UPDATE ON THE IMPLEMENTATION OF THE IOTC REGIONAL OBSERVER SCHEME

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Purpose

To inform the Scientific Committee (SC) of the status of implementation and reporting to the IOTC Secretariat of the Regional Observer Scheme (ROS) set out by Resolution 11/04 *on a Regional Observer* Scheme at the 15th Session of the Commission in 2011.

Background

Fisheries observer data is important for fisheries management, providing an independent source of detailed, high-quality information on fishing activities and catches at a sufficient level of resolution to be used for analyses such as the standardisation of catch rates and analysis of bycatch mitigation measures. At the 13th Session of the Commission (S13), the Commission adopted Resolution 09/04 *on a Regional Observer Scheme*, which was superseded in 2010 by Resolution 10/04, and again in 2011 by Resolution 11/04. The main objective of the IOTC Regional Observer Scheme is to *'collect verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence' [Res 11/04, para. 1].*

Resolution 11/04 *On a Regional Observer Scheme* makes provision for the development and implementation of national observer schemes among the IOTC CPCs starting in July 2010 and covering *"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. For vessels under 24 meters if they fish outside their EEZ, the above-mentioned coverage should be achieved progressively by January 2013".*

The Resolution also states that "*the number of the artisanal fishing vessels landings shall also be monitored at the landing place by field samplers*" and that "*the indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total levels of vessel activity (i.e., total number of vessel trips or total number of vessels active)*". There are currently no established guidelines for the collection of data from artisanal vessels fishing within their national EEZ, so this remains an area for further development.

Several national observer programmes have now been established for industrial fleets across the Indian Ocean and these are used to collect scientific fisheries data by onboard observers, according to specific research requirements specified by each of the coordinating organisations. Data are collected and reported at the regional level to the IOTC Secretariat as part of the mandate of the ROS and are summarised in this paper.

Update on the status of implementation and reporting

Implementation of the observer scheme

As of 30th October 2021, fifteen CPCs (Australia, China (including Taiwan,China), Comoros, EU (France[2], Spain, Portugal and UK), Indonesia, Japan, Kenya, Rep. of Korea, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa and Thailand) have submitted a list of observers and have been allocated an IOTC observer registration number. A total of **442** observers are currently registered as active.

To date, information for a total of **2,411** trips has been reported to the IOTC Secretariat (in different formats) by Australia, China (including Taiwan,China), EU (France, Italy, Portugal, Spain and the UK), France OT, Indonesia, Japan, Kenya, Rep. of Korea, Madagascar, the Maldives, Mauritius, Mozambique, Seychelles, South Africa, Sri Lanka and Tanzania.

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[2] Including Mayotte due to its status as a French outermost region since January 2014

Appendix A provides a summary of the status of implementation of the ROS between 2010 and 2020 by all IOTC CPCs. **Appendix B** and **Appendix C** provide an estimation of the level of effort covered by observers between 2016 and 2020 for industrial longline and purse seine vessels (data updated as of 30th October 2021).

Scientific observer coverage reported for the artisanal fleets is currently zero.

Reporting in electronic format

At the SC20 in 2017, there was a recommendation for all observer data to be submitted in electronic format:

(Para. 115) "*Resolution 11/04 On a Regional Observer Scheme requests the submission of a report after each trip but the SC **RECOMMENDED** that on the next revision of the Resolution, this should be amended to request the submission of data in an electronic format suitable for automated data extraction (including historic data) with a given deadline so that information from multiple trips can be provided*".

An increasing number of CPCs are now submitting data electronically, including Australia, EU,France, EU,Spain, EU,UK, China (partial), Indonesia, Japan, Kenya, Maldives, Mozambique, Mauritius, and Sri Lanka (see also Appendix A) although not all the formats adopted for data submission are suitable for automated and accurate extraction of the information to be stored in the ROS regional database.

Furthermore, several important data fields marked as *for reporting purposes* are regularly missing from these submissions (e.g., estimated catch by species at set level for some of the PS fleets) although known to be available to the data providers and in addition, a potential misunderstanding on the meaning of "*optional / mandatory for reporting*" (see the ROS data fields specification) was encountered with some CPCs thus preventing the submission of important data fields (e.g. weight measurements of caught / retained individuals) that were instead available in earlier reports.

A Pilot Project for the ROS

Since its origination in 2009, national implementation of the Regional Observer Scheme remains very low among IOTC CPCs. Where observer programmes have been established, these are wide ranging and highly variable in the type and quality of information collected and the reporting of data to IOTC standards remains poor and so the data that are submitted and stored regionally are currently of little value.

In recognition of these issues and in a positive step towards addressing the problems and seeking solutions, the IOTC adopted Resolution 16/04 "*On the implementation of a pilot project in view of promoting the Regional Observer Scheme of IOTC*" and following this a pilot project has been developed. This was discussed and further developed at the WPEB, WPDCS[3] and SC[4] in 2016, circulated to all Members for comment in March 2017 and was approved by the Commission in May 2017[5].

The project outlines a comprehensive plan as part of a long-term, holistic strategy for supporting the implementation of the Regional Observer Scheme in the IOTC area of competence. It aims to tackle each of the key issues that currently prevent the collection and analysis of high-quality data to contribute to stock assessment and management advice through the development of new technologies, tools, standards, and processes. The overall strategic framework is centred on five key components:

1. Observer training programme and minimum standards
2. Electronic reporting
3. Observer database development and historic data collation
4. Electronic monitoring system
5. Observation in-port

[3] IOTC-2016-WPDCS-22: http://www.iotc.org/documents/pilot-project-iotc-regional-observer-scheme

[4] IOTC-2016-SC19-14: http://iotc.org/documents/pilot-project-iotc-regional-observer-scheme-0

[5] IOTC-2017-S21-10: http://www.iotc.org/documents/pilot-project-iotc-regional-observer-scheme-1

A critical component in each of the work streams is the piloting phase and Resolution 16/04 provides a framework for trialling these innovations by drawing together the outputs from the various work streams and operationalising them in selected voluntary CPCs.

Outcomes of SC23 relevant to the IOTC ROS and its pilot project

Report of the 16th Session of the Working Party on Data Collection and Statistics (WPDCS16)

The SC **NOTED** that Electronic Monitoring Systems can be one viable and effective means to collect fishery independent information, including when external circumstances prevent human observers from being deployed onboard, while at the same time **ACKNOWLEDGING** that data collection through EMS alone cannot fully conform to Res. 11/04 *On a Regional Observer Scheme* requirements.

The SC **ACKNOWLEDGED** that this information is the result of combined efforts from several stakeholders (that include the industry, national organizations and the IOTC Secretariat) and that when deciding how to give access to this data, the original providers should be pre-emptively consulted before the information is released. Also, the SC **CONSIDERED** the possibility that access priority to this data be given to scientists affiliated with the source institutions / stakeholders, to recognize their work.

ACKNOWLEDGING a potential lack of clarity in the current definition of "*For reporting (Optional)*" data elements in the context of the ROS minimum standard data fields, the SC **RECOMMENDED** that the Commission require CPCs to report such fields to the IOTC Secretariat (as part of their regular ROS data submissions) when these are available to the national observer programmes.

The SC **NOTED** the steps forward in the definition of Electronic Monitoring Programme Standards presented at the WPDCS and **ACKNOWLEDGED** that these require additional contributions and development for their successful implementation at regional level.

For this reason, the SC **RECOMMENDED** that an *ad-hoc*, intersessional Working Group on the development of EM Programme Standard be constituted and physical or virtual workshops (depending on the circumstances) be held to further progress with the definition of EMS minimum standards.

The SC **NOTED** that further information on these matters will be provided during the agenda item on EMS Minimum Programme Standards, and therefore deferred all discussions to later (in particular, those related to the newly constituted *ad-hoc* Working Group and procedures for participation).

Implementation of the Regional Observer Scheme

The SC **NOTED** paper IOTC–2020–SC23–07 which provided an update on the status of implementation and reporting to the IOTC Secretariat set out by Resolution 11/04 On a Regional Observer Scheme (ROS) including the coverage estimated for both the longline and purse seine large scale fisheries from concerned CPCs, and how these compare to the expected minimum coverage level.

The SC **ENCOURAGED** CPCs to validate the information provided in appendices A, B and C of paper IOTC-2020-SC23-07 and confirm that it correctly reflects the status of implementation of the ROS at the national level, and to liaise with the IOTC Secretariat should any discrepancy be identified.

The SC **NOTED** that Japan intends to liaise with the Secretariat intersessionally to ensure that information relating to Japan and South Africa are correct to avoid misunderstandings relating to the joint venture agreement in place between the CPCs.

The SC **NOTED** a clarification of the definition of dry observers **NOTING** that these are observers based on land who analyse the footage received from Electronic Monitoring Systems (EMS) and that therefore they are not required to be accredited in the same way that onboard observers are.

The SC **NOTED** that while many data are now submitted electronically to the Secretariat, still many are not reported in formats such as PDFs from which data cannot easily be extracted so not all submitted data are included in the Regional Observer Scheme (ROS) database. The SC **CLARIFIED** that data held in the database are only those which are officially submitted in trip reports rather than those included within National Reports but that the Secretariat uses the National Reports to cross verify information received in trip reports. The SC **SUGGESTED** that the process of submitting data and accrediting observers should be formalised NOTING that currently the methods for doing this are inconsistent.

The SC **NOTED** that the ROS is very important for the collection of independent scientific data and expressed CONCERN that the level of coverage remains low at 2.15% and that there is no coverage of the artisanal fleet which comprise a large proportion of catches taken in the Indian Ocean.

The SC **CLARIFIED** that currently the level of observer coverage is estimated for longline fleets by comparing the observed number of hooks with the total reported number of hooks and for purse seine fleets fishing days are used to estimate the level of coverage.

The SC **NOTED** comments from Kenya that the pilot project is progressing well and has been very helpful in training observers to a high level.

The SC **NOTED** paper IOTC-2020-SC23-12 on minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries

The SC **NOTED** that EMS is a very promising tool for enhancing observer coverage and can complement data collected by onboard observers, noting there are still certain types of information which cannot yet be collected using EMS.

The SC **NOTED** the plan decided by the WPDCS to establish an ad-hoc working group to continue discussions around developing the EMS standards further. The SC **NOTED** that several CPCs expressed interest in joining this group including Australia, China, the European Union, Japan, Maldives, Seychelles, and Somalia. The SC **NOTED** that the formalities for this group have not yet been finalised but **ENCOURAGED** all interested parties to attend including scientists, managers, and industry.

The SC **NOTED** that electronic monitoring has been used successfully in Australia onboard their longline vessels which has ensured uninterrupted coverage which would not have otherwise been possible (using human observers) during the Covid-19 pandemic and Australia stated that they were encouraged to see the momentum growing towards more widespread use of this tool.

The SC **NOTED** that the Maldives and Seychelles are also in the process of developing EMS onboard parts of their fleet and considered it beneficial for them to join the ad-hoc working group.

The SC **NOTED** that the equipment requirements for the systems vary depending on the size and type of vessel in order to meet the minimum standards. The SC **NOTED** that in most cases data will be directly recovered by dry observers for analysis without a need for data entry by members of the crew.

The SC **NOTED** concerns about data confidentiality with such systems and **SUGGESTED** that this will be discussed as part of the dedicated working group.

Consideration of Resolution 16/04 On the implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC

The SC **NOTED** that the ROS pilot project had been paused indefinitely due to the inability of the Contractors to travel to the participating countries and provide the necessary training. It is hoped that the project will resume in early 2021.

Outcomes of S24 and S25 relevant to the IOTC ROS and its pilot project

Due to the insurgence of the CoViD pandemic, the S24 - that was originally scheduled to be held in May 2020 - had to be postponed to November 2020. Both the S24 (2020) and S25 (2021) were held as remote meetings, with daily sessions shortened to four hours per day.

The necessary readjustments to the commission's meetings schedule and the exceptional circumstances under which these were held did not allow enough time for participants to discuss about Regional Observer Scheme matters.

ROS Pilot Project: progress update

Observer training programme and minimum standards

A vast array of observer initiatives, with different training curricula, data collection methods and procedures has been developed across the Indian Ocean by a range of organisations, both prior to and since the implementation of Resolution 11/04. As a result, an assortment of data of varying quality is being collected and reported, with many inconsistencies and gaps, and overall, a lack of standardisation in the procedures employed by national observer schemes and of conformity with IOTC mandatory data requirements.

Minimum standards for the ROS

The issues associated with this variety of standards, programmes and lack of coordination have already been identified in some areas such as the southwest Indian Ocean region and resulted in increasing number of requests being addressed to the Secretariat for clarification of standards and for formal accreditation or recognition that national or sub-regional programmes are adhering to IOTC standards. However, no formal mechanism was in place through which to do this or a concrete and auditable set of standards against which programmes could be assessed.

During 2018, funds were obtained and a consultancy was developed for an expert to comprehensively review the *ad-interim* data collection and reporting requirements and set out the minimum standard for the scheme in a clear and concise format. A full project report was developed that includes a revised set of data fields and programme standard, and an expert consultation workshop – involving a working group of selected experts from each of the main fleets (longline, purse seine, pole and line, gillnet, and handline) from the eastern and western Indian Ocean as well as from other oceans – took place in Seychelles from 24-28 September 2018.

The workshop-specific objectives focused on the revision of proposed ROS standards, data collection fields and reporting requirements, with participants that were invited to review the relevance and practical applicability of existing and proposed standards, data collection fields and reporting requirements.

The final set of standards recommended by this expert group was then presented to the WPDCS14 for review and to the SC21 for approval and triggered several significant updates to the ROS e-tools that were eventually finalized.

ROS training package

In 2019, a project to develop a complete training package for the IOTC ROS has been awarded to CapMarine: this is based on the finalised standards and include training materials for observer coordinators as well as observers, both on-line (e-learning tools) and on paper.

The newly developed tools and materials will be implemented in four counties (Sri Lanka, Tanzania, Kenya, and Indonesia[6]) and the IOTC Executive Secretary has secured high level commitment for the support of this project in each country.

As of today, a first round of visits has been performed by the Service Provider in Sri Lanka, Tanzania and Kenya: in Kenya, a second site visit including comprehensive training on all aspects of the ROS programme and written tests to assess the competence of the trainees, was also delivered in February 2020 and the IOTC Secretariat is awaiting confirmation from

[6] Due to issues with many CPCs being unable to meet the requirements set out for participating in the Regional Observer Scheme, the number of participating countries has now been reduced from the six that were originally planned down to four.

the Kenyan Observer Programme Coordination Team (OPCT) about the details of the trainees that successfully passed the tests and have been officially designated as Scientific Observers ready for deployment onboard.

Due to the insurgence of the CoViD pandemic and the consequent health risks and travel restrictions implemented at national levels, the project was temporarily suspended for reasons of *force majeure*, as was the deployment of ROS scientific observers in the IOTC area of competence. The project has recently restarted with necessary modifications to allow for the online training of observers and observer coordinators.

A package of training manuals and supporting documents and forms prepared by the service provider will be presented at the forthcoming WPDCS 17 (end November 2021) and will include the following items:

- Observer Logistics Coordinator (OLC) training curriculum
- OLC Manual
- Scientific Field Observer (SFO) training curriculum
- Draft SFO training manual
- Observer workbooks (for purse seine / longline / gillnet)
- Observer data collection forms (for purse seine / longline / gillnet)

Electronic data collection and reporting

The IOTC has developed a set of electronic tools to support data collection and reporting of ROS data, specifically aimed at observers and observer coordinators.

Two different tools were developed with this purpose:

- the **ROS e-collection tool**, to support observers in their task of compiling observed data in electronic format, and verify that the ROS minimum data collection requirements are met
- the **ROS national database**, to help observer coordinators collate all data produced with the ROS e-collection tool (for observers deployed on vessels from a given flag state), analyze their content, and submit the data to the ROS regional database

Both tools are designed to be platform-independent (they can run on Windows, Mac OS and Linux), have minimum HW / SW requirements, are localized in the two official languages of IOTC and can seamlessly integrate with the IOTC databases to ensure continuous update of all reference codes and core datasets (e.g., the IOTC Record of Authorised Vessels).

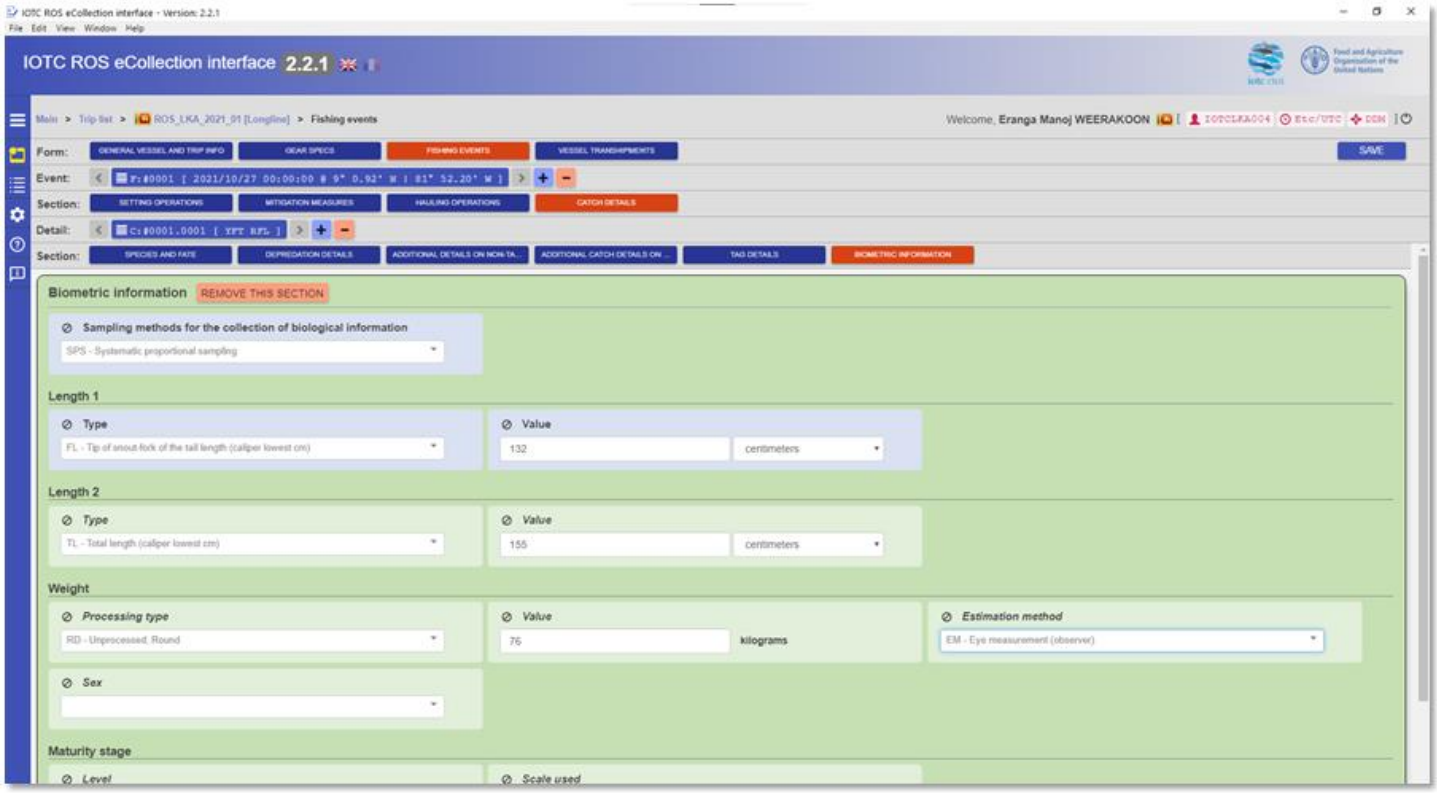
End-users need to authenticate against a list of currently accredited IOTC observers (ROS e-collection) and ROS focal points (ROS national database): for this reason, a formal workflow should be established in IOTC so that CPCs can provide asynchronous updates to their list of active observers (see also Appendix A) and focal points, and see these reflected in real time within the set of valid ROS credentials.

The ROS e-collection tool does not require internet connectivity to work, and it has been recently updated to include changes in data collection and reporting requirements emerging from the *ROS expert consultation workshop*, and eventually from the discussions held with the ROS training programme service provider.

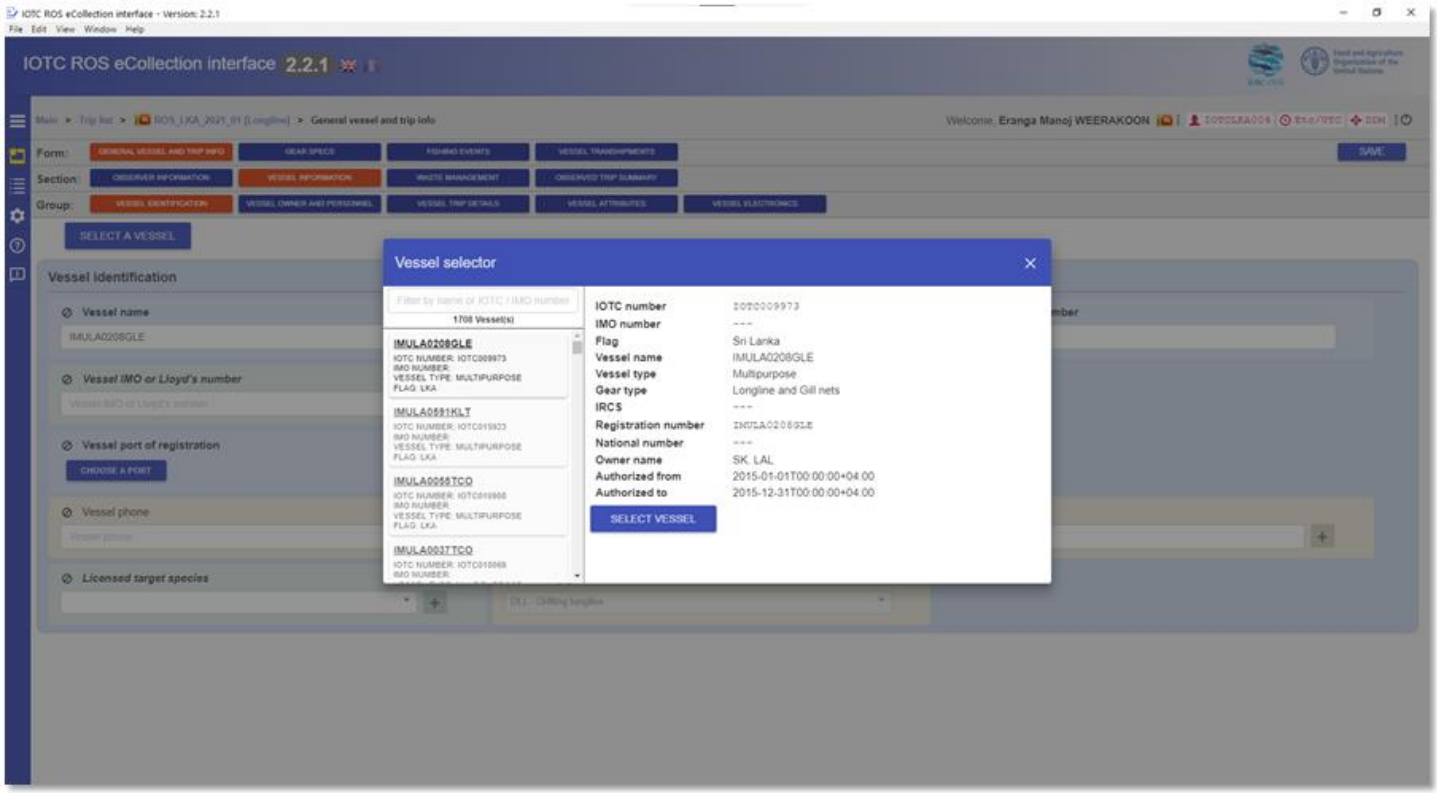
The tool is currently undergoing another major revision exercise to accommodate the feedback collected during the practical training sessions delivered by the staff of the IOTC Secretariat and / or by the service provider to various CPCs that include:

- Sri Lanka and Indonesia (2017, 2018)
- Mauritius (2019)
- Kenya (2020)

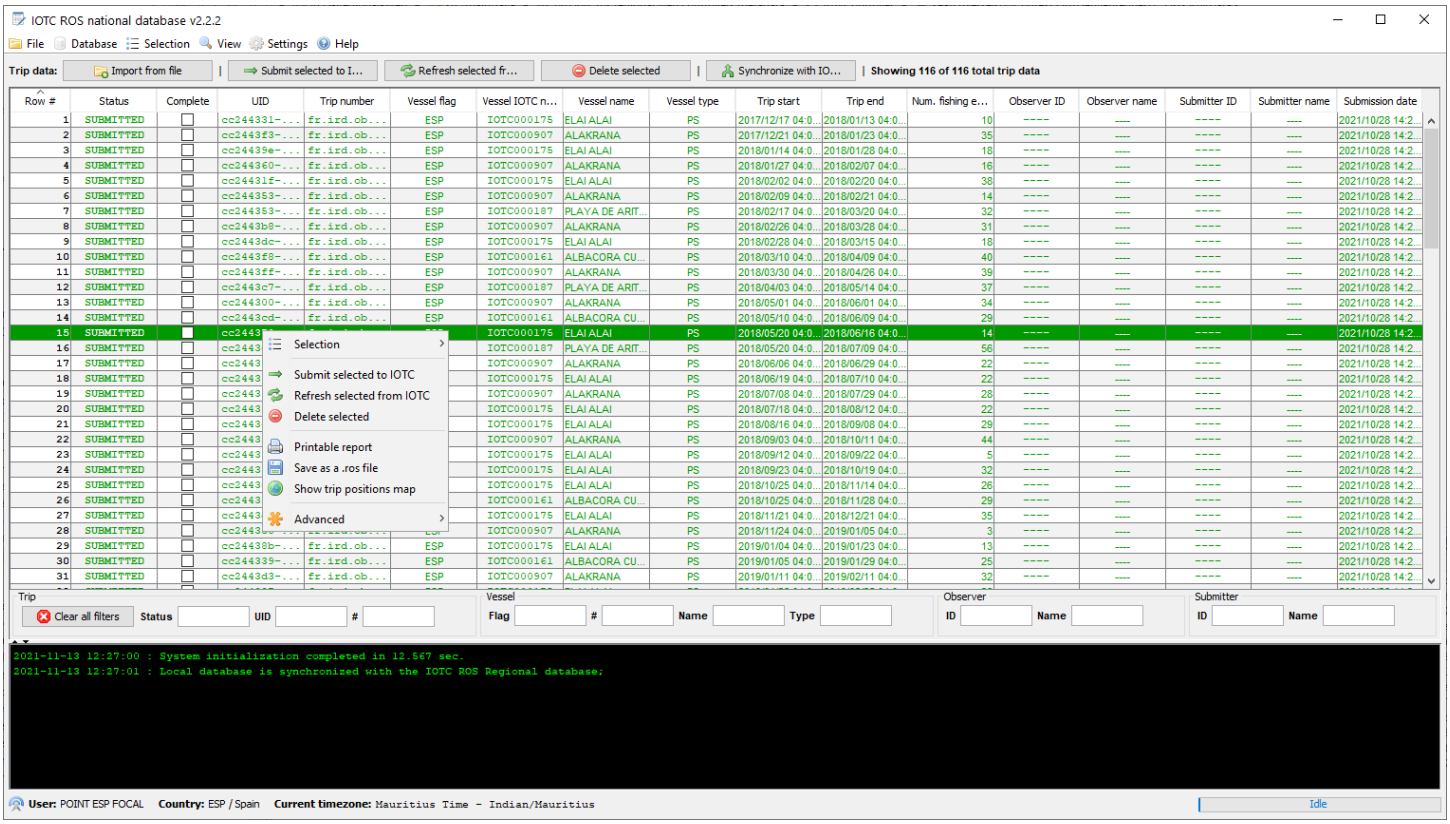
with Sri Lanka currently committed to reporting their observer data through the ROS e-collection tool on a regular basis.



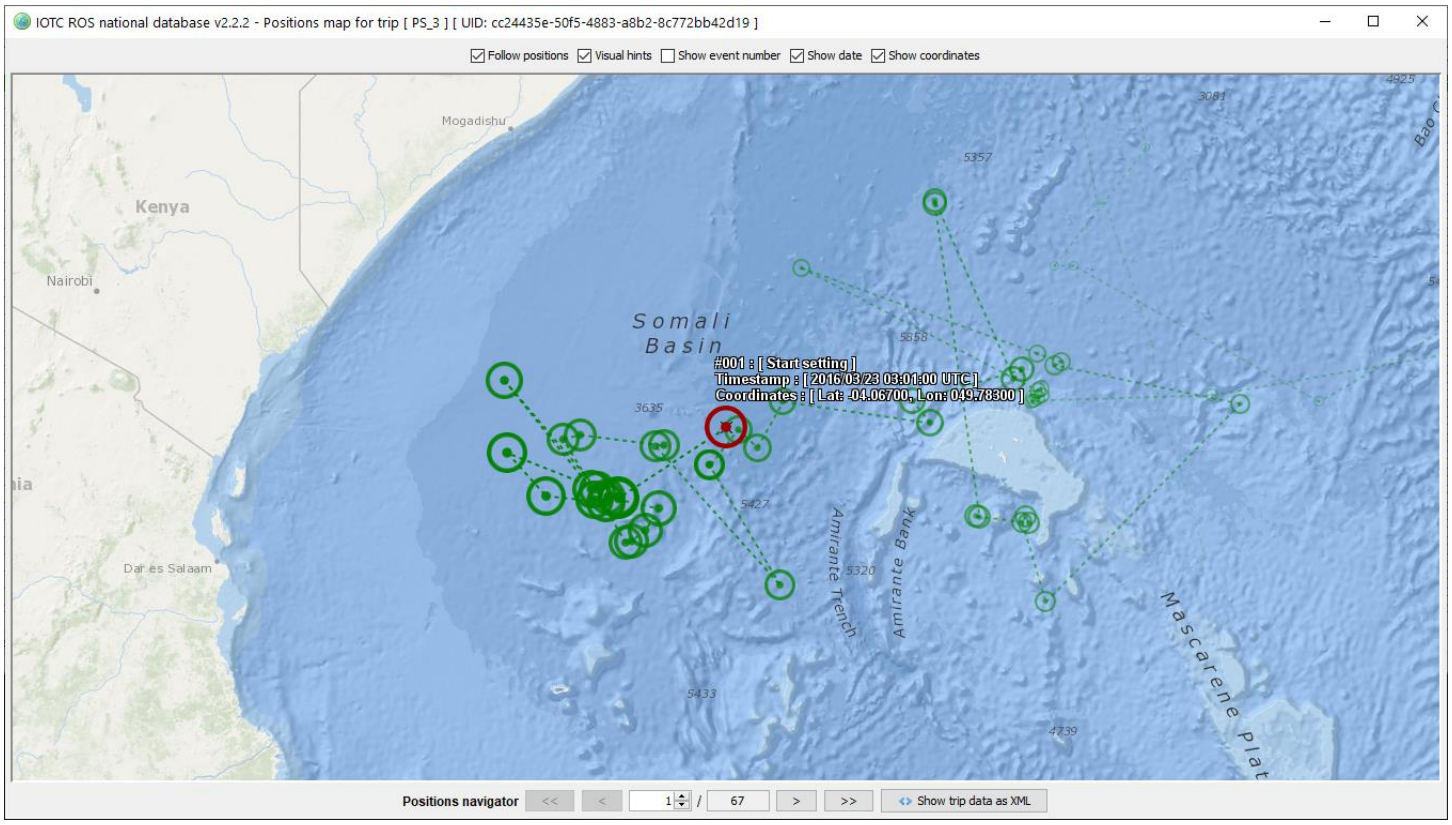
A screenshot of the ROS e-collection tool showing the data-entry process for a specimen's biometric information



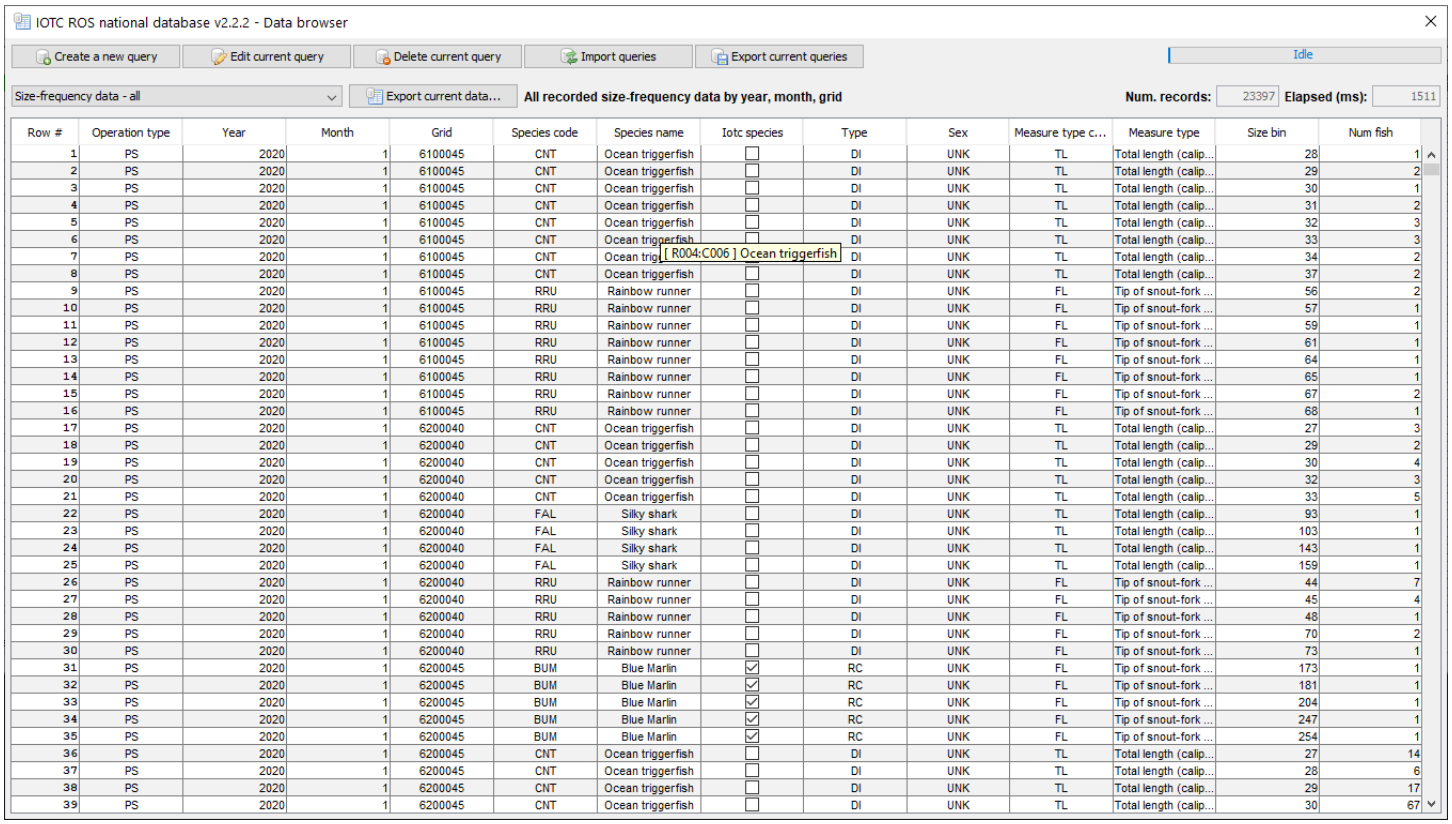
A screenshot of the ROS e-collection tool showing the integration of IOTC reference datasets (the IOTC RAV in this case)



A screenshot of the ROS national DB showing summary details of all trips reported, and the available management actions



A screenshot of the ROS national DB showing all event locations reported for a trip, with details on the event type, timestamp and coordinates



Row #	Operation type	Year	Month	Grid	Species code	Species name	Iotc species	Type	Sex	Measure type c...	Measure type	Size bin	Num fish
1	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	28	1
2	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	29	2
3	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	30	1
4	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	31	2
5	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	32	3
6	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	33	3
7	PS	2020	1	6100045	CNT	Ocean trig[R004:C006] Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	34	2
8	PS	2020	1	6100045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	37	2
9	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	56	2
10	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	57	1
11	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	59	1
12	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	61	1
13	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	64	1
14	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	65	1
15	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	67	2
16	PS	2020	1	6100045	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	68	1
17	PS	2020	1	6200040	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	27	3
18	PS	2020	1	6200040	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	29	2
19	PS	2020	1	6200040	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	30	4
20	PS	2020	1	6200040	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	32	3
21	PS	2020	1	6200040	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	33	5
22	PS	2020	1	6200040	FAL	Silky shark	☐	DI	UNK	TL	Total length (calip...	93	1
23	PS	2020	1	6200040	FAL	Silky shark	☐	DI	UNK	TL	Total length (calip...	103	1
24	PS	2020	1	6200040	FAL	Silky shark	☐	DI	UNK	TL	Total length (calip...	143	1
25	PS	2020	1	6200040	FAL	Silky shark	☐	DI	UNK	TL	Total length (calip...	159	1
26	PS	2020	1	6200040	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	44	7
27	PS	2020	1	6200040	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	45	4
28	PS	2020	1	6200040	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	48	1
29	PS	2020	1	6200040	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	70	2
30	PS	2020	1	6200040	RRU	Rainbow runner	☐	DI	UNK	FL	Tip of snout-fork ...	73	1
31	PS	2020	1	6200045	BUM	Blue Marlin	☑	RC	UNK	FL	Tip of snout-fork ...	173	1
32	PS	2020	1	6200045	BUM	Blue Marlin	☑	RC	UNK	FL	Tip of snout-fork ...	181	1
33	PS	2020	1	6200045	BUM	Blue Marlin	☑	RC	UNK	FL	Tip of snout-fork ...	204	1
34	PS	2020	1	6200045	BUM	Blue Marlin	☑	RC	UNK	FL	Tip of snout-fork ...	247	1
35	PS	2020	1	6200045	BUM	Blue Marlin	☑	RC	UNK	FL	Tip of snout-fork ...	254	1
36	PS	2020	1	6200045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	27	14
37	PS	2020	1	6200045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	28	6
38	PS	2020	1	6200045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	29	17
39	PS	2020	1	6200045	CNT	Ocean triggerfish	☐	DI	UNK	TL	Total length (calip...	30	67

A screenshot of the ROS national DB showing its data analysis and extraction capabilities, in this case summarizing all recorded size-frequency data

The adoption of the ROS electronic tools can support the full management lifecycle of data collected under the ROS program for those CPCs that lack established data management systems, but at the same time can also be a viable option to manage observations collected through other instruments such as EMS.

In this regard, the IOTC Secretariat is currently liaising with EMS providers to verify the feasibility of exporting data in the IOTC ROS format for future integration within ROS national databases of selected CPCs.

The ROS electronic tools are complemented by a revised version of the ROS electronic data reporting forms, which will be presented at the WPDCS17.

These forms are designed to be used by all those CPCs that already have well-established observer data collection systems in place and need to submit this information to the ROS Regional Database of IOTC.

The ROS electronic data reporting forms provide a tabular representation of the highly structured ROS data reporting requirements, and as such can be programmatically (and automatically) filled by CPCs with limited effort.

The overarching goal of this workstream is to ensure that scientific observer data could be seamlessly transmitted to the IOTC for inclusion within the ROS Regional Database while avoiding a proliferation of different data exchange formats.

These will indeed be limited to two only:

- the ROS structured format (produced by the ROS e-collection tool and managed by the ROS national databases)
- the ROS tabular format (Excel)

and will contribute to increase the coverage of data in the ROS Regional Database and ensure its close-to-real time updates as soon as information is received by the IOTC Secretariat.

Observer database development and historic data collation

The ROS *e-collection tool* mainly serves as a tool to support data collection on the field: all captured information has to be submitted to a national focal point that will in turn incorporate all observer data within a ROS *national database* (also supplied as a standalone and multi-platform application). The main goal of the ROS national database – besides establishing

a central repository for national observer data – is also to submit information to the ROS *regional database*, hosted by IOTC and specifically designed to accommodate all data marked as "*mandatory / optional for reporting*" (according to the revised definitions following the ROS expert consultation workshop).

The ROS national database and the ROS regional database have both been finalised: the regional database is now integrated with the IOTC statistical systems and contains a collation of all ROS data submitted so far in a convenient (from a data extraction and analysis perspective) electronic format – including (but not limited to) the information entered through the various version of the ROS e-collection tool.

Currently, the ROS regional database stores observer data reported by several fleets during different time periods, covering a total of **27,798** sets for **1,582** trips recorded between 2005 and 2020 (see **Tables 1.a-c** and **Figures 1.a-b**).

The processed information consists of trip reports provided in the ICCAT ST09 format (for both European longliners / purse seiners and Seychellois purse seiners), trip reports in a custom electronic format (Japan), ROS trip reports entered through the ROS e-collection tool (Sri Lanka) and various purse seiners trip reports (for Rep. of Korea, Mauritius, and Seychelles) originally provided as Word / PDF documents and digitized with the support of a consultant funded by SIOTI[7].

The data currently available in the IOTC ROS regional database covers **65.6%** of all ROS trip data provided to the Secretariat so far (coverage decreased slightly from the **68.5%** calculated in 2020 due to the provisions of data for several new trips through a non-processable electronic format).

[7] The Sustainable Indian Ocean Tuna Initiative (SIOTI) has been jointly established by key governments in the region, major tuna processors, producer organisations and their fishing vessels, with the support of WWF. This FIP is a multi-stakeholder effort, and its goal is to support improvement in the management of tuna fisheries in the Indian Ocean so that in the future, consumers can be assured that the purse-seine tuna they purchase has been harvested sustainably.

A breakdown of all currently available observer data in the ROS regional database (with data as of 30th October 2021) is as follows (**Table 1.a-c**):

Fleet	Gear	Num. trips
EU.ESP	PS	116
EU.FRA	LL	635
EU.FRA	PS	393
JPN	LL	51
KOR*	PS	6
LKA	LL	11
MUS*	PS	17
SYC*	PS	354
Total		**1,583**

Table 1.a: Number of available observer trips by fleet and gear (* includes data entered with support from SIOTI)

Year	Number of trips	
	PS	LL
2020	44	47
2019	137	57
2018	179	50
2017	153	61
2016	144	59
2015	122	98
2014	50	87
2013	11	90
2012	7	95
2011	3	42
2010	0	6
2009	3	4
2008	13	0
2007	11	0
2006	8	0
2005	1	0
Total	**886**	**696**
	1,582	

Table 1.b: Number of available observer trips by year and gear

Year	Number of sets	
	PS	LL
2020	1,253	441
2019	3,526	479
2018	4,211	355
2017	3,336	377
2016	3,616	896
2015	2,496	917
2014	981	1,283
2013	206	896
2012	156	958
2011	95	219
2010	0	54
2009	137	41
2008	307	0
2007	370	0
2006	168	0
2005	24	0
Total	**20,882**	**6,916**
	27,798	

Table 1.c: Number of available observed sets by year and gear

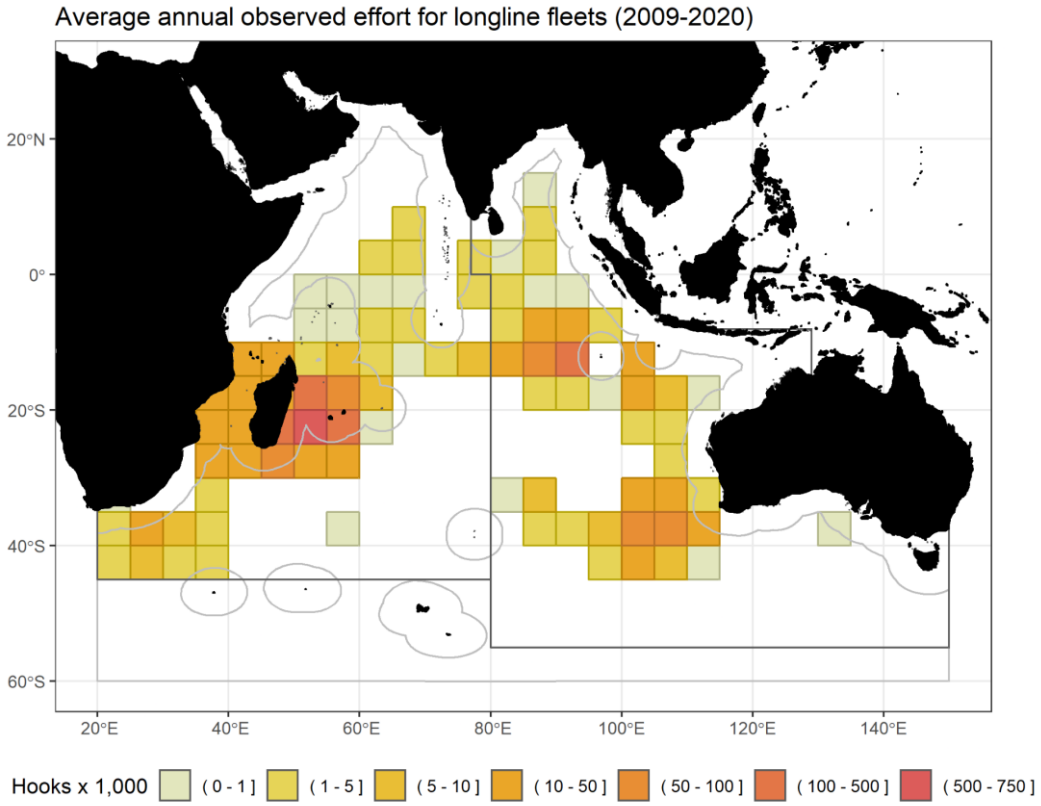


Figure 1.a: Average annual effort (in number of hooks by 5x5 degrees grids) reported to the ROS by longline fleet between 2009 and 2020s. Includes coastal longlines for selected flags.

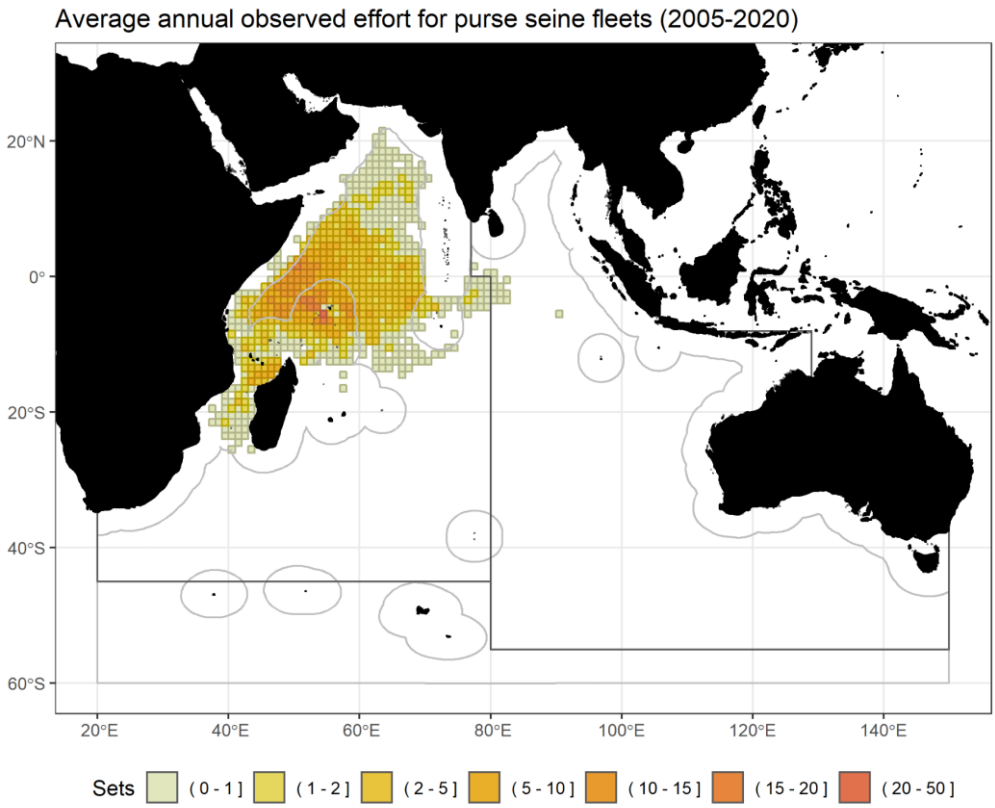


Figure 1.b: Average annual effort (in number of sets by 1x1 degrees grids) reported to the ROS by purse seine fleets between 2005 and 2020.

Once in full operation, the ROS regional database will be regularly and automatically populated with *live* observer data collected through the ROS e-collection tool and managed through dedicated ROS national database instances deployed at country level, increasing the level of compliance and the technical capacity of all participating developing flag states.

Furthermore, and with the goal to incorporate as much historical information as possible, the IOTC is developing custom importers that can generate data in ROS format (for inclusion in the IOTC ROS Regional Database) from data files produced through other well-established platforms such as *ObServe* (EU and Seychelles PS and LL fleets) and the SWIOFP database (IOC countries).

This task is currently ongoing, with increased support from the IOTC Secretariat expected during 2022.

Data extracted from the ROS regional database is still considered to be preliminary and subject to changes in structure and content without prior notice: the scientific community should ask explicit consent from the IOTC Secretariat before publicly disseminating any study or analysis based on this information.

Electronic monitoring systems

This activity aims at improving the quality of data collection and coverage of fisheries where there are practical difficulties in placing scientific observers onboard (e.g., due to safety issues, lack of space, logistics, etc.), particularly in the case of the smaller-scale fisheries under 24m LOA.

Since 2017, the IOTC Secretariat conducted field visits to I.R. Iran, Pakistan, and Sri Lanka, to assess the logistical practicalities of implementing EMS onboard their coastal gillnet (and gillnet-longline) vessels.

A proposal was subsequently developed in collaboration with the Sri Lanka Ministry of Fisheries and Aquatic Resources Development (MFARD) to trial EMS on-board six coastal longline/gillnet vessels (between 15 – 24m LOA): funding for this activity has been confirmed, procurement of the EMS equipment has been completed and the equipment has been installed on 4 of the vessels originally identified by the Sri Lankan authorities.

A first round of test trips was performed with the equipment fully deployed onboard: this helped stakeholders to identify some important technical issues (e.g., interference with radio communication equipment, high current drain from the main vessel batteries etc.). Equipment to support the work of "*dry observers*" (desktop computers, their training material etc.) was also purchased and deployed on site.

The insurgence of the CoViD pandemic has introduced unexpected delays in the finalization of the procurement and deployment processes for this task, which was put on temporary halt for reasons of *force majeure*: furthermore, a field mission to Sri Lanka – originally expected to be undertaken in Q2 2020 by the IOTC Secretariat in collaboration with the providers responsible for the actual installation of the EMS hardware and the training of designated observers – had to be postponed until further notice.

Eventually, in Q3 2021 the service provider confirmed the delivery of the last batch of EMS equipment to Sri Lanka, and requested the local representative and technology provider in the country to ensure onboard NAS (Network Attached Storage) are replaced with IP68-certified waterproof / shockproof external hard drives, to resolve the major issue of electronic interference between the EMS and the radio equipment reported by some of the vessels participating to the pilot study, which is a solution that will also have the beneficial effect of reducing the overall energy consumption of the systems, that was also another major concern.

Considering that travel restrictions were still in place during Q3 2021, the service provider also agreed about delivering remote training sessions to selected Sri Lanka observers and their coordinators, to cover for the basics of the entire EMS data collection and curation workflow, and discussion is still ongoing about the way forward to ensure that data collected through the deployed EMS systems can be properly "enriched" with the mandatory information that will make it fully compliant with the IOTC ROS data requirements, for its future inclusion within the ROS Regional Database.

On a separate note, in April 2020 a *Letter of Agreement* was signed between FAO of the UN and the International Seafood Sustainability Foundation (ISSF) for the provision of services related to "*improvements of data-limited methods for assessing Indian Ocean neritic tuna species*". Integral part of this LoA and the expected services to be provisioned is the development of Electronic Monitoring Systems (EMS) minimum standards, including specifications and procedures for the

implementation of EMS for IOTC fisheries, as well as an evaluation of EMS capabilities to collect IOTC ROS minimum standards data fields.

The project focuses on EMS standards for purse seiners and longliners (and small-scale fisheries, if possible) that would help standardize EMS implementation (e.g., number and position of cameras, installation, software requirements etc.) as well as data collection, usage, revision, and ownership.

A final report describing the minimum standards was presented to the IOTC Working Party on Data Collection and Statistics (WPDCS) and Scientific Committee (SC) in 2020 for consideration of adoption and recommendation to the Commission.

Observation in-port

There is currently no funding available for this project component and as such it has not yet been fully developed.

IOTC Species ID guides

	1. Tuna & like	2. Billfish	3. Turtles	4. Sharks and rays	5. Seabirds
Persian	2	1	1	1	1
Arabic	2	2	2	2	2
Urdu	4				
Bahasa Indonesian	1	3	5	**5**	**5**
Swahili		4			
Spanish		5	3	3	3
Portuguese		**6**	**4**	**4**	**4**
Thai		7			
Sinhala	3	8			
Tamil		8			
Bahasa Malaysia	1				
Hindi	3				

Table 2. Summary of priority languages and species groups for translation and printing as identified by the SC16 and SC17 (1=high).
Green = translation and printing complete. Yellow = in progress; entries in **boldface** represent printed guides not available at the last WPEB.

Progress to date

- Translation and printing of IOTC species ID guides into Persian has already been completed for tuna, sharks, billfish and turtles and these are now available on the IOTC website[8] (IOTC, IFO and WWF-Pakistan)
- Translation and printing of IOTC species ID guides into Arabic has been completed for tuna and tuna-like species and translation of the others is currently underway (IOTC and WWF-Pakistan)
- Translation and printing of tuna, billfish, turtles and shark ID guides into Urdu is complete and these are now available on the IOTC website (WWF-Pakistan)
- Translation and printing of tuna, billfish and turtles ID guides into Bahasa Indonesian is complete and these are now available on the IOTC website (OFCF)
- Translation of sharks and seabirds ID guides into Bahasa Indonesian and is complete, typesetting has been finalised and cards are ready to print (DGCF and IOTC)
- Translation of turtles ID guides into Spanish is complete and available on the IOTC website (IOSEA & IOTC)
- Translation of tuna and tuna-like species ID guides into Hindi is complete and cards have been typeset for printing (CMFRI and IOTC)
- Translation of tuna and tuna-like species ID guides into Malaysian is complete and card are ready for printing (IOTC)

[8] https://www.iotc.org/science/species-identification-cards

- Translation of tuna and tuna-like species ID guides into Sinhala and Tamil has been completed and are available on the IOTC website (NARA, DFAR and FAO)
- Translation of all IOTC species ID guides into Portuguese has been completed and cards have been printed and these are now available on the IOTC website (IIP, IPMA OFCF)
- Translation and printing of all IOTC species ID guides into Maldivian is underway (Ministry of Fisheries and Agriculture, Maldives)

While a number of guides are now ready for printing and funding has been obtained for these, the major administrative hurdle which has delayed further progress is the need for all future publications (including language translations) to proceed through the 12-step FAO approval process which has also caused severe delays with some cards taking >8 months to progress through the system. Nevertheless, the Secretariat is seeking solutions to these issues and, once resolved, progress should be rapid.

Cetacean ID guides

An Indian Ocean cetaceans ID guide has now been developed with inputs from an expert group of WPEB scientists. This has been translated into ten languages as requested by the WPEB13 (Arabic, French, Hindi, Indonesian, Persian, Sinhalese, Spanish, Swahili, Tamil and Urdu) which are currently undergoing typesetting. Several translations of the guide are now published on the IOTC website, and the Marine Mammal Commission has provided funding for the printing.

Progress to date

- English (**published**, **printed** and available on the IOTC website)
- French (**published**, **printed** and available on the IOTC website)
- Spanish (**published**, **printed** and available on the IOTC website)
- Indonesian (**published**, **printed** and available on the IOTC website)
- Arabic (**published**, **printed** and available on the IOTC website)
- Sinhala (**published**, **printed** and available on the IOTC website)
- Persian (**published**, **printed** and available on the IOTC website)
- Tamil (**published**, **printed** and available on the IOTC website)
- Urdu (revisions taking place)
- Swahili (revisions taking place)
- Hindi (revisions taking place)

Appendices

Appendix A: Update on the implementation of the IOTC regional observer scheme

Appendix B.1: Annual total effort and estimated observer coverage for longline fleets (2016-2020)

Appendix B.2: Average annual total effort and observer coverage for longline fleets (2016-2020)

Appendix C.1: Annual total effort and estimated observer coverage for purse seine fleets (2016-2020)

Appendix C.2: Average annual total effort and observer coverage for purse seine fleets (2016-2020)

Appendix A: Update on the implementation of the IOTC Regional Observer Scheme

CPCs		Vessels on active list (2020)					Accredited observers		Number of observed trips																				Totals
		LL	PS	GN	BB	Tot	Number	Last update	2012		2013		2014		2015		2016		2017		2018		2019		2020		
									O	E	O	E	O	E	O	E	O	E	O	E	O	E	O	E	O	E	
Contracting parties																													
Australia		3	10	-	-	13	21		3				2	4		11		27		46		30		28		16	167
Bangladesh		NO INFORMATION RECEIVED																											0
China	CHN	80	-	-	-	80	4	2020-07	1		1		2		1		4		4		5		4						22
	TWN, CHN	261	-	-	-	261	54		1		19		18		26		18		31		29		31		33				206
Comoros		-	-	-	-	0	7		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A				N/A
Eritrea		NO INFORMATION RECEIVED																											0
European Union	FRA	37	17	-	-	54	64		16	92	10	92	23	116	24	135		111		121		110		108		69	1027
	ITA	-	1	-	-	1			N/A		N/A		N/A		6		4		1		11								22
	PRT	3	-	-	-	3	6		1		1		1		1		1			1		1		1					8
	ESP	11	15	-	-	26	9				1		2			24		15	19	2	3	35		40		23			164
	GBR	-	-	-	-	0	2	2019-09												2		2			N/A				4
France (OT)		-	-	-	-	0	N/A	N/A	7		7		N/A		N/A		N/A		N/A		N/A		N/A		N/A				14
India		4	-	-	-	4											N/A												0
Indonesia		278	103	-	-	381	9						5				7		4			5		9		2			32
Iran, Isl. Rep. of		-	4	1206	-	1210																							0
Japan		58	1	-	-	59	30			10		6		13		6	2	9	9		14		9							78
Kenya		4	6	-	-	10	5		N/A		N/A		N/A		N/A			1	N/A		6		4		2				13
Korea, Rep. of		12	2	-	-	14	40		2		3		3		4		11		5		3		3						34
Madagascar		5	-	-	-	5	7		5		7		7		5														24
Malaysia		17	-	-	-	17																							0

CPCs	Vessels on active list (2020)					Accredited observers		Number of observed trips																		Totals
	LL	PS	GN	BB	Tot	Number	Last update	2012		2013		2014		2015		2016		2017		2018		2019		2020		
								O	E	O	E	O	E	O	E	O	E	O	E	O	E	O	E	O	E	
Contracting parties																										
Maldives	-	-	-	373	373	4												1		2		54				57
Mauritius	-	3	-	-	3	8	2019-04							5		8		4		9		9				35
Mozambique	14	-	-	-	14	11		1		N/A					7		3		2							13
Oman	1	-	-	-	1															N/A						0
Pakistan	-	-	-	-	0	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		0
Philippines	-	-	-	-	0	N/A								N/A		N/A		N/A		N/A		N/A		N/A		0
Seychelles	74	13	-	-	87	78							7		66		63		91		83		44			354
Somalia	NO INFORMATION RECEIVED																									0
South Africa	15	-	-	-	15	30	2019-08	10		13		10		16		5		8		34		18				114
Sri Lanka	669	92	164	-	925	23						2		2		2					4		5		1	16
Sudan	NO INFORMATION RECEIVED																									0
Tanzania, United Rep.of	1	-	-	-	1											1		N/A		N/A		1				2
Thailand	-	-	-	-	0	30	2019-11													N/A		N/A		N/A		0
United Kingdom (OT)	-	-	-	-	0	N/A	N/A	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Yemen	NO INFORMATION RECEIVED																									0
COOPERATING NON-CONTRACTING PARTIES																										
Liberia	-	-	-	-	0	N/A	N/A	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A
Senegal	-	-	-	-	0	N/A	N/A	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A

Year = year in which considered observed trip began with the vessel sailing from its origin port

Number of observed trips:

E: number of trips whose observed data are reported in a structured electronic format,

O: number of trips whose observer data are reported in other formats, including non-structured electronic ones)

Observed trips for Madagascar include data collected by observers onboard foreign vessels

11 observed trips reported for EU,ITA in 2018, although no vessel flagged by EU,ITA was officially indicated as active during the year

Not applicable (N/A) or no information received

Data provided according to standards

Data only partially provided according to standards

Data not provided

Appendix B.1: Annual total effort and estimated observer coverage for longline fleets (2016-2020)

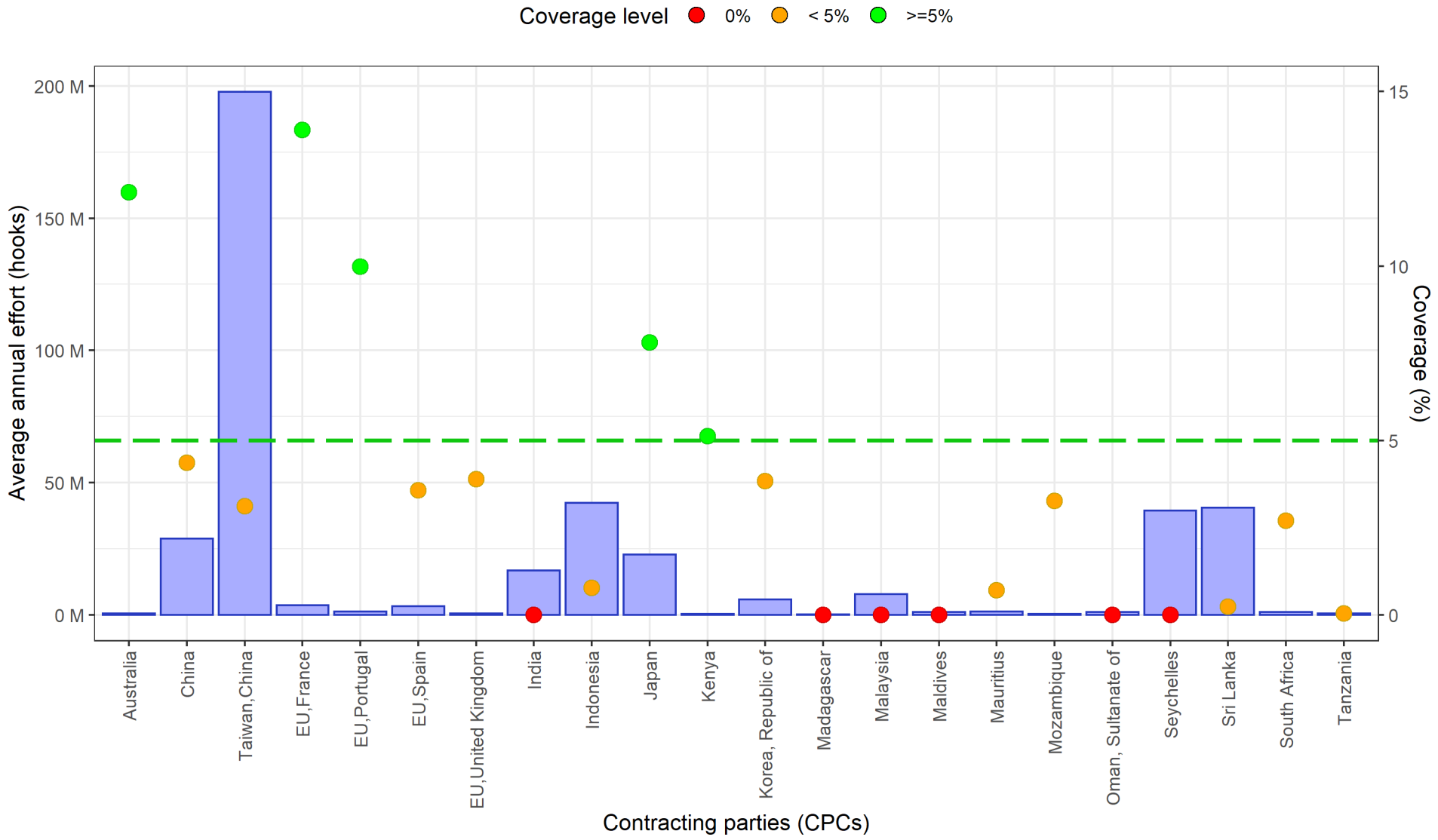
Contracting parties	Total effort (no. hooks)					Observed effort (no. hooks)					Coverage rate					Average		Trend
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	Effort	Coverage	
Australia	429,288	532,396	411,101	373,810	241,225	49,875	62,126	54,010	47,047	27,710	11.62%	11.67%	13.14%	12.59%	11.49%	397,564	12.11%	
Bangladesh, People's Republic of	-	-	-	-	-	-	-	-	-	-						-		
China	24,107,147	33,070,839	32,987,773	26,380,951	27,858,657	1,206,739	1,584,934	1,681,983	1,814,426	-	5.01%	4.79%	5.10%	6.88%	0.00%	28,881,073	4.35%	
Taiwan,China	205,030,919	206,353,760	191,283,729	207,142,582	179,463,480	3,461,035	6,412,309	7,959,058	8,829,597	4,073,449	1.69%	3.11%	4.16%	4.26%	2.27%	197,854,894	3.11%	
Comoros	-	-	-	-	-	-	-	-	-	-						-		
Eritrea	-	-	-	-	-	-	-	-	-	-						-		
EU,France	3,710,089	3,067,200	3,321,759	4,046,121	3,577,112	566,024	534,686	369,011	497,672	496,928	15.26%	17.43%	11.11%	12.30%	13.89%	3,544,456	13.91%	
EU,Italy	-	-	-	-	-	-	-	-	-	-						-		
EU,Portugal	1,673,150	1,624,100	895,800	810,000	593,600	152,385	128,201	138,245	139,600	-	9.11%	7.89%	15.43%	17.23%	0.00%	1,119,330	9.98%	
EU,Spain	4,427,429	3,579,479	2,821,579	2,992,243	2,654,022	-	401,116	137,877	-	49,686	0.00%	11.21%	4.89%	0.00%	1.87%	3,294,950	3.57%	
EU,United Kingdom	271,700	500,300	498,100	621,600	270,000	-	38,688	45,437	-	-	0.00%	7.73%	9.12%	0.00%	0.00%	432,340	3.89%	
France (OT)	-	-	-	-	-	-	-	-	-	-						-		
India	26,646,906	7,801,057	22,326,325	16,215,171	10,437,393	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	16,685,370	0.00%	
Indonesia	50,499,106	54,081,638	23,735,844	35,957,951	47,228,024	808,600	228,970	251,891	264,421	86,845	1.60%	0.42%	1.06%	0.74%	0.18%	42,300,513	0.78%	
Iran, Islamic Republic of	-	-	-	-	-	-	-	-	-	-						-		
Japan	27,038,829	23,366,927	22,201,649	19,940,314	21,669,624	1,549,071	1,858,735	1,998,387	1,975,168	-	5.73%	7.95%	9.00%	9.91%	0.00%	22,843,469	6.46%	
Kenya	-	-	567,814	822,307	-	67,240	-	68,807	2,400	682			12.12%	0.29%		278,024	5.12%	
Korea, Republic of	5,862,099	6,462,887	6,052,850	5,899,410	4,980,671	377,864	251,355	214,244	277,326	-	6.45%	3.89%	3.54%	4.70%	0.00%	5,851,583	3.83%	
Madagascar	324,386	175,559	139,275	151,408	155,501	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	189,226	0.00%	
Malaysia	5,463,815	7,760,622	8,896,151	8,404,889	8,817,171	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	7,868,530	0.00%	
Maldives	2,679,463	1,680,871	828,434	165,327	-	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%		1,070,819	0.00%	
Mauritius	763,618	1,653,981	1,445,477	1,553,466	129,500	-	-	39,200	-	-	0.00%	0.00%	2.71%	0.00%	0.00%	1,109,208	0.71%	
Mozambique	230,296	265,808	202,281	205,152	749,074	29,600	24,354	-	-	-	12.85%	9.16%	0.00%	0.00%	0.00%	330,522	3.26%	
Oman, Sultanate of	467,375	1,179,315	1,121,144	1,743,474	817,673	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	1,065,796	0.00%	
Pakistan	-	-	-	-	-	-	-	-	-	-						-		
Philippines	-	-	-	-	-	-	-	-	-	-						-		
Seychelles	35,608,822	38,476,480	45,956,262	37,392,851	39,695,309	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	39,425,945	0.00%	
Somalia	-	-	-	-	-	-	-	-	-	-						-		
Sri Lanka	20,376,492	35,254,617	44,499,762	59,427,840	42,656,053	-	36,294	200,282	142,960	71,980	0.00%	0.10%	0.45%	0.24%	0.17%	40,442,953	0.22%	
South Africa	616,518	1,284,160	1,325,446	1,355,677	572,461	5,340	27,554	24,785	81,112	-	0.87%	2.15%	1.87%	5.98%	0.00%	1,030,852	2.69%	
Sudan	-	-	-	-	-	-	-	-	-	-						-		
Tanzania	2,510,929	-	-	11,663	10,212	757	-	-	-	-	0.03%			0.00%	0.00%	506,561	0.03%	
Thailand	-	-	-	-	-	-	-	-	-	-						-		
United Kingdom (OT)	-	-	-	-	-	-	-	-	-	-						-		
Yemen	-	-	-	-	-	-	-	-	-	-						-		
Cooperating non-contracting parties																		
Liberia	-	-	-	-	-	-	-	-	-	-						-		
Senegal	-	-	-	-	-	-	-	-	-	-						-		
Total	418,738,376	428,171,996	411,518,555	431,614,207	392,576,762	8,207,290	11,589,322	13,183,217	14,071,729	4,806,598	1.96%	2.71%	3.20%	3.26%	1.22%	416,523,979	2.49%	
	Total effort is ESTIMATED		Total effort is AS REPORTED			Observed effort is > total effort			Observed effort is ≤ total effort		Coverage is	Unavailable	= 0%	< 5%	≥ 5%			

Notes: Data reported by Australia has been collected exclusively through EMS

Total effort: Total number of hooks set by longliners, by vessel flag and year, including:

- **AS REPORTED**: total effort extracted from the yearly submissions of catch-and-effort data for the fleet
- **ESTIMATED**: total effort not originally available, and estimated using the nominal catches available and sampled effort or catch rates from other fleets or year periods

Appendix B.2: Average annual total effort and observer coverage for longline fleets (2016-2020)



Appendix C.1: Annual total effort and estimated observer coverage for purse seine fleets (2016-2020)

Contracting parties	Total effort (no. fishing days)					Observed effort (no. fishing days)					Coverage rate					Average		Trend
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	Effort	Coverage	
Australia	84	69	115	125	117	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	102	0.00%	
Bangladesh, People's Republic of	-	-	-	-	-	-	-	-	-	-						-		
China	-	-	-	-	-	-	-	-	-	-						-		
Taiwan,China	-	-	-	-	-	-	-	-	-	-						-		
Comoros	-	-	-	-	-	-	-	-	-	-						-		
Eritrea	-	-	-	-	-	-	-	-	-	-						-		
EU,France	3,152	2,943	3,233	2,692	2,217	744	792	802	741	352	23.60%	26.91%	24.81%	27.53%	15.88%	2,847	24.10%	
EU,Italy	252	395	542	349	332	147	42	339	-	-	58.33%	10.63%	62.55%	0.00%	0.00%	374	28.24%	
EU,Portugal	-	-	-	-	-	-	-	-	-	-						-		
EU,Spain	3,933	3,242	3,433	3,397	3,505	531	392	946	1,188	643	13.50%	12.09%	27.56%	34.97%	18.35%	3,502	21.13%	
EU,United Kingdom	-	-	-	-	-	-	-	-	-	-						-		
France (OT)	-	-	-	-	-	-	-	-	-	-						-		
India	-	-	-	-	-	-	-	-	-	-						-		
Indonesia	216,477	135,396	79,083	108,245	78,049	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	123,450	0.00%	
Iran, Islamic Republic of	110	114	81	67	19	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	78	0.00%	
Japan	69	79	43	4	11	-	-	26	-	-	0.00%	0.00%	60.47%	0.00%	0.00%	41	12.62%	
Kenya	-	-	-	-	-	-	-	-	-	-						-		
Korea, Republic of	556	336	297	345	253	232	121	-	-	-	41.73%	36.01%	0.00%	0.00%	0.00%	357	19.75%	
Madagascar	-	-	-	-	-	-	-	-	-	-						-		
Malaysia	10,724	-	-	16,013	12,919	-	-	-	-	-	0.00%			0.00%	0.00%	7,931	0.00%	
Maldives	-	-	-	-	-	-	-	-	-	-						-		
Mauritius	266	326	347	451	373	148	44	67	95	-	55.64%	13.50%	19.31%	21.06%	0.00%	353	20.08%	
Mozambique	-	-	-	-	-	-	-	-	-	-						-		
Oman, Sultanate of	-	-	-	-	-	-	-	-	-	-						-		
Pakistan	-	-	-	-	-	-	-	-	-	-						-		
Philippines	-	4	-	-	-	-	-	-	-	-		0.00%				1	0.00%	
Seychelles	4,087	3,269	2,787	2,923	3,222	1,102	1,431	1,218	682	-	26.96%	43.77%	43.70%	23.33%	0.00%	3,258	27.22%	
Somalia	-	-	-	-	-	-	-	-	-	-						-		
Sri Lanka	-	-	-	-	-	-	-	-	-	-						-		
South Africa	-	-	-	-	-	-	-	-	-	-						-		
Sudan	-	-	-	-	-	-	-	-	-	-						-		
Tanzania	-	-	-	-	-	-	-	-	-	-						-		
Thailand	56,995	45,794	35,411	36,303	39,901	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	42,881	0.00%	
United Kingdom (OT)	-	-	-	-	-	-	-	-	-	-						-		
Yemen	-	-	-	-	-	-	-	-	-	-						-		
Cooperating non-contracting parties																		
Liberia	-	-	-	-	-	-	-	-	-	-						-		
Senegal	-	-	-	-	-	-	-	-	-	-						-		
Total	296,705	191,967	125,372	170,914	140,918	2,904	2,822	3,398	2,706	995	0.98%	1.47%	2.71%	1.58%	0.71%	185,175	1.39%	
	Total effort is ESTIMATED		Total effort is AS REPORTED			Observed effort is > total effort			Observed effort is ≤ total effort		Coverage is	Unavailable	= 0%	< 5%	≥ 5%			

Total effort: total number of days fished by tuna purse seiners, by vessel flag and year, including:

- **AS REPORTED**: total effort extracted from the yearly submissions of catch-and-effort data for the fleet
- **ESTIMATED**: total effort not originally available, and estimated using the nominal catches available and sampled effort or catch rates from other fleets or year periods

Appendix C.2: Average annual total effort and observer coverage for purse seine fleets (2016-2020)