EMS implementation and minimum standards in IOTC

Hilario Murua (IOTC WGEMS Chair)

6th Workshop of an Electronic Monitoring System (EMS) in the EPO

13 – 15 Decembeer, 2023, ONLINE

Outline

- IOTC EM Process and History
- Key milestones
- Summary and discussion

IOTC EM Process and History

- Started around 2014

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RESOLUTION 16/04
ON THE IMPLEMENTATION OF A PILOT PROJECT IN VIEW OF PROMOTING THE REGIONAL OBSERVER SCHEME OF IOTC

6. The pilot project will explore the possibilities offered by electronic observation and observation in port.

7. The Scientific Committee will evaluate whether electronic observation or observation in port can be used to collect data matching IOTC standards. Scientific Committee will also propose minimum standards for the implementation of Electronic observation systems and how they can be used to increase levels of observer coverage for Indian Ocean fisheries.

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RESOLUTION 11/04
ON A REGIONAL OBSERVER SCHEME

- Following an expert consultation workshop in 2018, the IOTC Scientific Committee developed new Regional Observer Scheme Program Standards, including **Minimum Standards Data** Fields, that the Commission endorsed *in principle* in 2019.
- The Regional Observer Scheme Program Standards includes
  - requirements about observer coverage,
  - CPC's observer program verification by IOTC,
  - observer registration, training, and coordination,
  - equipment and materials, and observer manuals, etc.

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- 2021-2022: the WG further developed EM standards for SC revision

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- 2021: the Commission endorsed the ad hoc working group
- 2021-2022: the WG further developed EM standards for SC revision
- In 2022, Resolution 22/04 on a Regional Observer Scheme was adopted.

RESOLUTION 22/04

ON A REGIONAL OBSERVER SCHEME

4. The IOTC Scientific Committee, in collaboration with the Compliance Committee, shall develop and agree on minimum standards for the use of EMS for purse seine, longline, bait boat (pole and line), handline, and gillnet fleets by 2023 at the latest, including on modalities of the substitution of the human observer coverage by an EMS, taking into account factors such as, the principles and regulations regarding minimum safe manning requirements. The Commission may consider and adopt these standards by 2024 in a separate Resolution.

5. Once the EMS standards are adopted and providing CPCs meet the minimum mandatory ROS data reporting standards, the minimum human observer coverage provided for in paragraph 3 may be complemented or substituted by means of an EMS. To ensure the minimum mandatory ROS data reporting standards are met, the EMS may be complemented by port sampling and/or other Commission approved data collection methods. CPCs are encouraged to use an EMS to improve the collection of scientific data before the standards mentioned in paragraph 4 are adopted.

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- 2021: the Commission endorsed the ad hoc working group
- 2021-2022: the WG further developed EM standards for SC revision
- In 2022, Resolution 22/04 on Regional Observer Scheme was adopted.
- In 2022, the SC adopted the EM minimum standards developed by the WGEMS

Background

Resolution 22/04 On a Regional Observer Scheme 27th Commission Meeting

- requests "the IOTC SC, in collaboration with the CC, to develop and agree on minimum standards for the use of EMS for PS, LL, PL, HL, GN by 2023 at the latest
- allows using EM to achieve the observer coverage requirement **IF** EMS standards are adopted and CPCs meet ROS data reporting standards.

25th Scientific Committee - 2022

- **ENDORSED** a) the EM terms and definitions b) the EM Program standards, and c) the EM Data standards described in Appendices 6A, 6B and 6C (except Annex 1 and 2 to be adopted in March 15-16), respectively, and **RECOMMENDED** their adoption by the Commission.
- Also **NOTED** that Annex 1 and 2 of the EM Data Standards (Appendix 6C) are general guides that should be tailored to each fishery and could vary from fleet to fleet, **those annexes (Vessel Monitoring Plans –VMP- and EM capabilities to collect ROS minimum requirements) will be finalised during next IOTC WGEMS (15-16 March, 2023) before IOTC Commission Consideration**

3rd WGEMS RECOMMENDATIONS

The **WGEMS RECOMMENDED** the adoption of Annex 1- Vessel Monitoring Plan as part of the EM System and Data Standards adopted by the Scientific Committee (Appendix 6c of the IOTC-2022-SC25-R) as a general guide and examples of existing EMS installations.

3rd WGEMS RECOMMENDATIONS

To ensure that ROS minimum mandatory data requirements are met by CPCs implementing EM, as required by Res 22/04, the **WGEMS RECOMMENDED** that those CPCs include a table, alongside the VMPs submission, that details which minimum required data fields are to be collected by EM and which are to be collected by other approved methods (including specifying those methods for each field).

3rd WGEMS RECOMMENDATIONS

- NOTING the difficulty to collect by EMS alone some of the data minimum requirements of the ROS, **the WGEMS in 2023 AGREED to review the data that cannot be collected by EMS (and/or human observers) and their utilisation for scientific and management purposes**.

- The WGEMS **SUGGESTED the issue to be brought to the attention of the WPDCS and Scientific Committee**.

IOTC EM Process

- And finally, the Commission adopted IOTC EM minimum standards in 2023

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RESOLUTION 23/08
ON ELECTRONIC MONITORING STANDARDS FOR IOTC FISHERIES

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RESOLUTION 23/08
ON ELECTRONIC MONITORING STANDARDS FOR IOTC FISHERIES

- the terms and definitions of EMS,
- EM Program Standards, and
- EM System and Data Standards as per IOTC SC recommendation, that allow CPCs to meet the minimum ROS data requirements under Resolution 22/04 using EMS.

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RESOLUTION 23/08
ON ELECTRONIC MONITORING STANDARDS FOR IOTC FISHERIES

CPCs who choose to implement EMS in the IOTC area of competence shall:

a) ensure that the implementation of their National EM Programs (NEMPs) and EM systems on their flagged vessels **meets the requirements of the EM Program Standard (Annex 1) and EM System and Data Standards (Annex 2)**.

b) submit to the IOTC Secretariat by 1 July each year, a **Vessel Monitoring Plan**, that covers each vessel in their IOTC fishery utilizing EMS, outlining the EMS setup on each vessel, consistent with the requirements in the EM Program Standard (Annex 1) and making use of guidance in Annex 3 (Vessel Management Plan Guide).

RESOLUTION 23/08
ON ELECTRONIC MONITORING STANDARDS FOR IOTC FISHERIES

Also requests CPCs implementing EMS programs to submit to the IOTC Secretariat by 1 July each year, a fleet level ROS data collection table, clearly specifying for each ROS minimum required data field as specified:

i. the data field name and description,

ii. the data field reporting requirement level (i.e, mandatory collection and reporting, mandatory reporting if collected, not mandatory etc),

iii. the data collection method used to collect data for that field, and

iv. a brief description of the data collection method.

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RESOLUTION 23/08
ON ELECTRONIC MONITORING STANDARDS FOR IOTC FISHERIES

Also requests the ***Scientific Committee to review, no later than 2024, the ROS minimum required data fields*** to:

I. identify any fields that are logistically difficult for EM and/or human observers to collect, respectively; and

II. provide advice and recommendations to the Commission on the need and use of those identified fields for scientific purposes, and their collection and reporting status (i.e. mandatory, non-mandatory etc.), and

III. discuss and provide advice to the Commission on the potential need to develop a separate EM ROS minimum data fields list

Key Milestones

- Started around 2014
- 2014-2017 trials in PS (EU) and LL (Australia), lessons learned.
- **In 2016, Resolution 16/04 on a Pilot project to promote the ROS requested SC to develop EM minimum standards**.
- In 2017 the SC recommended that the EMS standards presented for purse seine fisheries (IOTC-2016-SC19-15) be adopted. Preliminarily adopted by the Commission in 2018.
- In 2018 IOTC SC recommended the development of EMS minimum standards for all IOTC tuna fisheries.
- In 2019, Regional Observer Scheme minimum standard data fields were adopted by the IOTC Commission
- **In 2020, a technical paper on EM minimum standards for the installation, collection, analysis and storage of data was prepared and discussed at the SC.**
- In 2020, the SC recommended the creation of an ad hoc WG to advance EM in 2021.
- **2021: the Commission endorsed the ad hoc working group**
- 2021-2022: the WG further developed EM standards for SC revision
- **In 2022, Resolution 22/04 on Regional Observer Scheme was adopted.**
- **In 2022, the SC adopted the EM minimum standards developed by the WGEMS**

Minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries

H. Murua, F. Fiorellato, J. Ruiz, E. Chassot, V. Restrepo

2nd IOTC WGEMS

13 – 15 JUNE, ONLINE

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

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Outline

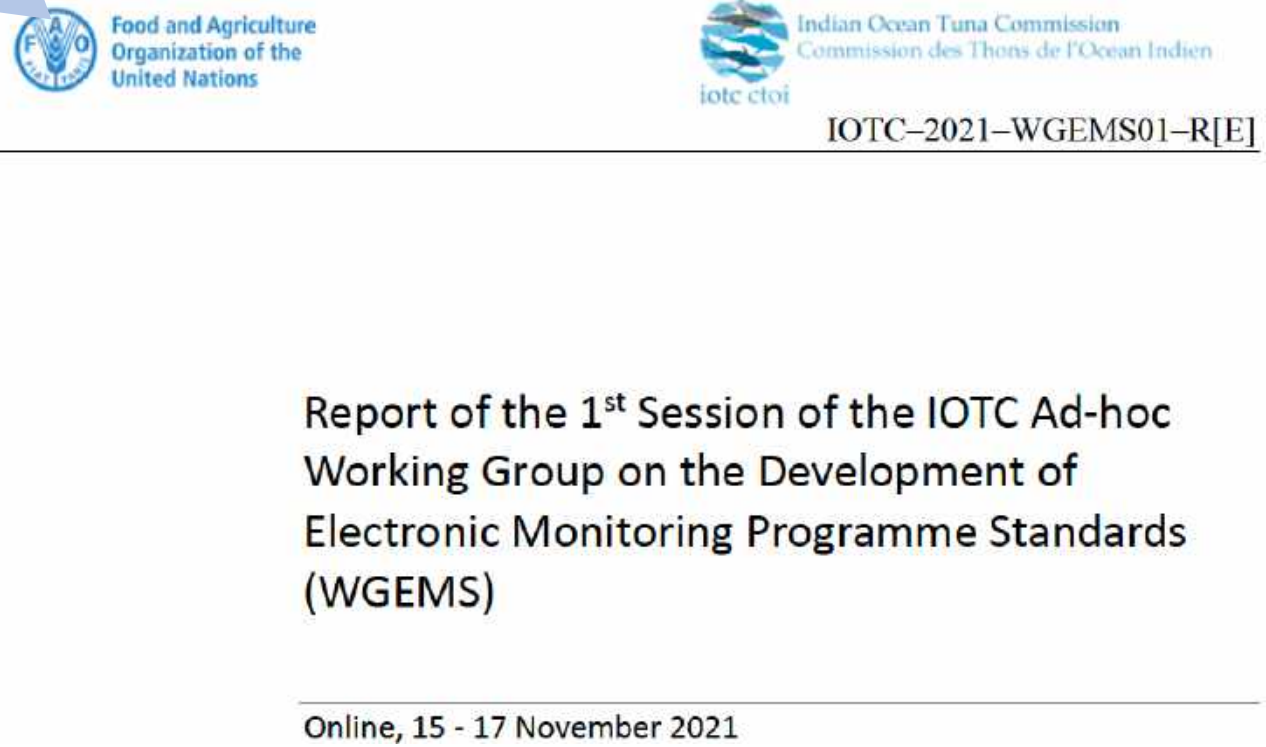
1. Introduction
2. Objectives and Scope of the IOTC EMS
3. IOTC ROS minimum standard data fields
4. General information relation to EM standards: **what is needed**?
    1. EM Program Standards
        1. Objectives
        2. Institutional Structure and management of the Program
    2. EM Data Standards
5. Draft IOTC EM Standards: **what is needed for IOTC?**
    1. IOTC EM Program Standards
    2. IOTC EM System and Data Standards
6. EM capabilities to collect ROS Minimum Data Standards

It recommended to create an ad-hoc intersessional Working Group to progress on the development of EM Programme Standards to be presented to the WPDCS/Scientific Committee in 2021 and the IOTC Commission in 2022.

IOTC EM

All PENDING

- Objectives and Scope
- EMS definitions,
- EM Data Standards,
- EM Program Standards
  - Institutional structure and program management,
  - Data collection and review rate,
  - Roles and responsibilities,
  - Specifications and procedures,
  - Timeframe for implementation
  - Confidentiality
  - Cost and financial considerations.
- Expert WS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IOTC–2021–WGEMS01–R[E]

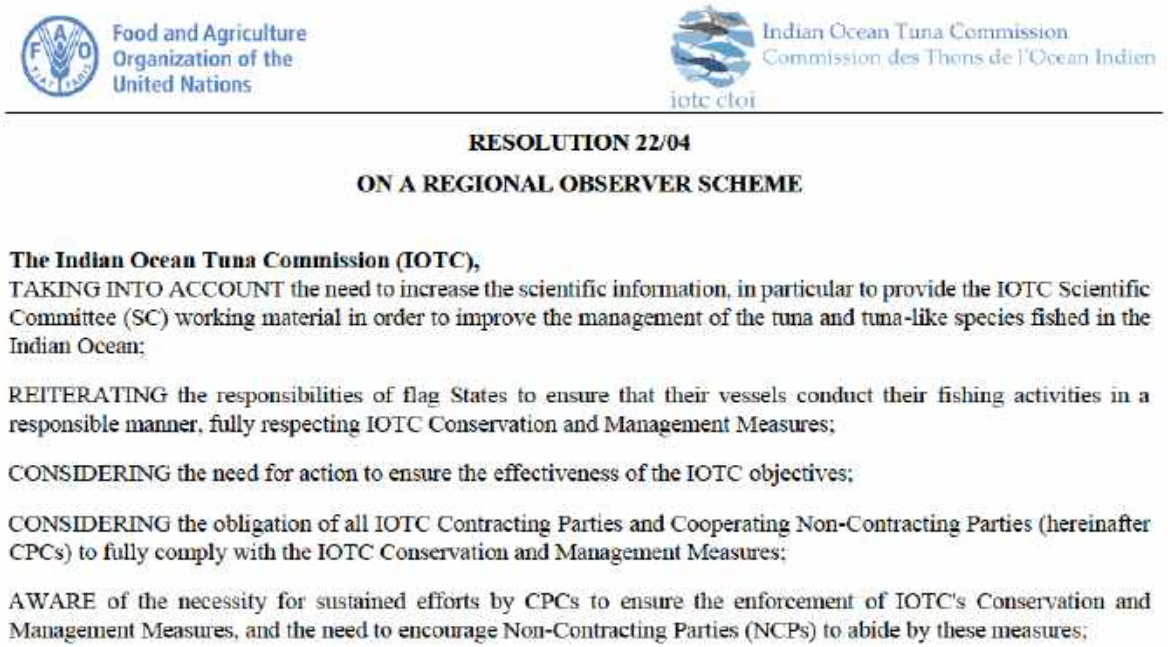
Report of the 1st Session of the IOTC Ad-hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS)

Online, 15 - 17 November 2021

The **SC ENDORSED the Terms of Reference and Plan of Work for the WGEMS**

IOTC Resolution 22/04 on a Regional Observer Scheme

- In the case of vessels covered by the Regional Observer Scheme, **EMS be considered as a complementing or substituting source of information to reach 5% coverage, provided that minimum standards for EMS developed and agreed by the IOTC Commission** are followed.
- It requests the Scientific Committee, in collaboration with the Compliance Committee, to **develop and agree on minimum standards for the use of EMS for purse seine, longline, bait boat (pole and line), handline and gillnet fleets by 2023 at the latest**, including modalities for the substitution of human observer coverage by an EMS;
- So, **WGEMS mostly focused on discussing EM minimum standards for science**.



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RESOLUTION 22/04

ON A REGIONAL OBSERVER SCHEME

The Indian Ocean Tuna Commission (IOTC),

TAKING INTO ACCOUNT the need to increase the scientific information, in particular to provide the IOTC Scientific Committee (SC) working material in order to improve the management of the tuna and tuna-like species fished in the Indian Ocean;

REITERATING the responsibilities of flag States to ensure that their vessels conduct their fishing activities in a responsible manner, fully respecting IOTC Conservation and Management Measures;

CONSIDERING the need for action to ensure the effectiveness of the IOTC objectives;

CONSIDERING the obligation of all IOTC Contracting Parties and Cooperating Non-Contracting Parties (hereinafter CPCs) to fully comply with the IOTC Conservation and Management Measures;

AWARE of the necessity for sustained efforts by CPCs to ensure the enforcement of IOTC's Conservation and Management Measures, and the need to encourage Non-Contracting Parties (NCPs) to abide by these measures;

IOTC EM

All ADOPTED by the SC

- Objectives and Scope,
- EMS definitions,
- **EM Data Standards**,
- EM Program Standards
  - Institutional structure and program management,
  - Data collection and review rate,
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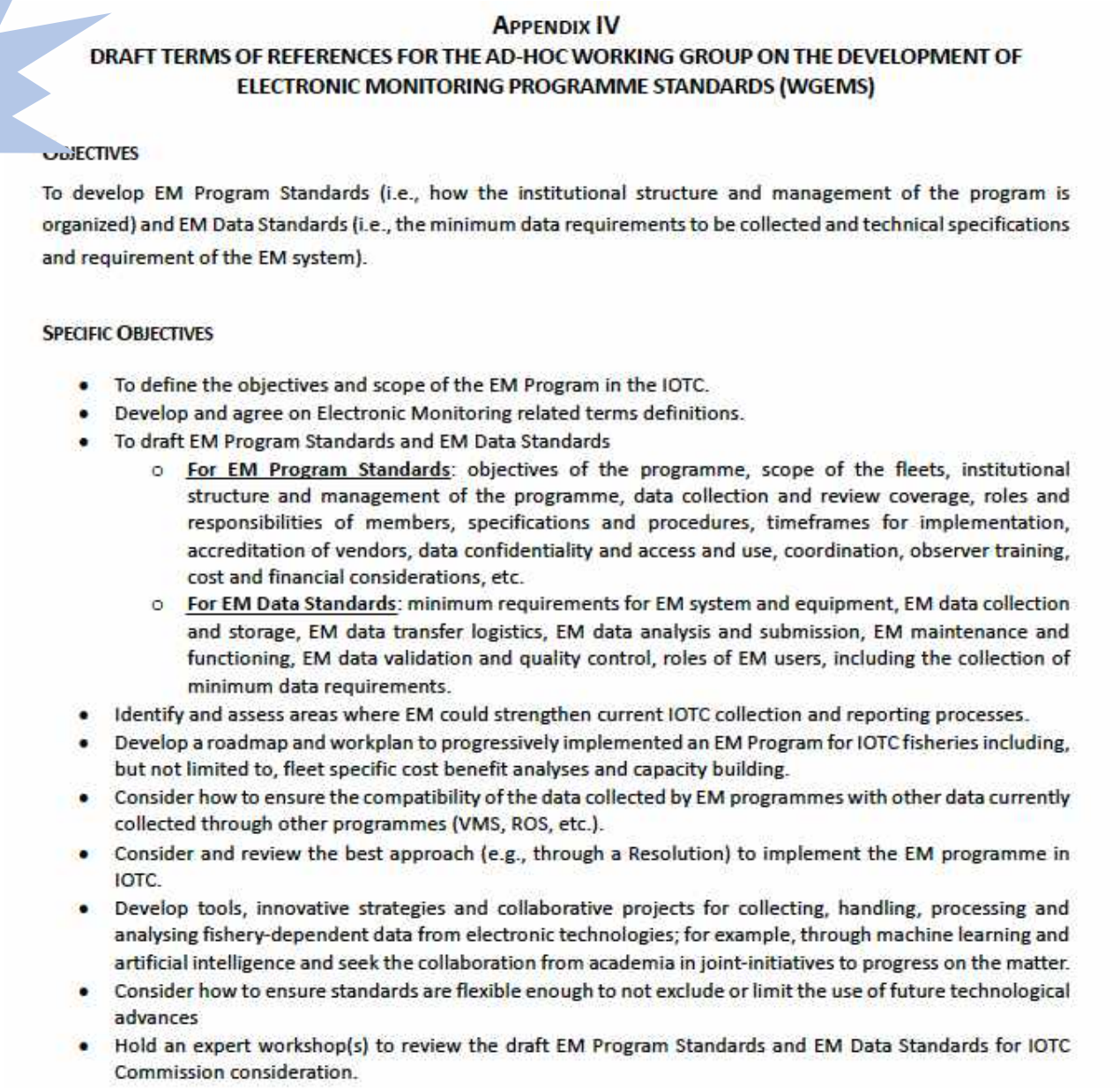


APPENDIX IV

DRAFT TERMS OF REFERENCES FOR THE AD-HOC WORKING GROUP ON THE DEVELOPMENT OF ELECTRONIC MONITORING PROGRAMME STANDARDS (WGEMS)

OBJECTIVES

To develop EM Program Standards (i.e., how the institutional structure and management of the program is organized) and EM Data Standards (i.e., the minimum data requirements to be collected and technical specifications and requirement of the EM system).

SPECIFIC OBJECTIVES

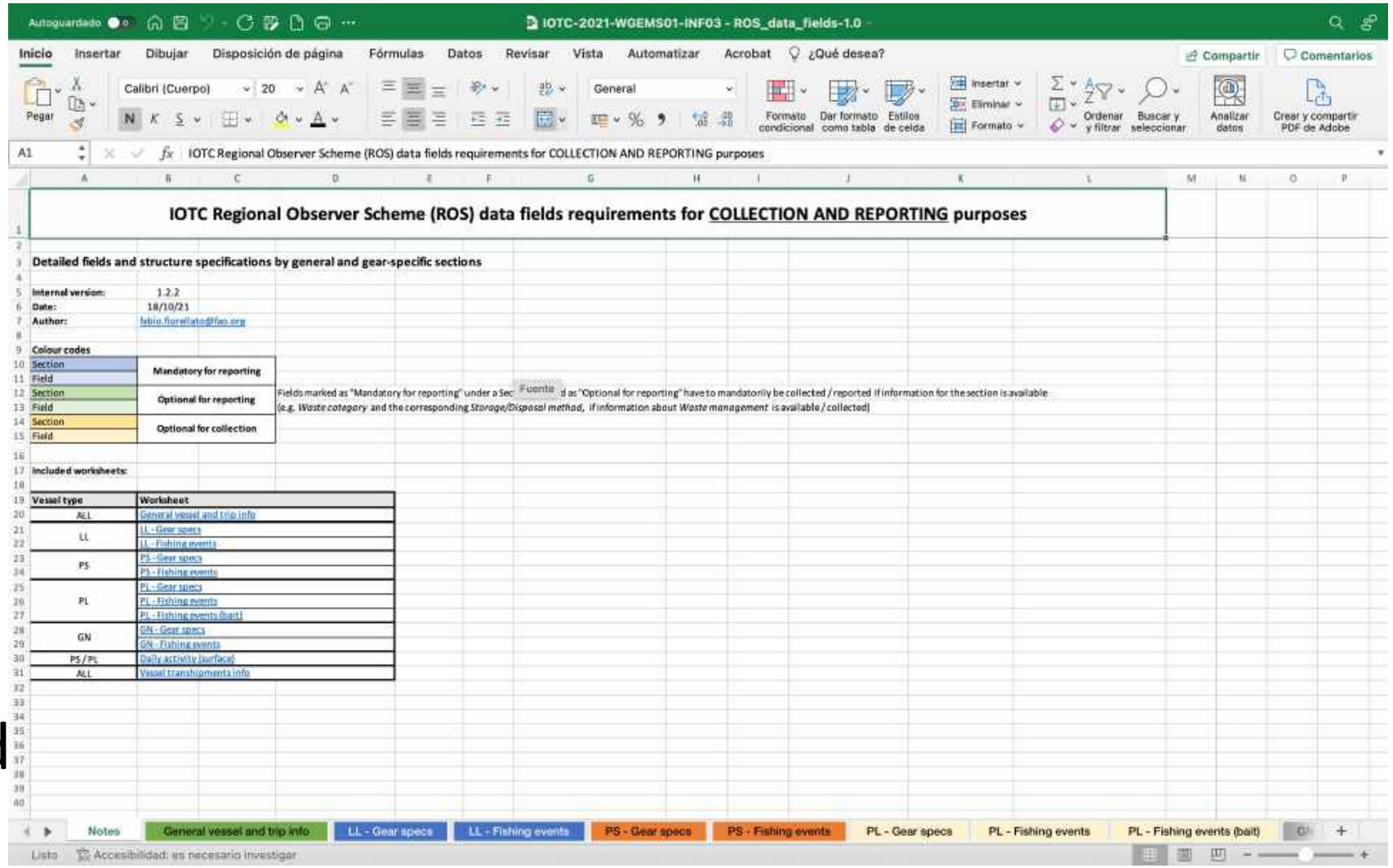
- To define the objectives and scope of the EM Program in the IOTC.
- Develop and agree on Electronic Monitoring related terms definitions.
- To draft EM Program Standards and EM Data Standards
  - For EM Program Standards: objectives of the programme, scope of the fleets, institutional structure and management of the programme, data collection and review coverage, roles and responsibilities of members, specifications and procedures, timeframes for implementation, accreditation of vendors, data confidentiality and access and use, coordination, observer training, cost and financial considerations, etc.
  - For EM Data Standards: minimum requirements for EM system and equipment, EM data collection and storage, EM data transfer logistics, EM data analysis and submission, EM maintenance and functioning, EM data validation and quality control, roles of EM users, including the collection of minimum data requirements.
- Identify and assess areas where EM could strengthen current IOTC collection and reporting processes.
- Develop a roadmap and workplan to progressively implemented an EM Program for IOTC fisheries including, but not limited to, fleet specific cost benefit analyses and capacity building.
- Consider how to ensure the compatibility of the data collected by EM programmes with other data currently collected through other programmes (VMS, ROS, etc.).
- Consider and review the best approach (e.g., through a Resolution) to implement the EM programme in IOTC.
- Develop tools, innovative strategies and collaborative projects for collecting, handling, processing and analysing fishery-dependent data from electronic technologies; for example, through machine learning and artificial intelligence and seek the collaboration from academia in joint-initiatives to progress on the matter.
- Consider how to ensure standards are flexible enough to not exclude or limit the use of future technological advances
- Hold an expert workshop(s) to review the draft EM Program Standards and EM Data Standards for IOTC Commission consideration.

Scope/Objectives of IOTC EM PROGRAM

- The objective of the IOTC REMP is to collect, via EMS, **verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence and achieve the EM observer/review coverage to meet the requirements of IOTC Observer Resolution on Regional Observer Scheme**.
- IOTC's REMP or any National EMP, under IOTC's REMP, shall ensure that the **data collected through EMS are documented and that all ROS minimum data standard requirements** (e.g., "Mandatory Reporting"), if necessary complemented with any additional monitoring program (e.g., port sampling, biological sampling, etc.), **are collected by EMS.**

Regional Observer Scheme (ROS)

Regional Observer Scheme Program Standards, including **Minimum Standards Data Fields**, that the Commission endorsed in 2019.



EM capabilities to collect ROS Minimum Data Standards

The agreed categories for assessing EM ability to collect ROS data minimum standards developed by (SPC-OFP, 2017) and (Emery et al., 2018).

R1	Ready now or require little work	P1	Possible, requires minor work
R2	Ready now but requires significant crew support	P2	Possible, requires major work
R3	Ready now but requires dedicated or additional work in the equipment	NP	Not possible
R4	Ready Now but inefficient/costly to analyze		

EM capabilities to collect ROS Minimum Data Standards

From 24 IOTC ROS MR:

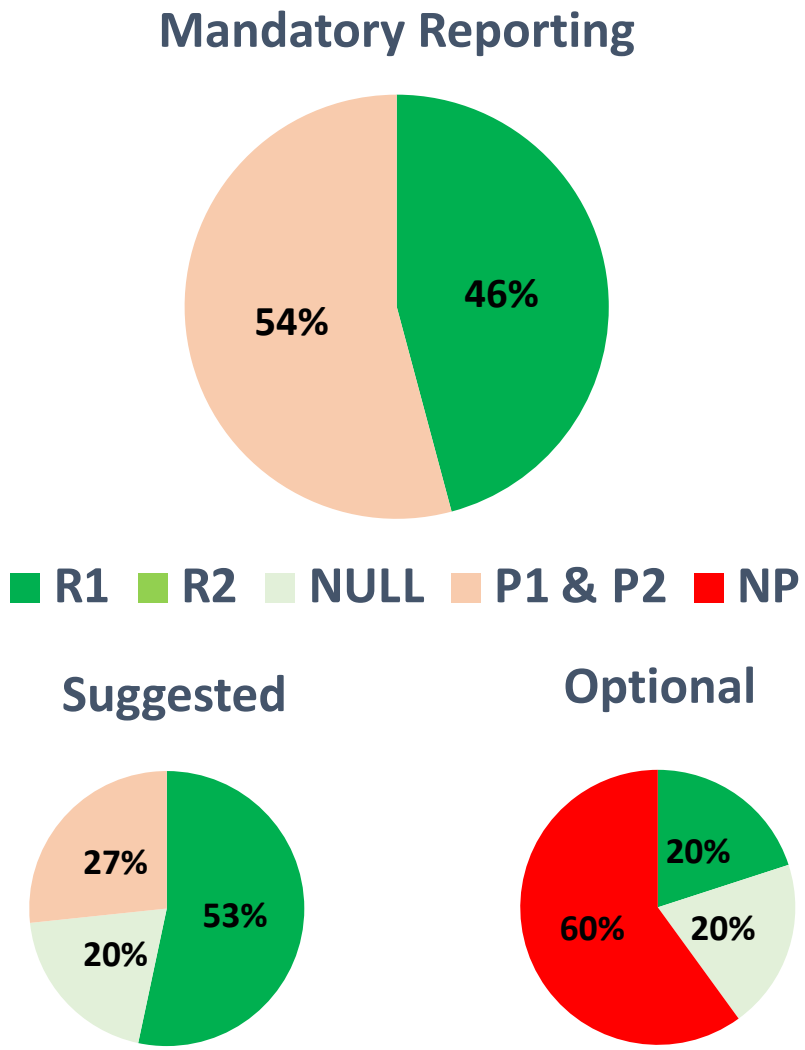
- 11 are ready to be collected
- 13 possible to be collected/reported with minor work.

5 “optional for reporting” and 30 “suggested for collection”:

- 17 are ready,
- 7 are not needed (i.e. observer information),
- 8 could be collected with minor work and
- 3 are not possible to collect.

It seems that EM is well suited to collect the current ROS data fields.

GENERAL DATA FIELDS



EM capabilities to collect ROS Minimum Data Standards

From 51 IOTC ROS Mandatory Reporting:

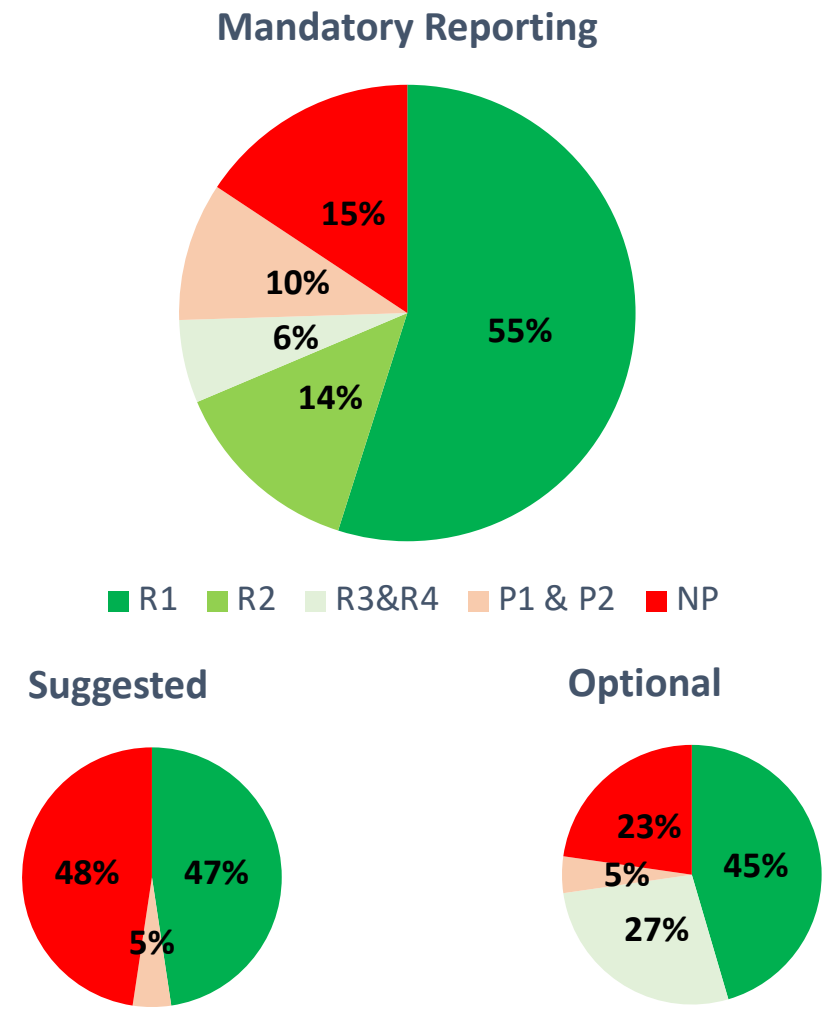
- 28 are ready to be collected (55%)
- 7 ready but require little work,
- 3 ready but require specific work and/or costly,
- 5 possible with minor/major work,
- only 8 not possible.

22 “optional for reporting” and 21 “suggested for collection”:

- 20 are ready,
- 6 ready but require specific work and/or costly,
- 2 possible with minor/major work,
- 15 not possible.

It seems that EM is well suited to collect the current ROS data fields.

PURSE SEINE



EM capabilities to collect ROS Minimum Data Standards

From 54 IOTC ROS mandatory reporting:

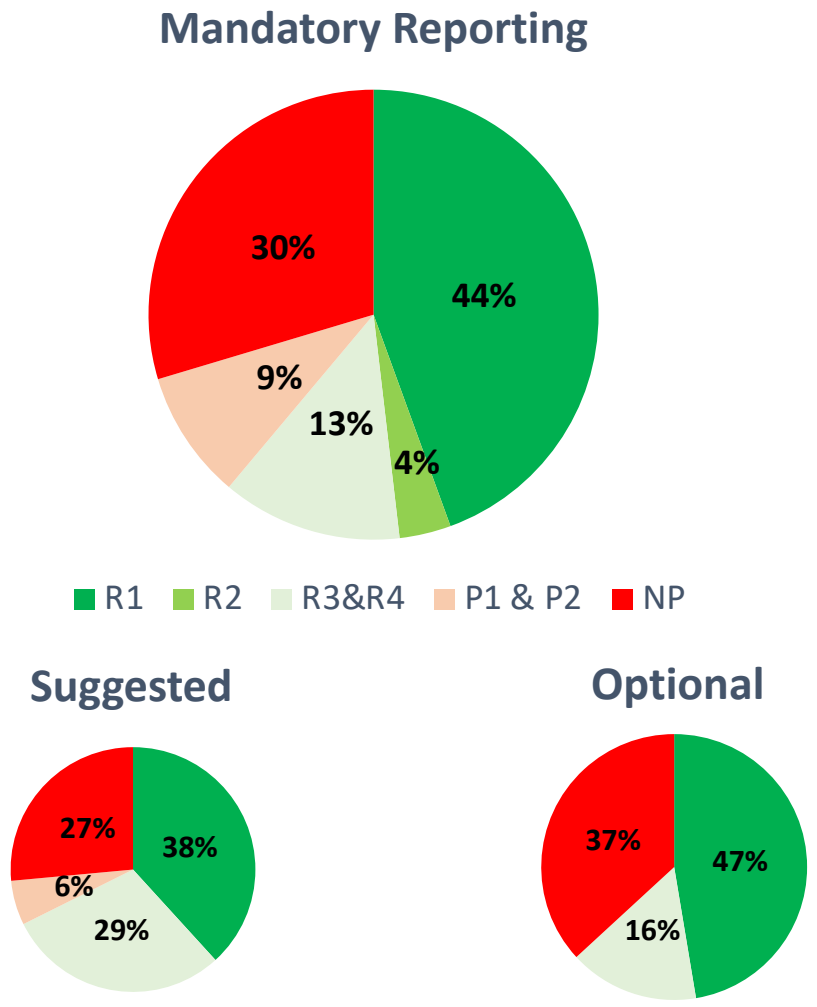
- 24 are ready to be collected (44%),
- 2 ready but require little work,
- 7 ready but require specific work and/or costly,
- 5 possible with major work, and
- 16 not possible to be collected.

19 “Optional” and 34 “suggested for collection”,

- 22 are currently *ready*,
- 13 ready but require specific work and/or costly,
- 2 are *possible with major work* and
- 16 *not possible* to be collected.

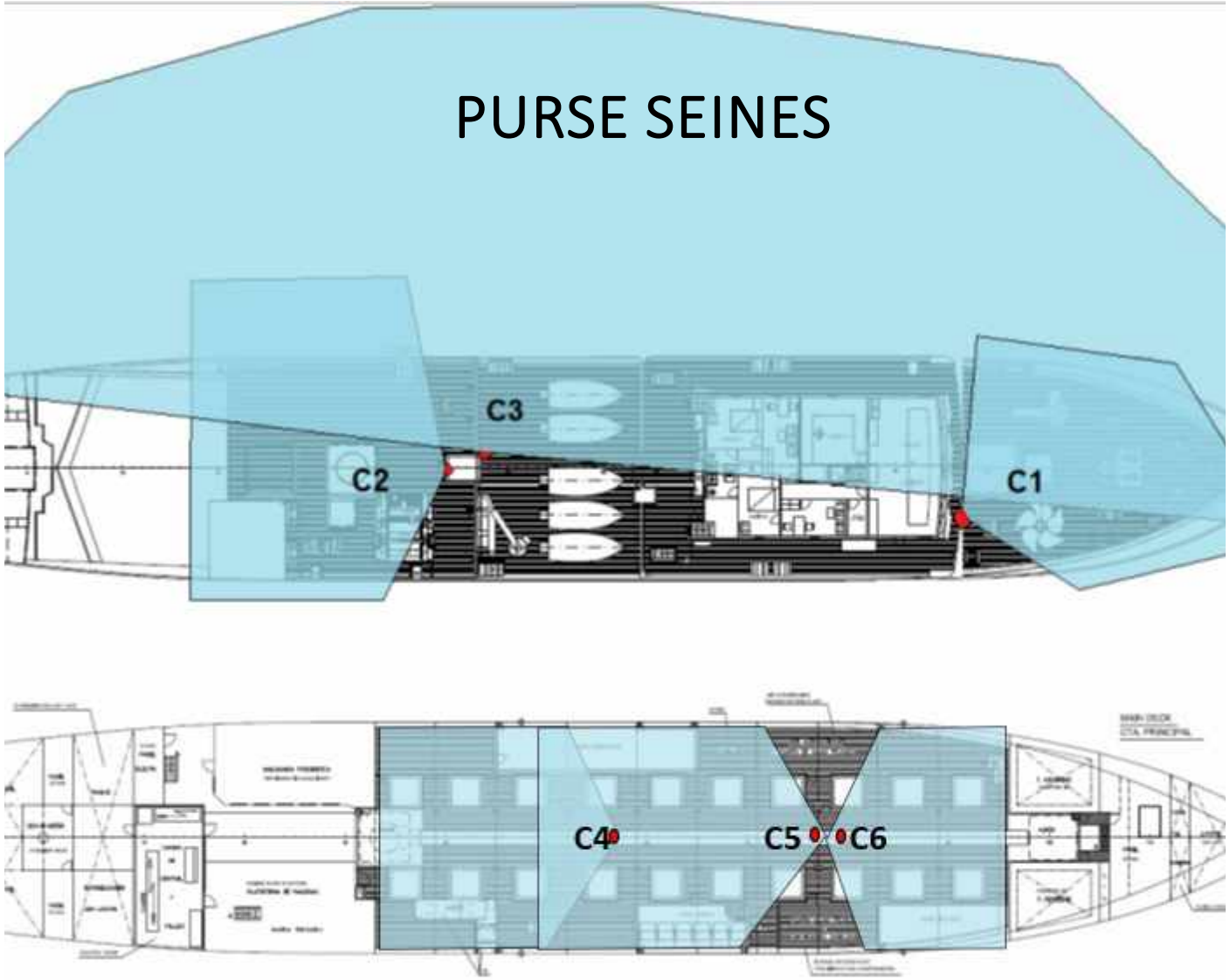
In general, EM is well suited to collect longline ROS mandatory data fields, however, for the collection of more detailed information on line material/hook type e-reporting mechanisms from a pre/post-trip, interviews are needed.

LONGLINE



EM SYSTEM AND EQUIPMENT

The minimum areas that cameras should cover are the working deck (both port and starboard sides), the net sack and the brailer, the foredeck or amidships, and the well deck and conveyor belt (Restrepo et al., 2018).



source: Digital Observer Systems (DOS)

PURSE SEINES

EM SYSTEM AND EQUIPMENT

Cameras must cover the following actions: brailing, net hauling, FAD activities, bycatch handling and release, tuna discards, catch well sorting (process of putting the catch in the hold or wells). In large purse seines, **at least 6 cameras** are needed to cover fishing and fish handling operations.







source: Digital Observer Systems (DOS)

Vessel Monitoring Plan (VMP)

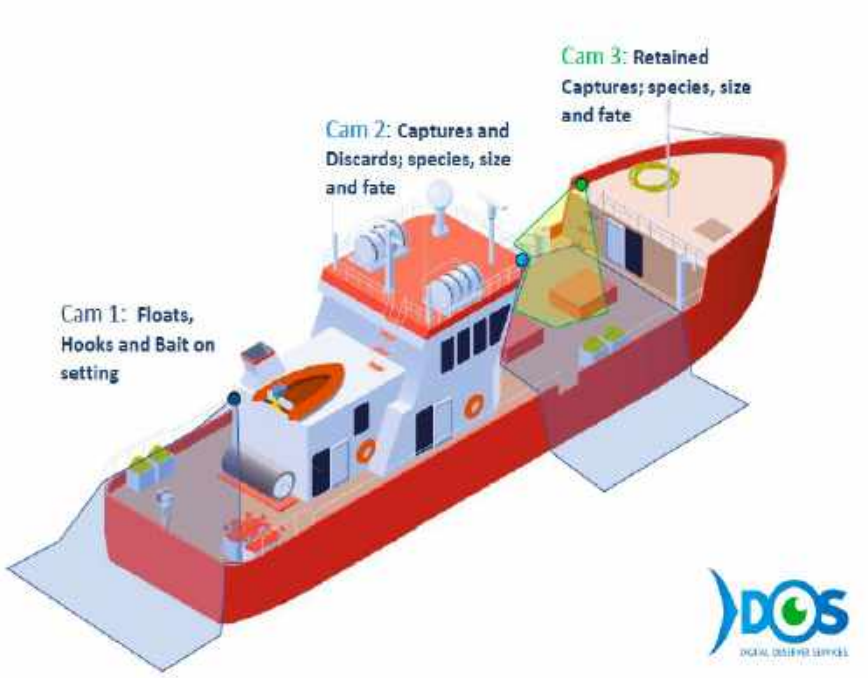
Area covered	Action covered	Purpose	Minimum data requirements to b monitored
Work deck (port side)	Brailing	Total catch by set Species composition	Number of brails & fullness by brail. Weight, size and species of retained t
	Tuna discards	Total tuna discards by set	Weight, size and species of discarded tuna
	Bycatch handling	Bycatch estimation	number of individuals handling mode Species ID
Work deck (starboard side)	Bycatch handling	Bycatch estimation	Handling mode
	Bycatch release	Total bycatch by	Number of individuals and species ID
In-water urse seine area	Brailing	Total catch by set	Number of brails & fullness by brail
	Bycatch handling and safe-release of individual animals (whale sharks, manta rays…)	Total bycatch by set . Application of handling and safe-release best practices	Handling mode
	Bycatch release of big species (whale sharks, manta rays…)	Total bycatch by set Application of handling and safe-release best practices.	Number of individuals and species ID
oredeck or amidships	FAD activity (deploying, replacement, reparation…)	Total number of FAD deployments, FAD design and FAD activities by trip	Number, material (natural or artificial and FAD characteristics (entangling o entangling)
Well deck and conveyor belt	Catch well sorting	Species composition	Weight, size and species of retained t
	Bycatch handling	Best practices	Handling mode
	Estimation of bycatch discards, releases or retention	Total bycatch by set Species composition Application of handling and safe-release best practices.	Number, size or weight of individuals, species ID and fate

Table.- Minimum areas and actions that should be monitored (adapted from Murua et al., 2022; Ruiz et al., 2017).

EM SYSTEM AND EQUIPMENT

On longlines, the cameras should provide a view of the setting of the longline, bait information, whether mitigation techniques are being used (e.g. tori lines), hauling of the longline, all hooked species (both retained and discarded) and the size of the specimens. On most of tuna longlines, **at least 3-4 cameras** are needed to cover fishing activities.

LONGLINE



source: Digital Observer Systems (DOS)

Vessel Monitoring Plan (VMP)

Table.- General configuration and areas/activities covered by the EM system onboard tropical tuna longline vessels (adapted from Murua et al., 2022).

Area covered	Action covered	Minimum data requirements to be monitored
Stern camera of the boat	Start and end setting operation	Position, date, and time
		Total number of hooks set and between floats
		Total number of floats set
		Bait type
		Bait species
		Bait ratio (%)
		Mitigation measures/marine pollution
Work deck	Catch onboard	Length and weight by capture
		Condition
		Fate
		Predator observed
	Bycatch discarded, released, or retained	Total bycatch by set and species composition
Processing area	Catch	Total catch by set
		Length and weight1 by capture
		Sex
		Fate
Surrounding water area	Start and end hauling operation	Position, time and date
	Estimation of bycatch discards, releases or retention	Total bycatch by set and species compos
		Species condition and fate

Summary & Discussion

- **EMS program/implementation scope**:
  - PS and LL and other fleets as well,
  - Voluntary to achieve ROS
  - Science but also discussed the standards at Compliance Commitee.
- ***Regional vs national program***.
  - National Programs similar to the IOTC ROS.
  - Discussed at SC level (Centralized vs decentralized) but not at the Commission level
- **How does it affect observer programs?**
  - EMS can complement but also replace provided that all ROS Minimum Data Fields are collected.
- **EMS Capabilities**
  - This was discussed and the EMS capabilities to collect ROS Minimum Data Standards were evaluated. However, there were some minor discrepancies depending on how the EM is implemented on vessels.
  - Resolution 23/08 requests how ROS data fields will be collected along with the VMP.
- **Potential uses**:
  - Scientific monitoring
- **Standards**.
  - performance-based standards: before, during and after the trip

Summary & Discussion (Part 2)

- Start with SCIENCE (less conflict)
- Voluntary rather than mandatory, eases implementation
- National responsibility (particularly for IOTC/ICCAT)
- Complement human observers first but can replace with additional sampling strategies (biological samples)
- Performance-based standard
- Allow for some flexibility (e.g., EM capabilities to collect data) and adjust when necessary

THANK YOU

Recommendations for EM implementation in IOTC

Minimum requirements for a standard EM System

Customized to vessel level: There is not a standard configuration that will cover all vessels from fleets operating in the Indian Ocean region, therefore each EMS installation must be customized at the vessel level. The number of cameras and sensors should be tailored to each vessel based on performance-standards to meet overall objectives of the program rather than being too prescriptive.

Include sensor: include sensors and indicators that monitor gear usage and fishing activity.

Include Global Positioning System (GPS): to monitor vessel positionand date/time and location

Tested (and certified) by a third party: through pilot studies and certified by a third party (e.g. by IOTC).

Compatibility: the EMS should be capable of integrating with other Monitoring, Control and Surveillance (MCS) tools (e.g. Vessel Monitoring System).

Robust System: EMS components installed outdoors (such as cameras/camera housing and sensors) should be capable to resist rough conditions at-sea and harsh environment on board the vessels.

Secure System: Tamper proof system with encrypted data, near-real-time remote online "status checks " and GPS linked data/imagery.

Recommendations for EM implementation in IOTC

Minimum requirements for a standard EM System

Cameras: Digital, high-resolution when possible, cameras covering all areas of interest according to the vessel and fishing operations are recommended.

Independence: The system needs to be self-governing with the exception of minimal maintenance by crew (e.g. cleaning senses). The system should incorporate a self-test function.

Data storage and autonomy: The system should have enough autonomy, and storage capacity, to store all recorded images a minimum of the duration of a common trip (around 4 months for PS and 12 months for LL).

Maintenance: The master should report to the competent authority (IOTC and flag state) when the system is malfunctioning. Rules of Procedures for vessels when the system fails.

Data retrieval: when possible automatically via mobile networks, Wi-Fi, or satellite and when video footage is too big it should be transferred via hard drive exchange. Hard drive exchange and transmission should be regulated.

EM records backup: if data is automatically transmitted electronically, operational procedures for the receipt and back-up of EM records should be implemented taking into account any necessary chain of custody arrangements.

Hard drives chain of custody: The system must ensure traceability of every hard drive and information recorded on-board.

Recommendations for EM implementation in IOTC

Minimum requirements for a standard EM System

Frequency: the method and frequency (e.g. after the trip) of EM records transmission to data review centers.

Dedicated image analysis software: EM System should provide dedicated software to facilitate the review of images and to produce a common output format for exchange/submission to IOTC.

EMS data analysis and reporting: Data analysis and reporting should be done by institutions, organizations and independent companies with proven expertise and experience.

EMS data analysis quality check: EM record analysis should be quality controlled including data entry checks, automatic error identification, and debriefing as required and EM data analysis is checked for inconsistencies, quality and accuracy prior to reporting to the IOTC Secretariat.

EM coverage and risk based review analysis: EM system should be incorporated in a level agreed by the Commission (e.g. 100% of vessels) and IOTC should also agree in a review coverage and type (e.g. fix coverage/risk-based assessment).

EM data: EM system should collect at a minimum, the ROS Minimum Standard Data Fields.

Office observers' training: EM data analysts must have specific qualifications which should be integrated in the EM program standards.

Recommendations for EM implementation in IOTC

Minimum requirements for a standard EM System

Office observer's qualifications: EM data analysts must have the ability to review and record data accurately on IOTC Resolutions, are familiar with fishing activities and are capable to identify (i) IOTC species and species of especial interest, (ii) IOTC Fishing methods and (iii) IOTC mitigation methods among other questions.

Compatible with ongoing standardized data flow and databases: Compatible data output format to exchange collected information with current IOTC data reporting format and e-reporting.

Data Storage and retention: Legal provisions on data protection, storage and retention by IOTC should be developed and agreed whether it is an EM Regional Program or National Program.

Data Ownership: regional vs. national.

Hardware/software ownership: irrespective of the scope of the program, it is recommended that hardware and software ownership (and maintenance) is of the vessel owner.

collected through EMS are documented and that all "Mandatory Reporting" as well as Optional for Reporting fields of IOTC Regional Observer Scheme minimum data standards fields, if necessary complemented with any additional monitoring programme (e.g. port sampling, biological sampling, etc.), are collected by EM.

Definitions:

- ***Electronic Monitoring (EM)***: the use of electronic devices to record and monitor fishing vessel's activities using video technology integrated with Global Position Systems (GPS).
- ***Electronic Monitoring System (EMS)***: all the vessel and shore-based components for collecting, analysing and reporting of EM records and implement EM Program.
- ***EM program***: a process administered by a national or regional administration that regulates the use of EM systems on vessels to independently collect and verify fisheries data and information responsible through a n implementing of an EMS in a defined area and/or fishery.
- ***EM Program standards***: the agreed standards, specification and procedures governing the establishment and operation of an EM Program, applicable to all components of the EM system.
- **EM Data standards**: the agreed data requirements by the Regional Observer Scheme that should be collected by the EM System.
- **EM records**: Imagery and sensor data recorded by an e-monitoring equipment that can be analysed to produce e-monitoring data.
- **EM Data**: data produced through analysis of e-monitoring records that conforms with the EM data standards.
- **EM equipment**: a network of electronic cameras, sensors and data storage devices installed on a vessel and used to record the vessel's activities.
- **EM analysis**: the analysis of EM records to produce EM data.
- ***EM analyst***: a person qualified to analyze EM records, record and produce EM data in accordance with the EM Data standards and analysis procedures.
- ***EM review center***: local, national, or regional office facility where EM records are analysed to produce and record EM data.
- ***EM coverage***: the proportion of vessels (or effort) by fleet that have an e-monitoring equipment and system installed and operational.
- ***EM review rate***: the proportion of e-monitored records (of vessel/fleet) that are reviewed/analysed to produce EM data.
- ***EM service provider***: a third-party provider of EM equipment (and/or system), technical and logistical services.
- ***EM service certifier***: a third-party organization which is accredited by the appropriate national or regional authority to inspect and approve EM systems and equipment to ensure that EM data standards can be collected.

Data:

- Resolution 12/02 on Data confidentiality policy and procedures applies for the data collected/submitted by Regional or National EMPs with regards to data stratification, policy for publishing the data in the public domain, and procedures for the safeguard of records.

11.1. Draft IOTC Regional EM Programme Standards

DRAFT POLICY PROGRAMME STANDARDS FOR THE IMPLEMENTATION OF THE IOTC REGIONAL ELECTRONIC MONITORING PROGRAMME (REMP)

- Data collected via EM should be provided in compliance with the requirements established by the Commission in Resolution 15/04 on the recording of catch and effort data by fishing vessels in the IOTC area of competence, Resolution 15/02 on mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPC), and Resolution 11/04 on a Regional Observer Scheme.
- EM National Programmes data outputs should be submitted following data format specifications provided by IOTC Secretariat to make them compatible with IOTC databases.

EM Systems

- EMS should be certified and accredited by IOTC Secretariat to ensure that minimum standards of the Programme including EM equipment installation, data minimum standards collection, automated EM record analysis by relevant organizations, and independence of EM systems are maintained.

Role

- IOTC Commission:
  - The monitor and oversight the implementation of REMP, including those recommended through National Programmes, including the adoption and revision, when necessary, of minimum standards for EMS and data minimum standards.
  - To agree on overall EM implementation coverage objective as well as the analysis rate by fleet/CPCs.
  - To agree and develop an IOTC REMP implementation plan.
  - When necessary, the Commission may consider REMP records to be reviewed by Regional review centers.
  - To ensure sufficient financial resources to effectively administrate IOTC's REMP.
  - To review IOTC's REMP after an initial period (e.g. 5 years) of IOTC's REMP implementation.
- IOTC CPCs:
  - To ensure that fishing vessels under its flag comply with the requirements established by the Commission for the purposes of IOTC's REMP implementation and are equipped with EMS as national level, minimum data minimum standard flagged to IOTC following aggregation levels required in Res 15/01 and 15/02.
  - To ensure that EM equipment are monitored in their vessels to comply with the correct tags established agreed by the Commission.
  - To ensure that EM implementation is consistent with IOTC's REMP and the minimum standards.
  - To collaborate to ensure national EM programmes are compatible and harmonized where necessary.
  - To ensure that national EM programmes are independent, transparent and accountable.
  - To document the roles and responsibilities of fisheries government.

11.1. Draft IOTC Regional EM Programme Standards

DRAFT POLICY PROGRAMME STANDARDS FOR THE IMPLEMENTATION OF THE IOTC REGIONAL ELECTRONIC MONITORING PROGRAMME (REMP)

General

- IOTC Regional Electronic Monitoring Programme (REMP) shall be coordinated by the IOTC Secretariat.
- National data collection programmes using electronic monitoring systems that are certified as meeting the objectives, procedures and data minimum standards of the EMP as adopted by IOTC could be included within IOTC REMP.

Objectives

- The objective of implementing IOTC REMP is to collect verified catch data and other scientific information related to the fisheries for tuna and tuna-like species in the IOTC area of competence, and to support the implementation of the conservation and management measures adopted by the Commission.

Purpose:

- The purpose of IOTC REMP is to allow IOTC CPCs to complement other monitoring tools currently in place in the region (e.g. ROP) and to collect data where observer coverage is low or non-existent, that will improve the quantity and quality of fishery data and the monitoring of IOTC fisheries addressing data gaps in the collection and verification of fishery data.

Scope:

- IOTC's REMP provide a framework for the development of EMS in the following IOTC fisheries:
  - Purse-seine vessels over 24 meters overall length and under 24 meters LOA when fishing outside their EEZs.
  - longline vessels over 24 meters overall length and under 24 meters LOA when fishing outside their EEZs.
  - Gillnet vessels over 24 meters overall length and under 24 meters LOA when fishing outside their EEZs.
  - Pole and line vessels over 24 meters overall length and under 24 meters LOA when fishing outside their EEZs.
  - Other gear types under 24 meters (when fishing in the high seas).
- IOTC's REMP, or any National EMP under IOTC's REMP, shall ensure that the data

11.2. *Draft IOTC Regional EM Minimum Standards*

MINIMUM STANDARDS FOR THE IMPLEMENTATION OF THE IOTC REGIONAL ELECTRONIC MONITORING PROGRAMME (REMP)

LOGISTICAL MINIMUM STANDARDS of EM System

Data retrieval: ideally, it is recommended that the data is automatically transmitted via mobile networks, Wi-Fi, or satellite and when video footage is too big it should be transferred via hard drive exchange. Hard drive exchange and transmission should be regulated and centralized by the IOTC, when possible.

DATA ANALYSIS MINIMUM STANDARDS of EM System

Dedicated image analysis software: EM System should provide dedicated software to facilitate the review of images and to produce a common output format for exchange/submission to IOTC. It is also recommended that the analysis software could analyse data collected from different EM systems or vendors.

TECHNICAL MINIMUM STANDARDS of EM System

Customized to vessel level: There is not a standard configuration that will cover all vessels from fleets operating in the Indian Ocean region, therefore each EMS installation must be customized at the vessel level. An EM system to be installed on board of a fishing vessel should consist of a control system connecting a number of different sensors and a number of cameras to collect and record images to address the objectives of the EM Program. The number of cameras and sensors should be tailored to each vessel based on performance-standards to meet overall objectives of the program rather than being too prescriptive and should include a sufficient number of cameras. Previous experience has shown that at least 6 cameras are needed in large purse seines and 3 cameras in longline and pole and line vessels.

THANK YOU