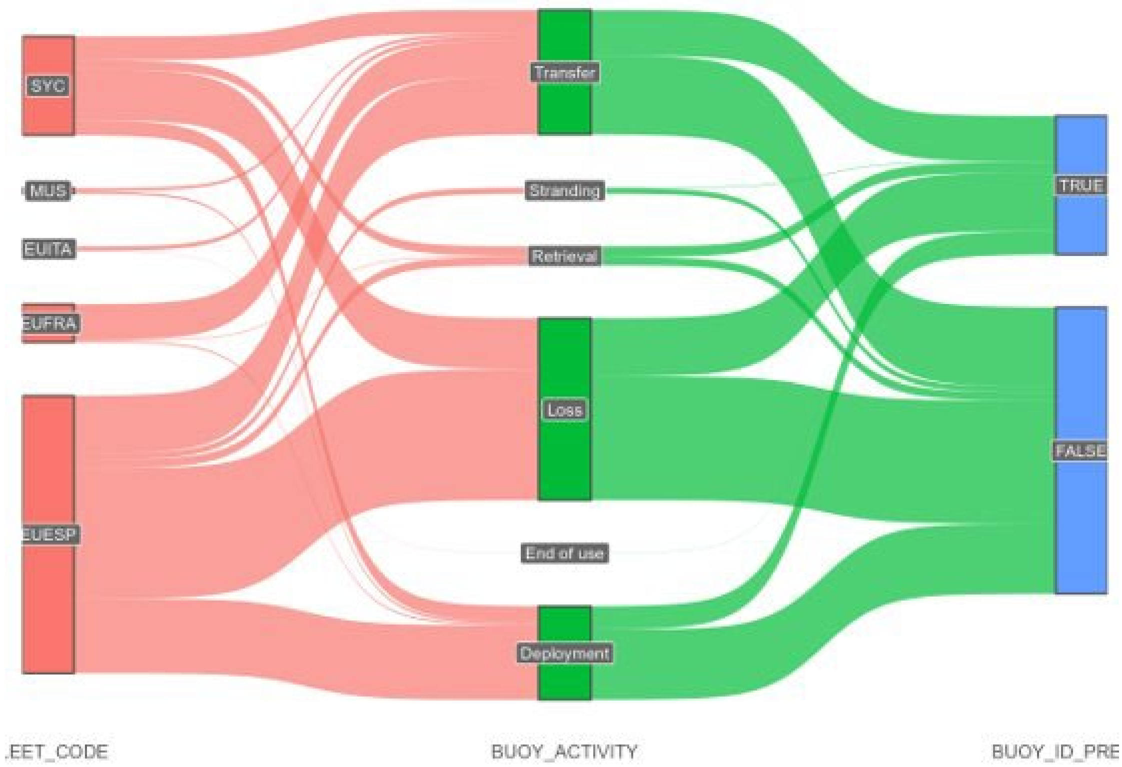


Fig. 4. Sankey diagram depicting part of the flow of buoy-related data reported through Form 3DA for each purse seine fleet, 2023

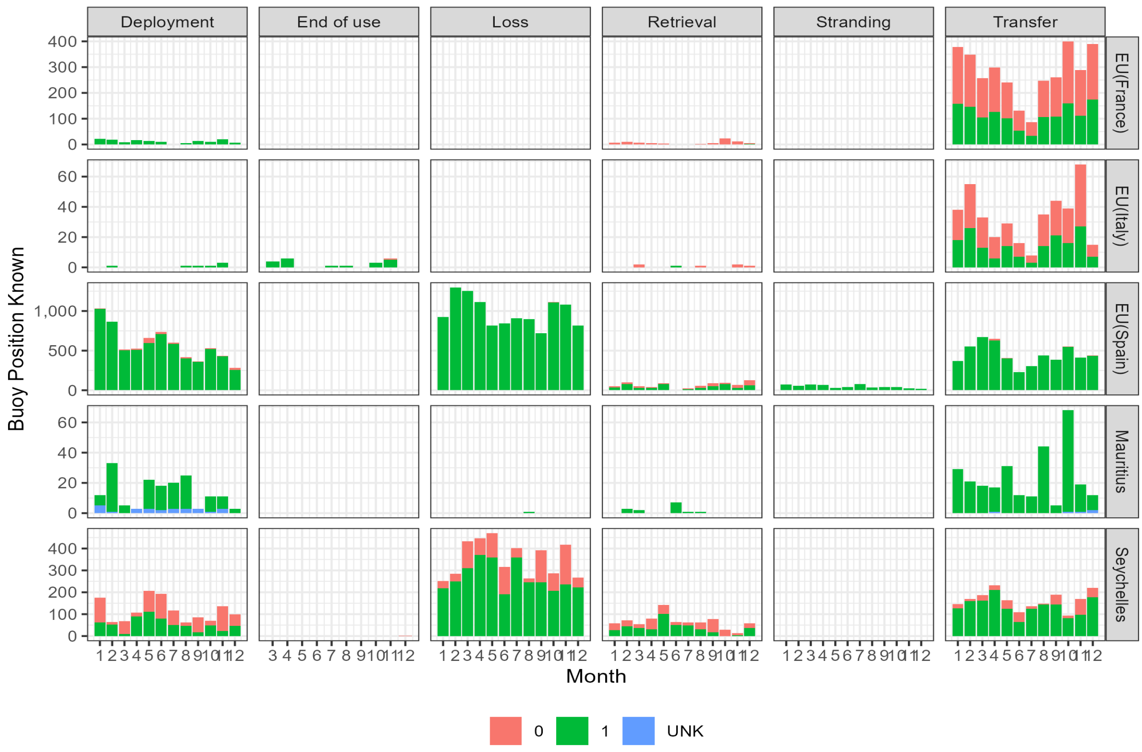


Fig. 5. Buoy position known by Fleet

dFOB activities

Furthermore, the template allows CPCs to report operational data on dFOBs by describing the associated activities, identifying the type of dFOB, and providing a unique identifier for each unit. In addition, CPCs are asked to provide details on the physical characteristics of the raft and tail, including material type and dimensions. However, as with the buoy data, these fields are not consistently completed across fleets. Some CPCs provided information on certain dFOB characteristics but omitted the identifier or type, while others submitted partial data using "NA" or left fields blank. In some cases, the size of the tail or raft was reported, but the material type was missing—suggesting that the materials used may not fall under the predefined categories of plastic or metal. Several inconsistencies were observed across key variables:

• dFOB Identifier: Some identifiers were incomplete, including only partial strings or left entirely blank. • dFOB Type: Not all dFOBs were assigned a type; many were marked as unknown. • dFOB Activity: Activity data were missing for several operational entries. • Raft Characteristics: Material types (e.g., plastic or metal) were often indicated using boolean values (TRUE/FALSE), "NA," or left blank. Size fields (length and width) were inconsistently reported, with many values listed as "0," "NA," or missing. • Tail Characteristics: Similarly, tail materials were inconsistently reported, and size data were often incomplete or missing.

Despite these issues, most fleets did report dFOB activity characteristics at the operational level. ((**Fig. 7**)) summarizes the information provided across CPCs.

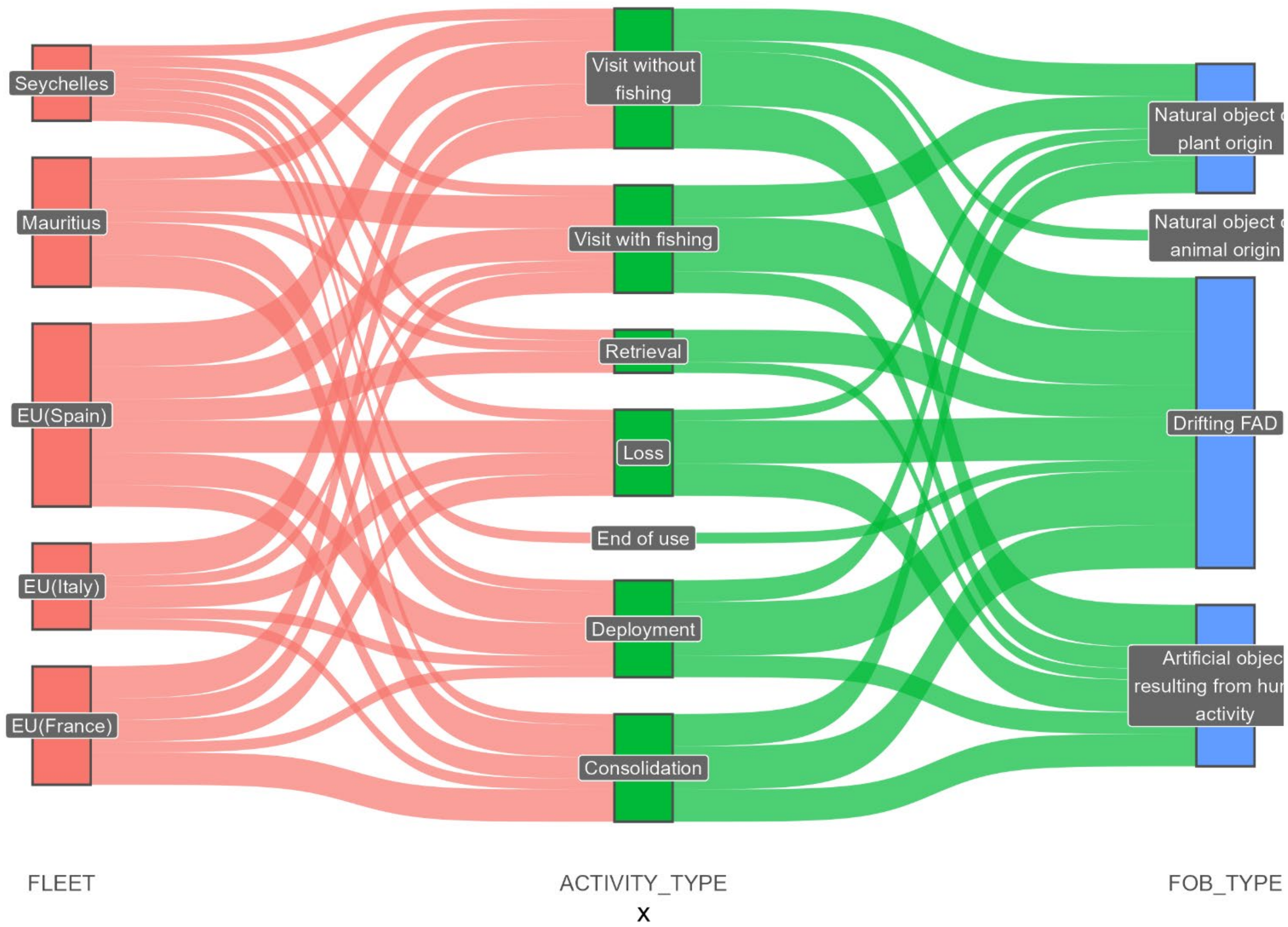


Fig. 6. Flow of dFOB activities and characteristics by fleet

dFOB Catch

As required, catch data from dFOB sets must include both retained and discarded catch. In previous years, only the retained catches of tropical tuna species were reported, with little to no information on interactions with other species. In contrast, the 2023 data include more detailed information, such as the fate of each species caught (e.g., retained, discarded, or released), whether the catch was raised (i.e., extrapolated), and the unit of measurement—since not all catch is weighed. However, the data are still not fully aligned with reporting requirements. Several inconsistencies were noted, such as entries with zero or nil catch for species that were otherwise reported. Despite these issues, the catch data are generally more complete than other required statistics. In 2023, catch data were reported for all species, including discards of sharks and marine mammals encountered during operations. While tropical tunas remain the primary target, neritic tuna species are also retained by most purse seine fleets (**Table 2.**).

Table 2. Retained catch by species categories and fleet on dFAD

SPECIES_CATEGORY	EU(France)	EU(Italy)	EU(Spain)	Mauritius	Seychelles
BILLFISH	0	0	3	5	12
NERITIC	632	158	1,151	305	0
OTHERS	0	0	296	108	29

SPECIES_CATEGORY	EU(France)	EU(Italy)	EU(Spain)	Mauritius	Seychelles
RAYS	0	0	3	0	0
SEERFISH	0	0	21	18	0
SHARKS	0	0	80	7	0
TEMPERATE	3	0	0	1	0
TROPICAL	49,042	5,226	109,742	21,516	104,603
TUNAS_NEI	0	0	0	77	0
TURTLES	0	0	0	0	0

Catch rates per fishing set varied across fleets. Although EU–Spain reported substantial total catches of tropical tuna, the boxplot ((**Fig. 8**)) shows that the distribution of catch rates from drifting floating objects (dFOBs) was lower for EU–Spain compared to Mauritius, which recorded a wider range of catch values.

In 2023, the median tropical catch per set (TCPS) for Spanish purse seiners was 33 tonnes, compared to 41 tonnes for French vessels. Seychelles recorded the highest median TCPS at 100 tonnes, while Mauritius reported the lowest at 14 tonnes.

These differences in catch rates may be influenced by various technical factors, including the effectiveness of FOB selection, set timing, and operational strategies. In particular, the Spanish and Seychellois fleets operate some of the largest purse seine vessels in the region and may benefit from the use of larger nets and more advanced equipment.

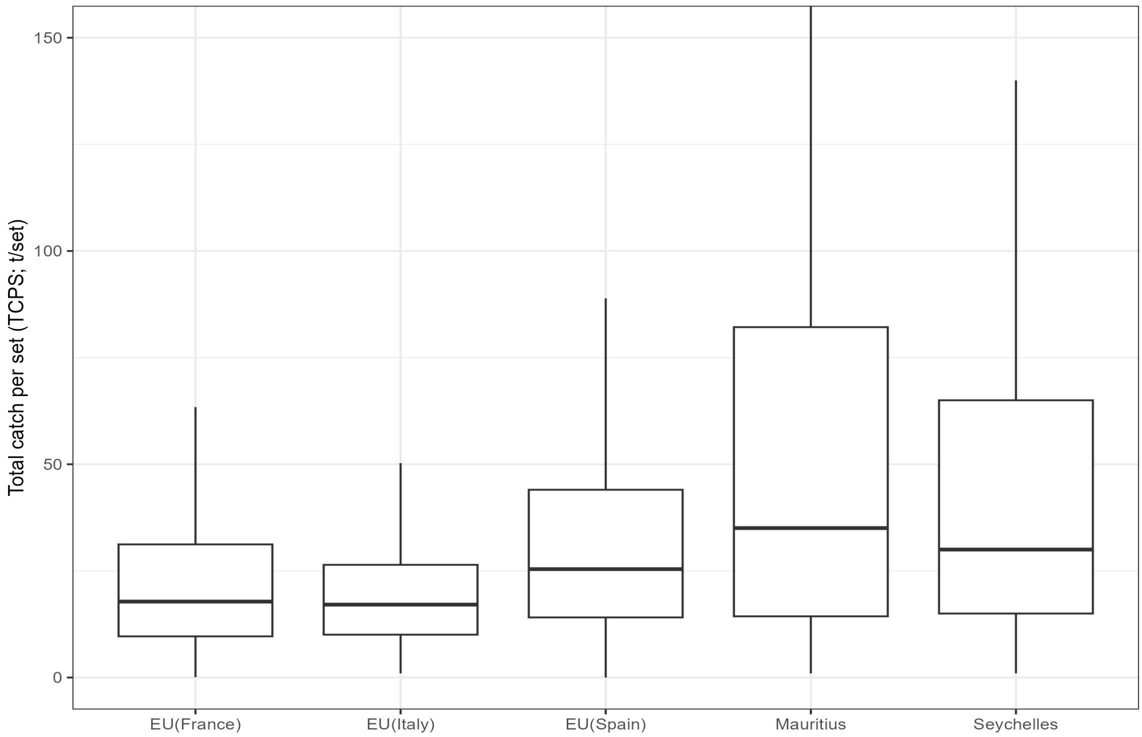


Fig. 7. Distribution of total catch per set (TCPS; t/set) on drifting floating objects (FOBs) by fleet

Buoy deployment

DFADs at sea monitored by purse seine fisheries include (i) new DFADs built on land or at sea and added into the Indian Ocean waters through deployments by purse seine and support vessels and (ii) DFADs encountered at sea and reused through buoy transfer or re-deployment. In addition, some information on the numbers of DFADs drifting at sea without any tracking system is available through data on the type of FOBs encountered at sea.

Deployments

FOB-related data reported for 2023 show the concentration of deployments in the western Indian Ocean, from the northern tip of Madagascar (Cap d'Ambre) at 12°S to the Arabian Sea, up to 20°N (**Fig. 9**). While there is some seasonality in the extension of the deployment areas on the high seas of the Arabian Sea, the core area of deployment is quite stable over the year within and around the area under national jurisdiction (AUNJ) of Seychelles.

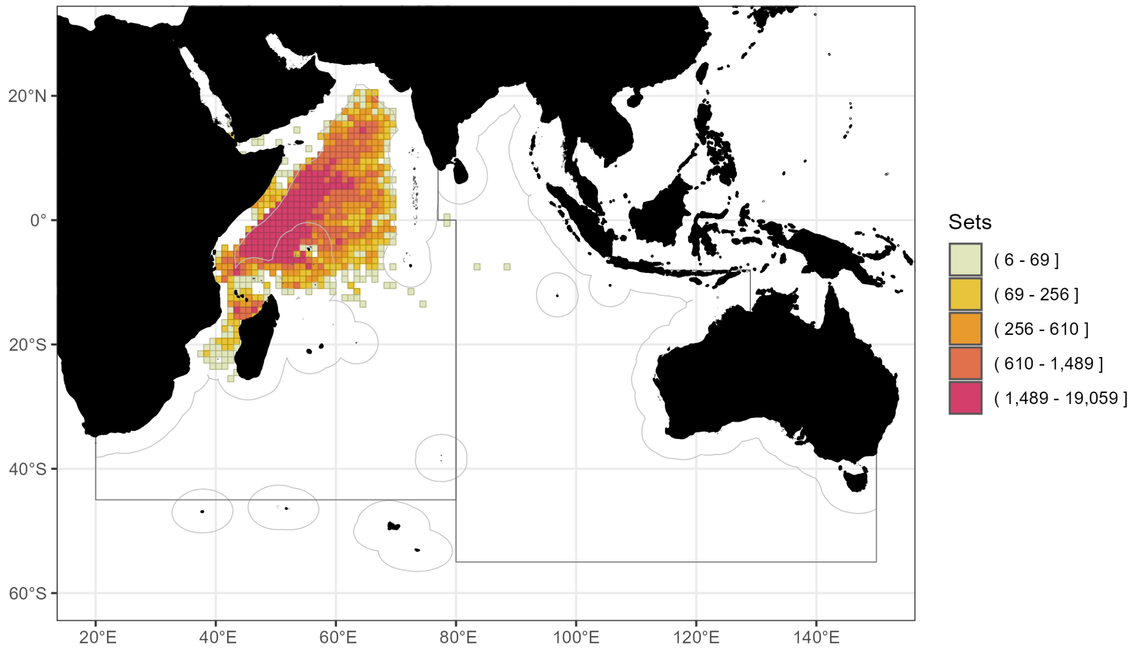


Fig. 8. Number of drifting floating objects (FOBs) deployed by for all fleets and FOB types in 2023 as reported through IOTC form 3DA

Catches by type of drifting object indicate that significant volumes are associated with drifting FADs, along with smaller catches from artificial objects linked to human activity—though these are not reported by all fleets (**Table** 3).

Table 3. Retained catch by dFOB type and fleet

FOB_TYPE	EU(France)	EU(Italy)	EU(Spain)	Mauritius	Seychelles
Artificial object resulting from human activity (and related to fishing activities)	0	0	2,481	1,118	0
Artificial object resulting from human activity (not related to fishing activities)	0	0	771	312	0
Drifting FAD	49,660	5,384	106,045	19,400	104,644
Natural object of animal origin	0	0	0	0	0

FOB_TYPE	EU(France)	EU(Italy)	EU(Spain)	Mauritius	Seychelles
Natural object of plant origin	17	0	1,999	1,206	0

DFAD materials

All DFADs encountered at sea by the fleets of EU,France and Korea between 2015 and 2022 were reported as "FDT", i.e., satellite-tracked DFADs without any nets used in their construction (**Appendix II**). This is highly unlikely as these fleets have been shown to frequently transfer buoys on "foreign" DFADs (Snouck-Hurgronje et al. 2018) which were mostly composed of netting materials in 2015-2016 (see section Deployments). Consequently, only data from the fleets of EU,Spain, Japan, and Mauritius were considered to assess the extent of use of fishing nets in the DFADs at sea.

Ownership information, which indicates whether the encountered FOB is owned by the reporting CPC, has generally not been reported to the Secretariat. Future work could focus on FOB ownership to assess the composition of FOB types between fleets although specific fleet information is not available through the current version of IOTC Form 3FA. However, such data are collected throughout purse seine fisheries observer programs and could be included in the ROS data requirements. In addition, data on FOB types provide information on the relative numbers of unmonitored DFADs at sea, which is essential to estimate the total number of DFADs drifting in the Indian Ocean (Maufroy et al. 2017; Dupaix et al. 2021).

From a general point of view, improvements to the IOTC code lists and reporting 3FA forms are necessary to confirm the patterns and trends observed here and increase the general quality and usability of the FOB-related data required by IOTC Resolutions 15/02 and 19/02.

FOBs monitored at sea

Daily positions of the satellite-tracked buoys equipping FOBs provide information on the dynamics of the numbers of objects monitored in the purse seine fishery since their availability in January 2020. The total number of buoys showed large variability and strong seasonality between 01 January 2020 and 30 December 2024 (**Fig. 10**). Buoy numbers decreased throughout the year 2020 from a maximum of 12,016 on 06 February 2020 to less than 10,000 in early 2021. Buoy numbers then increased to an average of about 11,000 during the months of April-August 2021 before sharply decreasing to a minimum of 8,409 on 01 December 2021. From there, the buoys showed a general increasing trend until September 2022 although with some large variability, before showing a new decline in late 2022 to similar levels as observed in 2021. During the the year 2024, the total daily number of monitored buoys steadily increased to reach 8,954 buoys in end of 2024.

Fig. 9. Daily number of drifting floating objects (FOBs) monitored in the large-scale purse seine fishery of the Indian Ocean between 01 January 2020 and 30 December 2024. The blue solid line is a generalised additive model fitted to the data to visualise the temporal trend

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Appendices

Appendix I: IOTC classification of activities related to drifting floating objects

Tab. A1: Classification of activities related to drifting floating objects in use at the IOTC Secretariat

CODE	ACTIVITY_TYPE
CO	Consolidation
DE	Deployment
EU	End of use
LO	Loss
RE	Retrieval
ST	Stranding
VF	Visit with fishing
VI	Visit without fishing

Appendix II: IOTC classification of types of drifting floating objects

Tab. A2: Classification of types of drifting floating objects in use at the IOTC Secretariat

CODE	FOB_TYPE
ANLOG	Natural object of animal origin
DFAD	Drifting FAD
FALOG	Artificial object resulting from human activity (and related to fishing activities)
HALOG	Artificial object resulting from human activity (not related to fishing activities)
VNLOG	Natural object of plant origin

Appendix III: Buoy data coverage

Tab. A3: Overview of the buoy position data set between 01 January 2020 and 31 December 2024 as available at the IOTC Secretariat. PS = Number of purse seiners. Note the same purse seiner may appear in different fleets in case of change of flag over the period considered. Buoys shared among the fleets of EU,France, EU,Italy, Mauritius, and Seychelles are repeated for each of them

YEAR	CPC	FLEET_CODE	PS	DAYS	POSITIONS	BUOYS
2020	EU	EUESP	15	366	1,459,581	14,242
2020	EU	EUFRA	11	366	3,086,904	8,546
2020	EU	EUITA	1	366	226,579	2,504
2020	JPN	JPN	2	88	4,353	109
2020	KOR	KOR	2	366	288,086	1,381
2020	MUS	MUS	3	366	515,353	2,788
2020	SYC	SYC	13	366	1,406,849	13,394
2021	EU	EUESP	16	365	1,343,232	13,956
2021	EU	EUFRA	10	365	3,088,548	9,000
2021	EU	EUITA	1	365	285,636	3,494
2021	KOR	KOR	2	273	219,619	1,348
2021	MUS	MUS	3	365	975,284	3,933
2021	SYC	SYC	13	365	1,491,882	13,728
2022	EU	EUESP	15	365	1,265,491	12,871
2022	EU	EUFRA	10	365	2,880,152	8,934
2022	EU	EUITA	1	365	255,214	3,315
2022	KOR	KOR	2	365	188,334	1,503
2022	MUS	MUS	4	365	915,327	4,054
2022	OMN	OMN	1	171	31,621	441
2022	SYC	SYC	13	365	1,110,494	11,841
2022	TZA	TZA	1	283	58,436	745
2023	EU	EUESP	13	365	1,168,754	10,535
2023	EU	EUFRA	11	365	2,874,140	9,301
2023	EU	EUITA	1	365	270,936	3,327
2023	KOR	KOR	2	365	185,683	1,663
2023	MUS	MUS	4	365	734,192	3,367
2023	OMN	OMN	2	365	97,536	1,232

YEAR	CPC	FLEET_CODE	PS	DAYS	POSITIONS	BUOYS
2023	SYC	SYC	13	365	1,179,652	11,446
2023	TZA	TZA	1	365	83,834	1,090
2024	EU	EUESP	13	366	1,074,919	10,721
2024	EU	EUFRA	11	366	3,554,457	9,248
2024	EU	EUITA	1	366	373,691	4,529
2024	KEN	KEN	1	159	38,514	516
2024	KOR	KOR	3	366	136,050	1,429
2024	MUS	MUS	4	366	250,213	2,815
2024	OMN	OMN	3	366	174,872	1,782
2024	SYC	SYC	13	366	1,161,410	11,565
2024	TZA	TZA	1	366	85,792	1,194

Appendix VI. Composition of the large-scale purse seine fishery, 2023

Tab. A4: Number of active vessels in the large-scale purse seine fishery of the Indian Ocean in 2023. A weight of 0.5 was given to the vessels that changed flag during a given year

VESSEL_TYPE	FLEET_CODE	FLEET	N
Purse seiner	EUESP	EU (Spain)	13
	EUFRA	EU (France)	12
	EUITA	EU (Italy)	1
	KOR	Republic of Korea	2
	MUS	Mauritius	4
	OMN	Sultanate of Oman	2
	SYC	Seychelles	13
	TZA	United republic of Tanzania	1
Support vessel	EUESP	EU (Spain)	4
	EUFRA	EU (France)	2
	KOR	Republic of Korea	1
	MUS	Mauritius	1
	SYC	Seychelles	4
	TZA	United republic of Tanzania	1

Appendix V. Relationships between vessel technical attributes

Purse seine vessels

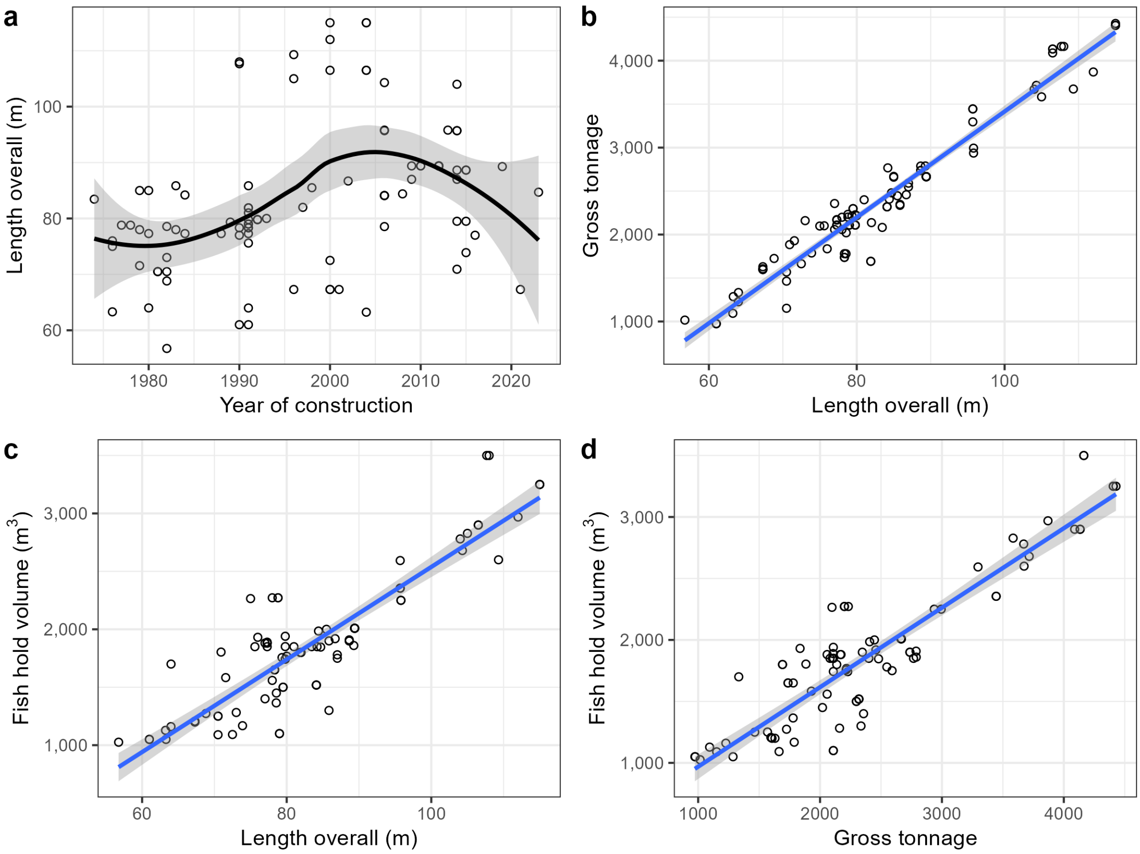

Fig. A1: Relationships between the technical attributes of the large-scale purse seiners using DFADs and having operated in the IOTC area of competence between 2004 and 2022. (a) Length overall (m) as a function of year of construction; (b) Gross tonnage as a function of length overall (m); (c) Fish hold volume (m3) as a function of length overall (m); Fish hold volume (m3) as a function of gross tonnage

Support vessels

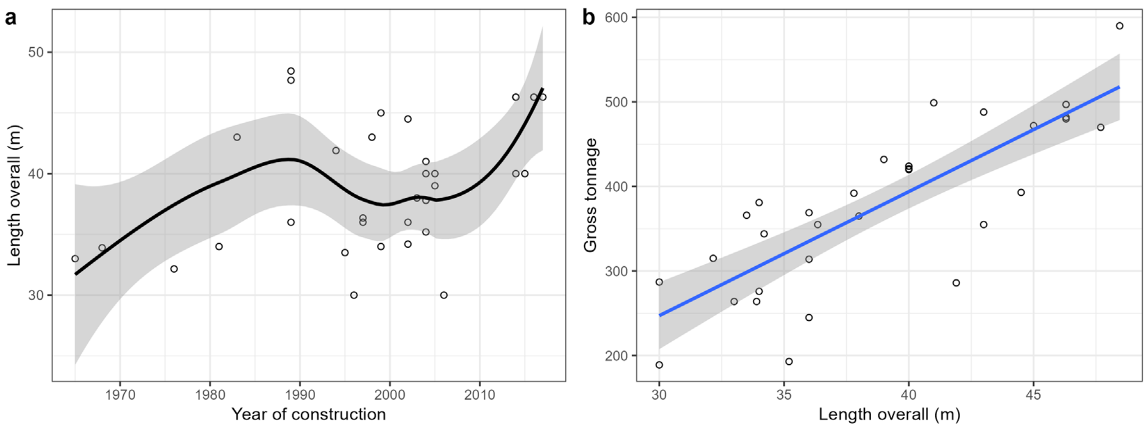

Fig. A2: Relationships between the technical attributes of the support vessels having operated in the IOTC area of competence between 2004 and 2022. (a) Length overall (m) as a function of year of construction; (b) Gross tonnage as a function of length overall (m)