



Food and Agriculture  
Organization of the  
United Nations



**COMMON  
OCEANS**  
PROGRAM

Tuna project

# **ELECTRONIC MONITORING MINIMUM STANDARDS HARMONIZATION**

**WORKSHOP REPORT | 10-12 DECEMBER 2024**  
San Sebastián, Spain



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# EXECUTIVE SUMMARY

The Electronic Monitoring (EM) Minimum Standards Harmonization Workshop, held in San Sebastián, Spain in December 2024, brought together 24 experts representing tuna regional fisheries management organizations (t-RFMOs), EM technology providers, and industry observers under the Common Oceans Tuna Project. The primary objective of the workshop was to conduct a technical review of existing EM standards across t-RFMOs, explore best practices and identify areas for potential harmonization. This initiative aimed to enhance the implementation of EM systems, particularly in under-monitored fisheries, while maintaining high data integrity and compliance standards.

Over the course of the workshop, participants examined the EM standards adopted by the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission (IOTC), the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). Although each t-RFMO has developed EM frameworks tailored to its own priorities, the workshop revealed significant commonalities. However, it also identified inconsistencies in definitions, data requirements, technical specifications, and implementation approaches that could hinder effective cross-jurisdictional EM deployment. For example, while all t-RFMOs treat EM as a voluntary monitoring tool, only some currently allow EM data to fulfil Regional Observer Scheme (ROS) obligations. The role of EM alongside human observers and the integration of alternative data sources such as port sampling also varied significantly among organizations.

Technology providers emphasized the importance of modernizing EM standards to reflect advances in artificial intelligence (AI), wireless transmission, and cloud-based data storage. The workshop underscored the need to shift from rigid technical mandates toward performance-based standards that prioritize outcomes over prescriptive specifications. This approach would foster innovation, improve cost-efficiency, and promote broader adoption across diverse fleets. Participants also recognized the need for clearer, harmonized definitions, particularly around EM coverage metrics, and recommended developing a universal template for Vessel Monitoring Plans (VMPs) that could be applied across multiple RFMO jurisdictions.

Data management was another critical area of discussion. Participants called for flexible, secure, and standardized protocols for data submission, storage, and review. The importance of defining data ownership, ensuring digital traceability, and supporting interoperability between different EM systems was emphasized. To ensure consistency and accountability,

the group strongly recommended the development of a unified audit and assurance framework applicable to all t-RFMOs.

The workshop concluded with agreement on a set of practical recommendations aimed at harmonizing EM standards, improving technological integration, clarifying roles and responsibilities, and ensuring long-term sustainability of EM programs. Participants emphasized that the success of future EM implementation will depend on continued collaboration among RFMOs, member states, and EM providers. A second workshop, scheduled for early 2026, will serve as a follow-up to assess progress, refine strategies, and finalize audit and compliance protocols.

Overall, the workshop marked a critical step forward in aligning EM practices across global tuna fisheries. It reinforced the value of shared standards, flexible frameworks, and transparent processes in enhancing monitoring, control, and compliance while supporting sustainable ocean governance.

## OVERVIEW

Under the auspices of the Common Oceans Tuna Project, 24 Electronic Monitoring (EM) experts comprising representatives from tuna-RFMO (t-RFMO) Secretariats, chairs of relevant t-RFMO working groups, EM technical providers, and other experts who participate in t-RFMOs EM discussions, met at the Aquarium of San Sebastián (Spain) 10-12 December 2024.

The workshop was an opportunity to share knowledge and experience, including getting feedback from EM providers on how to successfully rollout EM in t-RFMOs. The meeting Agenda is attached as **Appendix 1**. The list of participants is provided in **Appendix 2**. The recommendations are highlighted in the report and compiled in **Section 5**.

# INTRODUCTION

## THE COMMON OCEANS TUNA PROJECT

The Sustainable Management of Tuna Fisheries and Biodiversity Conservation in the Areas Beyond National Jurisdiction Project, commonly referred to as the Common Oceans Tuna II Project (the Tuna II Project), is dedicated to promoting responsible and sustainable tuna production while conserving biodiversity in international waters. The project is structured around three components. (i) enhancing tuna fisheries management, (ii) improving monitoring, control, and surveillance (MCS) to ensure compliance with conservation measures and combat illegal, unreported, and unregulated (IUU) fishing, and (iii) minimizing the environmental impacts of tuna fisheries.

An important goal of the Tuna II project is to strengthen MCS through various capacity-building efforts, the use of innovative tools and technologies, such as Electronic Monitoring (EM), and the sharing of experiences and lessons learned, with the aim to improving fisheries data and enhancing compliance with conservation and management measures (CMMs) to combat IUU fishing.

Tuna RFMOs (IOTC, ICCAT, IATTC and WCPFC) have already adopted EM standards with CCSBT having adopted High Level EM Guiding Principles. With this progress, there is now a need to review these standards to identify commonalities, gaps, and best practices, or in other words, to explore how to harmonize EM standards across t-RFMOs. In the Tuna II project, a key initiative is supporting t-RFMOs in implementing EM programs either as a complement to, or as an alternative to, at-sea human observer programs, particularly in poorly monitored fisheries. The project places strong emphasis on developing standardized protocols, such as minimum data requirements and technical standards, for EM across various t-RFMOs.

## WORKSHOP OBJECTIVES

The objective of this workshop was a technical review of existing EM standards (including, *inter alia*, standards for data, technical requirements, audit and assurance processes) across t-RFMOs. The workshop aimed to identify similarities, differences, and best practices among these standards and highlight key areas for potential harmonization without lowering EM standards in any region. A key feature of the workshop was the inclusion of EM providers and they were given the opportunity to share their unique perspectives on EM standards as ones who would need to build systems to meet these requirements.

This workshop report includes numerous recommendations which individual t-RFMOs could consider in any future revisions of their EM standards, ensuring a more cohesive approach to electronic monitoring across the world's tuna fisheries. Further, it includes recommendations for work that would be expected to benefit all t-RFMOs.

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## CONTEXT SETTING

This part of the meeting provided an opportunity for meeting participants to get an update from the five t-RFMOs on their progress on EM and for the invited EM providers and EM data review centers to share their thoughts on the process to date and their thoughts on the risks and opportunities in the future.

## 1.1 TUNA-RFMO ELECTRONIC MONITORING (EM) STANDARDS

The Chairs of EM Working Groups or tuna RFMO Secretariats presented the adopted EM standards of each t-RFMO. The presentations are attached as **Appendix 3**. A short summary of each presentation is presented below.

### **Commission for the Conservation of Southern Bluefin Tuna (CCSBT)**

CCSBT is currently working on EM but is some distance behind other t-RFMOs due to somewhat unique arrangements, as it manages southern bluefin tuna in its entire distribution but has no convention area and, therefore, seeks to harmonize with the t-RFMOs where southern Bluefin tuna are distributed and caught – most important in this regard is IOTC.

**High Level Guiding Principles for EM** were developed by the Compliance Committee and endorsed by the Commission in 2023. They are broadly based on IOTC definitions and accept that the use of EM is voluntary and, if used, can complement or supplement human observer programs. They should be compatible with the EM utilised in other relevant RFMOs and can be used to contribute to meeting the scientific observer coverage requirements as described in the CCSBT Scientific Observer Program. The Principles acknowledge that there is potential for EM data and information to be used to assist with the assessment and reporting of Members' compliance with CMMs in future if agreed by Members. This does not prevent Members choosing to use their own EM data and information to support compliance with CCSBT CMMs.

### **Inter-American Tropical Tuna Commission (IATTC)**

This presentation covered the IATTC-adopted minimum standards for Electronic Monitoring Systems (EMS) in IATTC fisheries (**Resolution C-24-09**). It outlined the scope and interim character of the Resolution, emphasizing its interim nature, and that a mandatory EM program is yet to be adopted. The IATTC EM Working Group (EMWG) is tasked to review these interim standards in 2027 and at least biennially thereafter, or until final EMS standards are adopted. The EMWG will also assess the feasibility for EM to be used as substitute for human observers to increase IATTC observer coverage (e.g. longline, and unobserved purse-seine vessels).

A key feature of C-24-09 along with its annexes with provisions and EM minimum standards, is its hybrid approach to language. "Shall", which are items that an EM System or EM Program

must have to meet minimum data quality requirements; “Should”, which are items that could be very useful to have, but not strictly required, and “May”, which are items that are much less critical to observe.

### **International Commission for the Conservation of Atlantic Tunas (ICCAT)**

Dr Rui Coelho, Convener of the ICCAT/SCRS Sub-Group on EMS, provided an overview of the progress and adopted EM standards at ICCAT. This SCRS Sub-Group on EMS worked since 2021 on the scientific component of ICCAT EM standards, with the ICCAT Commission adopting EM minimum standards for ICCAT fleets in November 2023. Those minimum standards currently adopted include EM standards for both scientific and compliance purposes, and cover pelagic longline and purse seine fisheries.

One important point to note from the ICCAT adopted EM minimum standards is that currently there is still a need to maintain a minimum human observer coverage for scientific purposes and that EM can be used to complement this. The CPCs must develop and describe their EMS domestic programme and submit the data to ICCAT using the electronic formats developed in line with procedures in place for other data reporting requirements. Another point to note is that the standards include a provision for periodic reviews of the standards, starting in 2026 and then least every 4 years thereafter, to evaluate the effectiveness of the systems in fulfilling their purpose and also to consider the need for revisions, allowing for the incorporation of new technologies as they are developed over time.

The next steps of this EM Sub-Group should be to start working on EM possibilities and standards for smaller vessels (e.g. coastal longlines, gillnets, etc.), which are usually fleets and vessels more complicated to take onboard observers (due to lack of space, security, etc.). Currently, there is very limited data from those fleets in general, so there is a need to plan for and establish alternative data collection methods, and some types of simplified EM systems might be a possibility.

### **Indian Ocean Tuna Commission (IOTC)**

Dr Hilario Murua, IOTC WGEMS Chair, provided an update of the process of Electronic Monitoring standards development and adoption in the IOTC. The implementation of EM in the IOTC began around 2014, with initial EM trials conducted. In 2016, Resolution 16/04 was introduced to promote a pilot project under the Regional Observer Scheme (ROS) and tasked the Scientific Committee (SC) with developing minimum EM standards.

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Building on these efforts, a technical paper outlining minimum EM standards for installation, data collection, analysis, and storage was prepared and discussed by the SC in 2020. This was followed by the establishment of a dedicated Working Group (WG) on Electronic Monitoring Standards in 2021, which further advanced the discussion on EM standards. In 2022, Resolution 22/04 on a Regional Observer Scheme (ROS) requested the IOTC Scientific Committee to develop EM standards and, once adopted, allowed members to fulfil ROS mandatory data collection requirements using EM. These efforts culminated in 2023 with the adoption of **Resolution 23/08 on Electronic Monitoring Standards for IOTC Fisheries**, marking a significant step towards integrating EM into IOTC fisheries management.

Resolution 23/08 establishes clear requirements to ensure that IOTC Members implementing Electronic Monitoring Systems (EMS) in the IOTC area of competence meet the minimum data requirements of the Regional Observer Scheme (ROS) under Resolution 22/04. It defines key terms and sets out EM Program Standards, as well as EM System and Data Standards that vessels should comply with. Additionally, Members are required to submit a Vessel Monitoring Plan to the IOTC Secretariat, detailing the EMS setup for each vessel in their fishery. Furthermore, CPCs are required to submit a fleet-level ROS data collection table annually, outlining the data fields required under the ROS, their descriptions, reporting requirements, and the methods used for data collection (EMS, port sampling, and/or others) and reporting. These provisions ensure that all mandatory data fields required by ROS are consistently collected by EMS or in conjunction with other data sources (port sampling, etc.) and the reliability in EMS implementation across the IOTC fisheries.

### Western and Central Pacific Fisheries Commission (WCPFC)

Dr Shelton Harley provided an update on Electronic Monitoring in the WCPFC. At its 20th Regular Session in 2023, the WCPFC agreed that Electronic Monitoring could be used by certain longline fleets to increase monitoring and verification and obtain increases in their longline bigeye tuna catch allocations. This was done before EM standards had been agreed so this led to a strong push within the Commission to adopt interim EM standards.

At its 21st Regular Commission meeting in late 2024, just prior to this workshop, the WCPFC adopted a set of Interim EM data requirements, EM technical standards, and EM reporting requirements (<https://www.wcpfc.int/doc/data-08/interim-electronic-monitoring-minimum-standards-covering-technical-data-and-reporting>). Like the IATTC, the WCPFC took a multi-level approach to interim EM technical standards, using “Must” (mandatory), “Should” (recommended), and “Could” (optional) to characterize the different requirements.

It also agreed to a forward workplan for its EM working group, with a focus on (1) harmonization as appropriate (based on the outcomes of meetings such as this), (2) further consideration of EM data standards based on the parallel work being undertaken in the WCPFC on observer data standards, (3) consideration of an audit and assurance process for EM programs, and (4) initiating work on the application of EM for longline transshipment (on the receiving vessel).

## 1.2 EM PROVIDERS' PRESENTATIONS

A representative from each EM technology provider and/or EM data review center gave a short presentation on the gaps, risks, challenges and opportunities that each saw in the development of EM standards across the t-RFMOs. The presentations are attached as **Appendix 4**, a short summary is presented below, and a summary of key recommendations from EM providers is found in section 3.3.

### Satlink/DOS

As EM expands globally, it brings both significant opportunities and critical policy challenges. EM enhances transparency, accountability, and data quality across diverse fisheries. Advances in 4G/5G and satellite transmission have made wireless systems more accessible, enabling near real-time data transfer and faster, more responsive analysis. While satellite connectivity can involve higher operational costs, it offers unmatched coverage and reliability—making it a strategic investment for remote and high-priority fisheries where timely data is critical. The integration of artificial intelligence (AI) and machine learning (ML) further boosts EM's potential—accelerating data processing, automating video review, and supporting timely, evidence-based decision-making.

To fully harness these benefits, clear and well-aligned standards play a key role. They support consistent implementation; help maintain data quality and encourage innovation. As technology continues to evolve rapidly, policy and regulatory frameworks need to adapt to keep pace, or they might inadvertently slow progress. Differences in standards—whether overly prescriptive or too broad—can lead to inconsistent practices across fleets and regions. Greater harmonization between national authorities and RFMOs could help simplify compliance, improve interoperability, and reduce costs for vessels operating across multiple jurisdictions. Legal and administrative considerations also pose significant challenges. Questions around data ownership, confidentiality, and compliance with and varying data protection laws remain unresolved in many jurisdictions. Overlapping regulatory

requirements can increase the administrative burden on vessel operators, while inconsistent reporting formats hinder the comparability and aggregation of EM data at broader scales.

Despite these hurdles, the path forward is clear. Adaptive, outcome-based standards—designed to be flexible and future-ready—can accelerate EM adoption, encourage innovation, and maximize the value of collected data. Harmonized and forward-looking frameworks not only reduce complexity but also lay the groundwork for EM to thrive as a cornerstone of sustainable fisheries management.

### Integrated monitoring

The presentation titled **“RFMO Minimum EM Standards – Integrated Monitoring’s Analysis and Recommendations”** critically examines the existing landscape of electronic monitoring (EM) standards across regional fisheries management organizations (RFMOs), identifying significant inconsistencies and systemic shortcomings that hinder effective implementation and scalability. It underscores the fragmentation of standards, which results in operational inefficiencies, limited cross-jurisdictional data interoperability, and delayed compliance actions due to the reliance on post-trip video review. Current frameworks often overlook modern advancements in wireless transmission, AI-based automation, cloud storage, and cybersecurity. Moreover, few RFMOs have adopted protocols that support real-time monitoring capabilities or standardized metadata and video formats such as ISO 22311.2012, which are essential for facilitating collaboration and ensuring traceability in the seafood supply chain.

To address these challenges, the presentation proposes a set of practical and forward-looking recommendations aimed at harmonizing EM standards and accelerating adoption of next-generation technologies. These include the inclusion of wireless video/data transmission requirements, integration of AI tools for automated species identification and compliance flagging, secure cloud-based data management systems, and clear benchmarks for system encryption and interoperability. Additionally, it emphasizes the importance of building capacity among RFMO member states (CPCs) through targeted support for backend infrastructure and integration with electronic logbook systems. The presentation calls for a global framework of minimum EM standards, rooted in interoperability, timeliness, and transparency, to strengthen enforcement, streamline data sharing, and support the broader goals of sustainable fisheries management under international cooperation.

## Thalos

Without standardized requirements, particularly for data, EM providers face significant challenges. It becomes inherently difficult to study and meet each program's specific needs across different oceans and regions. This results in inefficiencies, hinders interoperability, and prevents the smooth integration of data from various sources. The transition from small-scale pilots to large EM deployments hinges on having common, stable, minimal requirements and standards. The most important component of any EM standard is robust data requirements – defining precisely what data is collected, in what format, and at what level of quality. This emphasis on data over purely technical specifications is crucial for achieving truly effective, scalable, and interoperable EM systems globally.

## Zunibal

Zunibal presentation underlined that the harmonization of Electronic Monitoring standards is a key step towards achieving effective scalability across fleets and regions. They emphasized that this process should focus on practical functionality while carefully considering the cost implications of each decision, especially as standards become more prescriptive. They also stressed the importance of flexible and scalable EM systems and standards that can adapt to different operational contexts and economic realities.

Furthermore, they highlighted the crucial role that standards play in the promotion of innovation. In their view, clear and consistent definitions of visualization goals and data quality are essential for the development of technologies such as artificial intelligence, edge computing, and connectivity solutions. Finally, they acknowledged the challenges these innovations may bring—such as the integration of AI—which still need to be addressed.

## Flywire

As an organization that specializes in meaningfully incorporating digital data into fisheries management systems at scale, FlyWire values the Minimum EM Standards products developed by the participating RFMOs. It is encouraging that different RFMO Standards are already loosely compatible – and this harmonization process is an opportunity to create a streamlined common standard that any EM provider and fleet, in any RFMO jurisdiction, can operate under successfully.

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Given the fastest way to kill innovation is to regulate it out of existence by accident, to succeed in proper harmonization FlyWire recommends resolving the identified areas of disagreement among regional Standards by. (1) redoubling focus on “what” a proposed EM program needs to accomplish, (2) discarding bespoke stipulations controlling “how” individual tasks are to be adjudicated and (3) seeking input from stakeholders who fish.

### **Datafish**

Electronic Monitoring (EM) has been used in Spain since 2014 to collect scientific data through both onboard and on-land observers. Various providers of electronic technologies have installed their EM systems on more than 150 vessels in Spain over the years. The work and developments carried out by these different providers must be considered when aiming for standardization and interoperability—both within Spain and globally across all EM system providers.

Furthermore, to review EM records effectively, personnel need to have a scientific background. This requirement should be aligned with RFMO standards and, in the case of Spain, it should be consistent with ISO 195007.

For every vessel, EM providers must supply a Vessel Monitoring Plan detailing the system specifications and configurations. Some providers are advancing tools that enable real-time data transmission and recording via satellite connection, eliminating the need for hard drives; which will facilitate data transmission and chain of custody.

## 1.2.1 EM PROVIDER PERSPECTIVES

Across the EM Provider presentations, and subsequent discussions, a range of issues were raised by EM providers and these are summarized below.

### *Policy & governance*

- concern at the absence of universally accepted EM standards and policy guidance across t-RFMOs;
- concern at the added complexity in navigating national, sub-regional, and t-RFMO standards;
- absence of provisions for small-scale fisheries and developing nations in EM policies;
- strong need for globally recognized EM certification programs (i.e. once approved in one t-RFMO then approved for all);
- T-RFMOs should recognize the benefits of harmonized standards for improving compliance and reducing costs;
- recommended greater cooperation between technology providers and regulatory authorities;
- recommended the establishment of a multi-stakeholder working group to define core EM standards;
- recognition of the benefits of financial and technical support to accelerate the transition to harmonized EM systems.

### *Data management & technology*

- lack of interoperability between EM systems continues to be a big impediment to EM programs that cross multiple jurisdictions;
- lack of harmonized data minimum requirements across EM programs that will facilitate interoperability and EM implementation;
- clear guidelines needed on data security, ownership, and accessibility;
- reduce differences in data collection, transmission, and storage requirements across t-RFMOs as these are best harmonized;
- lack of standardized EM record (i.e. EM footage) review methodologies;

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- recognize the technical limitations in integrating EM solutions with existing vessel monitoring systems;
- need to develop modular and flexible EM systems adaptable to different regulatory requirements.

*Innovation & implementation*

- if EM standards are too prescriptive, they may delay technological innovation so focus on what you want the system to do – not how it must be done;
- recommend the inclusion of artificial intelligence and machine learning advancements into EM standards;
- recognize that varying environmental conditions, fleet composition and operational practices affect EM system performance;
- recommend the creation of a central repository for best practices and lessons learned in EM implementation.



## SECTION 2

# TUNA RFMO EM STANDARD COMPARISON

The focus of the meeting was then the detailed comparison of EM standards across the t-RFMOs. The comparison was guided by a detailed analysis conducted by CEA Consulting (CEA), with support from The Nature Conservancy (TNC), in collaboration with the International Seafood Sustainability Foundation (ISSF). This analysis document is attached as Appendix 5.

→ *Bluefin tuna.*

 SECTION 2

The EM standards comparison was structured by component of the EM standards. For each section, Jenny Moffett (CEA) gave a brief high-level summary overview of the elements covered in the comparison and high-priority areas for alignment or discussion (**Appendix 6**). Then, the workshop was split into three discussion groups and each group presented their findings to the plenary. Each small group reviewed each of the EM standards component for corrections, reflections, and recommendations based on the comparison analysis. The outcomes of these discussions are summarized below.

## 2.1 HIGH-LEVEL OBSERVATIONS

When considering each t-RFMOs set of EM standards the meeting noted that.

- IATTC and ICCAT's general requirements are most similar. In many cases, elements of the standards are nearly or entirely identical.
- WCPFC's standards are the most distinct in format from the other three (e.g. WCPFC standards are not formatted narratively). WCPFC includes entire categories of requirements the others omitted and omits many other requirements all the other t-RFMOs include.
- There is less variance across the IOTC, ICCAT, and IATTC standards.
- All t-RFMOs have proposed EM voluntary standards, with WCPFC limiting EM to longline (LL) vessels, ICCAT/IATTC to longliners and purse seiners (PS), and IOTC includes gillnet (GN) in addition to LL/PS.
- All t-RFMOs, except IATTC, currently allow the use of EM to collect data under their Regional Observer Schemes or Programs (ROS/P). IATTC, however, does not yet permit the use of EM to meet ROS data collection requirements.
- The approach to integrating EM alongside human observers also varies across t-RFMOs. For example, the IOTC allows EM to serve as an alternative or full replacement for human observers, while ICCAT maintains that a minimum level of human observer coverage, specifically 5 percent, is necessary for tasks such as biological sampling.
- In the case of IOTC, EM data could be used to collect the data required under their Regional Observer Scheme, provided that all EM data mandatory requirements are collected through EM or in conjunction with supplementary monitoring tools (such as port sampling, etc.).

## TUNA RFMO EM STANDARD COMPARISON

- All t-RFMOs EM programs are proposed to operate at a national or sub-regional level rather than a centralized RFMO-level.
- In the IOTC and IATTC, the scope of the EM programs only includes science, while in the others, both scientific and compliance information can be collected.

Following the plenary discussions, including the discussions of the small working groups, the **group recommended that**.

- t-RFMO be encouraged to clearly state the objectives of their EM programs, e.g. whether EM is intended for scientific research, compliance, or both;
- t-RFMOs consider, as appropriate, the potential for EM programs to be used to evaluate compliance with Commission requirements;
- t-RFMOs recognize the potential to use a range of monitoring tools (e.g. port and at-sea inspections, market sampling), alongside EM and at-sea observers, to achieve their data and verification requirements, and consider providing flexibility to those responsible of EM programs (e.g. flag states or RFMOs under a regional programme) to decide a preferred approach for certain data fields; and
- t-RFMOs recognize that for EM, that the additional cost for each field is likely to be greater than it is for at-sea observers (where the primary cost is having the observer on the vessel).

## 2.2 EM DEFINITIONS

The establishment of standardized definitions for EM across t-RFMOs is crucial to ensuring consistency, interoperability, and common understanding for EM monitoring fisheries activities.

During discussions, it was noted that all t-RFMO EM standards include a section of EM definitions, except ICCAT EM standards. Overall, there was alignment among the definitions of the different t-RFMOs. Therefore, **the group recommended that ICCAT also consider developing EM definitions aligned with those used in other t-RFMOs to avoid confusion.**

The group also agreed on the need of standardized definitions to streamline EM implementation and data usage among t-RFMOs. The agreed-upon definitions provide a foundation for future collaboration and improvement in EM implementation. Further efforts

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should focus on refining these definitions and ensuring their adoption across all relevant organizations.

The group recommended that the following terms/definitions be harmonized across t-RFMOs.

- **EM Records.** to refer to the electronic data (footage and other information such as ancillary data and metadata) captured during a fishing trip<sup>1</sup>.
- **EM Data.** The processed information derived from EM records after analysis
- **Fishing Trip.** A defined period during which a vessel engages in fishing activities, requiring consistent delineation across RFMOs (see WCPFC for an example).
- **EM Review Center.** A designated facility responsible for reviewing and analyzing EM records.

A significant discussion centered on the need to standardize the format and conventions of EM records. There was a strong push for interoperability between EM providers to ensure seamless integration and data sharing across t-RFMOs (see below section on data) as well as the possibility to review EM records with different EM data review software.

One of the most debated topics was the definition of “EM coverage,” as different t-RFMOs currently interpret this term in varying ways. **To create consistency, the group recommended the following definitions be harmonized across t-RFMOs (for application to a fleet or fishery of interest).**

- **Installation Coverage.** The percentage of vessels equipped with EM systems.
- **EM Record Coverage.** The percentage of total fishing effort (trips/events) for which EM records are available.
- **Analysis Rate.** The percentage of EM records that have been analyzed to produce EM data.
- **EM Coverage.** A composite metric calculated as EM Record Coverage multiplied by Analysis Rate.

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<sup>1</sup> This recommendation specifically relates to ICCAT.

**The group also recommended t-RFMOs ensure clear and consistent terminology between terms used in EM standards and those included in relevant resolutions/management measures/decisions.**

The group also suggested minor changes to be considered by different t-RFMOs when reviewing their definitions in the future. For example.

- include the definition of “fishing trip”;
- delete the word “System” from EM as it is creating some confusion;
- EM process instead of EM Systems;
- EM Program instead of EM System Program;
- although all included a type of definition for the “EM Review Center”, the term used is different among tuna RFMO. The term should be standardized, for example, using the IOTC term “*Electronic Monitoring Review Center*”;
- IATTC to add a definition for Vessel Monitoring Plan;
- WCPFC has additional definitions and suggest if these terms are used by other t-RFMOs in their resolutions/recommendations they should also be defined.

## 2.3 EM MINIMUM DATA REQUIREMENTS

During the workshop, participants engaged in extensive discussions regarding EM minimum data requirements. While there were differences in perspectives, a consensus emerged on key approaches to refining data collection through EM.

The workshop underscored the importance of viewing EM as one of several data collection methods, rather than as a standalone solution. **The group reiterated its recommendation that EM be used in conjunction with port sampling, port-interviews, and other methods, to collect the mandatory ROS data fields following the model established by the IOTC.**

Although EM cannot capture all observer data fields on its own, providing the ROS required data fields helps providers understand the full range of data each RFMO needs and develop more cost-effective advanced technological solutions, such as edge computing and geofencing, to improve EM capabilities. This helps providers and CPCs design more effective

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monitoring programs using a mix of tools like EM, dockside sampling, and logbooks.

The group recognized that when considering data fields currently collected by at-sea observers (often the starting point for EM discussions) there are many factors to consider, e.g..

- Some fields can be easily collected using EM (e.g., number of fishing operations or longline retained catches).
- Some fields can still be collected using EM, but at the cost of specific ad hoc cameras and/or human review time (e.g. bait types).
- Some could more easily be collected through modifications to fishing practices (e.g. handling practices);
- Many fields could become easier to collect over time with improvements in AI or other camera-related technologies (e.g. length measurements);
- Some fields could be collected using other means (e.g. fish size data through unloads or market sampling, or bait types through interviews or port inspections)
- Some fields that might not be required to be collected all the time, e.g., sub-sampling; and
- Some data fields which might not be feasible to collect through EM or other existing tools, such as line-weighting requirements for seabird mitigation in longline fisheries. For these fields a needs assessment would be required to determine the data collection approach.

**The group recommended that t-RFMOs consider using a framework that contemplates factors such as those listed above, when determining data requirements to ensure that EM programs are cost effective.**

Participants agreed that the work already done by Regional Fisheries Management Organizations (RFMOs) through EM pilot tests to assess what could be collected via EM is very informative. EM service providers could review these assessments, validate data collection feasibility, and provide cost-efficiency analyses to enhance EM data collection. Providers emphasized that RFMOs should not pre-emptively decide what EM can or cannot collect without allowing for EM providers innovation and feedback. The group identified the following key tasks in relation to potential EM data fields that RFMOs or the Tuna II project could address.

## TUNA RFMO EM STANDARD COMPARISON

- collating existing t-RFMO assessments of data fields based on feasibility of collection through EM;
- engaging EM providers to validate these assessments through pilot projects and direct feedback;
- presenting these findings to the relevant subsidiary bodies of each t-RFMO for further deliberation on suitability as an EM data field or whether supplementary data collection methods were needed.

In conclusion, the group recognized that a flexible, collaborative approach to EM data requirements, one that allows for technological advancement, stakeholder input, and integration with existing t-RFMO data collection frameworks was likely to achieve the best outcomes.

## 2.4 EM TECHNICAL REQUIREMENTS

During the workshop, participants discussed the need to refine and streamline the technical requirements for EM systems. There was broad agreement on the opportunities to simplify, align, and establish performance-based standards while promoting innovation in the field.

The discussion emphasized the importance of shifting from rigid specifications to performance-based standards. EM providers highlighted the need to balance innovation and efficiency, ensuring that requirements for aspects such as frame rate and resolution focus on what is necessary for species identification rather than prescribing fixed settings. Accuracy benchmarks should be oriented towards performance outcomes rather than rigid technical specifications. EM technical requirements based on performance standards will foster innovation while very prescriptive requirements will limit it.

There was significant concern that existing storage, backup, and transmission protocols are overly restrictive and misaligned with modern technological capabilities. Many current requirements were designed around hard drive storage rather than modern wireless transmission and cloud-based solutions. The group suggested a more flexible approach that ensures data is securely stored and backed up without dictating specific methods. The group agreed that the most important issue is to ensure traceability of the EM records (hard

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drive, data). Most EM technical standards do not specify how the data should be stored or backed up, but the group considered that it is important for EM standards to include it.

Regarding EM records security and traceability, the group underlined that digital signatures and end-to-end encryption to ensure EM record security, traceability and chain of custody should be included in the EM technical minimum requirements, which are crucial to protect sensitive EM records and maintain confidence in EM systems.

Workshop participants agreed that camera requirements should not be tied to specific settings but should align with what is required to observe/collect (i.e. data standards or requirements) and data quality thresholds (i.e. images should be of enough quality to allow species identification and produce required EM data). This would allow EM providers to set frame rates based on performance needs.

The ability for the vessel operator to view camera feeds in real time was identified as a key requirement. However, it was noted that this does not necessarily mean a dedicated “EM Control box” display must be included; alternative solutions such as phone apps or tablets could fulfil this need. Therefore, the **group recommended that RFMOs considers changing the term “control box” by “control center and an interface” to avoid prescribing specific hardware solutions and allow other alternatives.** The requirement should focus on ensuring the presence of a control center and interface rather than mandating a particular type of physical control box.

The discussion also emphasized minimizing manual interaction by fishers with the EM system, ensuring a streamlined process where the system operates independently, with service provider assistance available when needed. One possible exception would be allowing fishers to replace hard drives when necessary or clean the cameras.

The workshop emphasized that key components of an EM system, such as location tracking and communication equipment, must be fully integrated into the overall EM solution. These elements should not be treated as standalone devices outside the control of the EM provider. It was also considered essential to have the ability to remotely and in real-time monitor the equipment’s health status and to ensure there is no interference with other onboard equipment. Additionally, it was suggested that illumination standards be included in vessel monitoring plans (VMPs) to support better documentation and implementation.

## TUNA RFMO EM STANDARD COMPARISON

To enhance efficiency and consistency in EM, providers emphasized that compatibility and interoperability of EM systems depend on the establishment of standard formats. This ensures that EM records can be reviewed across different providers, enhancing efficiency and consistency in monitoring efforts.

In conclusion, the workshop discussions underscored the need to modernize and simplify technical requirements for EM systems. By adopting performance-based standards, reducing prescriptive hardware mandates, and ensuring seamless integration of key components, the industry can foster innovation while maintaining high standards of data quality and system reliability.

Based on these discussions, the **group recommended that t-RFMOs consider**.

- setting performance standards for cameras, rather than specifying technical inputs. For example, focusing on the ability to collect specific data fields instead of requiring a certain number of cameras with specific frame rates and resolutions at designated locations;
- requiring that location tracking and communication equipment be fully integrated into the EM solution, to ensure system compatibility and allow the EM provider to manage all necessary components for a robust EM solution;
- encouraging EM providers to continue developing interoperability features that would allow video footage to be viewed across different review platforms; and
- establishing data storage and transmission requirements that allow for flexibility; for instance, avoiding implicit mandates for hard drive use when other transmission methods may be more cost-effective depending on the context.

In addition to the above, there were specific suggestions on how to improve some of the individual t-RFMO standards, for example.

- IOTC/WCPFC adopting IATTC/ICCAT language for “Uninterruptable Power Supply” and “Controlled shutdown”;
- IOTC/WCPFC making mandatory the need of “Near-real-time Automatic System Malfunction/Tampering Alerts”;

- Require “Remote Verification of System Health”;
- All t-RFMOs work to develop harmonized EM Record format standards to ensure EM Records Interoperable between Reviewers.

## 2.5 EM LAYOUT AND VESSEL MONITORING PLANS (VMPS)

The discussion highlighted the multifaceted role of VMPs and the necessity of defining their purpose to guide the EM structure and implementation. The purpose of the VMPs should be clear, as the VMP will guide the EM implementation. **The group agreed that the purpose of the VMP should be to describe the EM system specifications that will allow the system to comply with and allow the collection of the mandatory EM data fields.**

The group recognized significant value in developing a universal VMP that would allow vessels operating under multiple t-RFMOs to use a single document that meets all relevant requirements. This universal VMP should be designed to fulfill the following key functions.

- **Agreement framework.** Establishing obligations of EM system (including cameras) installation and handling practices among the vessel, the RFMO/Coastal State/Port Control (CPC), and the EM provider as well as access to or publication of the VMP.
- **Operational guide.** Providing a duty of care list for crew members/vessels detailing onboard EM requirements and what to do in case of malfunctioning.
- **Compliance and enforcement tool.** Potentially might serve as a reference for high-seas inspections.

Some t-RFMO allow fleet level VMPs, but the group considered that VMP should be developed for each vessel as, otherwise, it would be difficult to ensure correct implementation of EM at vessel level. **The group recommended that VMPs are developed for each specific vessel and that this requirement be considered by each t-RFMO in the next revision of their EM standard.**

## Harmonization and universal template

The group identified the need for a standardized VMP template incorporating all mandatory requirements. The following **recommendations** were made to achieve harmonizations and a universal template with harmonized content.

- Adoption of a single VMP format/template across t-RFMOs to prevent vessels operating in different regions from managing multiple versions. This VMP template should be incorporated in the EM standard document.
- Inclusion of mandatory required VMP elements as stipulated by IOTC as an example of current best practice.
- Integration of best practices from existing VMPs under ICCAT and IATTC, with IOTC and WCPFC incorporating similar structures.
- Consideration of harmonization of those key operational procedures, including catch handling/fishing operations<sup>2</sup> and all other crew responsibilities and requirements, and vessel survey requirements, which enable more efficient and effective application of EM.
- A framework should be developed to define what types of changes necessitate VMP updates, and the required timelines for such updates (e.g. before the next trip or some other period).
- The group agreed that vessels in collaboration with EM providers are best placed to develop the VMP.
- IOTC should consider making VMP elements mandatory, currently the elements included IOTC VMP are not mandatory but recommended to be included.
- Until vessel-fleet VMPs are agreed, clear guidelines should be established for fleet-level VMPs (i.e. IATTC), ensuring consistent camera placement and tracking of installed views.
- Vessel measurement calibration should remain optional.

The discussion emphasized the necessity of assurance and verification processes for VMP compliance, and more broadly for EM standards. The group proposed the development of an audit protocol for this purpose and suggested that the meeting planned for early 2026 to discuss EM implementation could be used for this purpose.

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<sup>2</sup> Alternatively, these could be included as t-RFMO specific appendices if these required practices vary across t-RFMOs.

By implementing these recommendations, the harmonization of VMPs will facilitate streamlined compliance, improved monitoring efficiency, and enhanced trust in Electronic Monitoring Systems across global fisheries. By ensuring interoperability, security, and harmonization, VMPs will become more effective tools in monitoring and managing fisheries operations worldwide.

## 2.6 EM DATA MANAGEMENT AND REVIEW

EM data management and review processes are influenced by varying timeframes across different fishing operations and the type of review undertaken. For example, it was noted that in some cases a maximum of 100 days after a trip is completed by longliners (LL) is required to analyse the data, though retrieving hard drives from LL presents challenges.

This can be expedited if EM records are submitted electronically via cloud-based systems or by utilizing transshipment events as was demonstrated in an IATTC trial. Purse seine (PS) trip data is typically available earlier than LL data, though hard drive recovery and analysis from extended PS trips may take 3-4 months after the trip.

It was also noted that longline operations reviews involve 1 day in the office for every 4-7 fishing days, with a typical review encompassing approximately 200 fish per five fishing events. If analysis rates are set at 20 percent, this process can be shortened.

**The group recommended EM providers/data reviewers to assess timeframes for retrieving, reviewing, and submitting EM data to the relevant RFMOs based on fleet operations and strategies; which could then be used to establish data revision and submission timelines by RFMOs. The EM providers/data reviewers can provide this data during the next planning workshop.**

### Data storage and retention

Aligning data storage and retention requirements is necessary, but it was noted that decisions on audit and assurance frameworks (e.g. which EM records must be retained and available for review and for how long) are likely to drive policy decisions. Ownership of EM records and data should also be clarified to ensure accountability and adherence to t-RFMO regulations (currently only IOTC EM standard includes the notion of ownership).

## Review software and data output format

There was consensus that review software requirements should not be overly prescriptive to allow flexibility, particularly for CPCs piloting EM programs in smaller fisheries. However, defining minimum requirements was considered valuable to help stakeholders and CPCs understand essential functionalities versus additional features and associated costs. Certification of systems and reviewers may provide further clarity. It was noted that ideally the generated EM records collected by different EM providers should be interoperable with multiple review providers. As such, EM records can be reviewed by different EM analysis software.

To enhance consistency, submission frequency, review timelines, and reporting deadlines should be aligned with data retention policies. **It was recommended that t-RFMOs consider establishing clear requirements and standardized EM data forms for submitting EM data. CPCs should adhere to these adopted formats when submitting their EM data.**

## Chain of custody and observer qualifications

A clear definition of the chain of custody is needed, specifying key components such as ownership and accountability, which may vary based on CPC determinations. Ensuring buy-in from CPCs will reinforce adherence to chain of custody protocols. This should be included in current/future EM standards. Furthermore, harmonizing EM review analyst qualifications across CPCs and t-RFMOs is critical to maintaining review consistency and data integrity.

**The group provided the following recommendations in relation to Data Management and Review.**

- conduct a survey of EM providers and data review centers to determine timeframes for data retrieval, review, and submission across different fleet operations;
- encourage quick retrieval of hard drives, particularly for long LL trips, potentially leveraging transshipment events;
- establish clear guidelines for data security, including encryption and digital signatures, while balancing t-RFMO and CPC-specific requirements;
- develop interim data retention policies until audit and assurance mechanisms are established; once these are in place, finalize the data retention policies;
- align reporting and submission timelines with data retention policies to streamline workflows;

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- maintain flexibility in review software requirements to accommodate smaller fisheries and emerging EM initiatives;
- develop t-RFMO best practices and guidelines to assist CPCs in implementing EM programs.

By implementing these recommendations, EM data management and review processes can be optimized, ensuring timely and secure submission of high-quality data to support fisheries management and compliance efforts.

## 2.7 ROLES AND RESPONSIBILITIES IN EM PROGRAMS

All t-RFMOs EM Programs operate at a national level rather than through a centralized regional approach, which affects the roles and responsibilities of t-RFMOs, CPCs, and other stakeholders. Therefore, at RFMO EM program level, CPCs hold responsibilities related to program design, management, and reporting. Among the t-RFMOs, WCPFC has the fewest individual responsibilities assigned to CPCs. There are opportunities for harmonization in approval processes and program management responsibilities, which are currently misaligned.

Common requirements across all t-RFMOs for CPCs include. (i) Annual reporting, (ii) Establishing procedures for system failure, (iii) Ensuring EMS implementation complies with t-RFMO standards.

RFMOs are responsible for program management, program review, and supporting CPC EM programs. However, WCPFC does not specifically define t-RFMO-level responsibilities, while IOTC has the most program management responsibilities, all of which are mandatory. ICCAT has similar responsibilities, though not all are required. In general, the definition of t-RFMO roles in program management could benefit from greater alignment.

The requirements for enabling data collection vary across t-RFMOs. ICCAT and IATTC have the most direct and similar crew duty of care requirements, whereas IOTC mandates that CPCs ensure crew duty of care, and WCPFC includes duty of care requirements in vessel monitoring plans (VMPs). The discussion highlighted that most onboard responsibilities should be incorporated into VMPs rather than as standalone elements.

Additionally, it is recommended that VMPs include explicit provisions ensuring that camera views remain unobstructed. The EMS installation should either be part of VMPs or mandated as a requirement for IOTC. The duty of care for cameras must also be defined, either as a standalone requirement or within VMPs. Furthermore, it is recommended to include a requirement in the VMP stating that a designated person is responsible for ensuring the system is not tampered with. Specifically, the vessel Master shall ensure that, unless authorized and instructed by the flag CPC, the EMS remains intact and operational at all times (e.g. cameras must not be disconnected, repositioned, manually switched off, or intentionally damaged).

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Currently, only WCPFC explicitly mentions EM service provider responsibilities related to installation and technical support. While IOTC does not explicitly include EM service providers, VMP development requires engagement with EM providers. A recommendation is made that CPCs should submit their Electronic Monitoring Program (EMP) to the t-RFMO, even though IOTC currently only requires submission of a VMP for each vessel.

The workshop noted the following key points regarding EM roles and responsibilities.

- Program review, annual reporting, and collaboration responsibilities are well aligned across t-RFMOs, except WCPFC.
- Only IOTC currently mandates an audit of CPC programs.
- ICCAT, IATTC, and IOTC require t-RFMOs to suggest improvements to CPC programs.
- RFMOs should collaborate with CPCs to implement national EM programs, as required in IOTC/ICCAT and recommended in IATTC. However, no established process exists for this collaboration. A recommendation is made that t-RFMOs develop a structured process to facilitate CPC EM program implementation.
- The group recommended establishing a framework for cross-RFMO certification where one t-RFMO-approved EM systems can gain recognition across multiple t-RFMOs and organizations.

The workshop underscored the need for better alignment across t-RFMOs in defining roles and responsibilities related to Electronic Monitoring. Incorporating responsibilities into VMPs, clarifying the roles of EM service providers, ensuring CPC accountability, and establishing a structured t-RFMO collaboration process are key recommendations moving forward. The proposed audit and assurance process should be a primary focus, with early drafting efforts facilitating smoother integration across t-RFMOs.

It was suggested that drafting the audit and assurance process in advance could minimize the need for harmonization later and provide a framework that t-RFMOs can refine rather than create from scratch. The group considered that it could take about 18 months to develop of an audit and assurance process suitable for t-RFMOs.


## 2.8 SUMMARY OF THE EM STANDARD COMPARISON

The key findings from EM standard comparison are summarized below.

- **Objectives.** WCPFC/ICCAT EM standard objectives encompass both science and compliance, while IOTC and IATTC only science. CCSBT High Level EM Guiding Principles could also be used for both science and compliance. Tuna RFMO objectives should be explicitly stated in its EM standards (i.e. science, compliance, or both).
- **Common definitions and terminology harmonization.** There are benefits to be made in further standardizing definitions, especially around the concept of “EM coverage”. ICCAT should include EM definitions in its EM standard recommendation. ICCAT should align its terminology (e.g. “EM records” instead of “data”). Priority should be given to defining “EM Coverage” consistently using, as example, IOTC approach.
- **Compulsory EM requirement.** No t-RFMO currently mandates EM usage across the board.
- **EM standards.** EM standards should be performance-based to encourage innovation by focusing on the outcome rather than prescribing rigid elements, characteristics, and implementation methods. Avoid legacy technologies that hinder scalability and cost-effectiveness. Consider cross-RFMO certification for EM systems.
- **Application to Regional Observer Scheme (ROS).** All t-RFMOs except IATTC allows using EM to comply with ROS requirements, with IATTC preferring their current human observation to achieve observer data requirements. In those that allow EM however, the role of observers in relation to EM differs across t-RFMOs. For instance, in the IOTC, EM can serve as an alternative or a full replacement, whereas ICCAT emphasizes the necessity of maintaining a minimum level of human observer coverage.
- **Development of a universal vessel monitoring plan (VMP) template.** Recognizing that many vessels fish under the jurisdiction of multiple t-RFMOs, it is critical that a standardized VMP template that incorporates all mandatory requirements is developed.
- **Alternative data collection methods.** IOTC allows the use of alternative data collection methods to achieve the data requirement under the ROSs, while other don't. It is recommended that alternative data collection methods are used in conjunction with EM to collect the required minimum data fields.

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- **Standardization across t-RFMOs.** Most t-RFMOs have proposed voluntary standards. WCPFC limits EM to longline (LL) vessels. IOTC includes guidelines for gillnet (GN).
- **Data confidentiality and ownership.** CPC-led programs can manage confidentiality, whereas regional-level approaches face greater complexity.
- **Audit and assurance process.** Implement systematic auditing to verify data accuracy and consistency across different EM programs is necessary. The group recognized the need for an audit and assurance framework tailored to EM programs used to meet obligations within t-RFMOs. A potential next step could see the development of a draft audit and assurance process based on existing t-RFMO audit models, e.g. the audit and assurance process used within the WCPFC Regional Observer Program (ROP).
- **Interoperability.** EM providers are encouraged to continue work around common standards for EM systems to support the exchange of EM records between different EM systems.



## SECTION 3

# SUMMARY OF MAIN RECOMMENDATIONS

The Electronic Monitoring (EM) workshop was productive, fostering a collaborative and focused discussion. The contributions of EM providers were particularly valuable, enhancing momentum and confidence in the process of aligning and simplifying EM standards.

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**Technological requirements.** The group recognized that existing technological requirements might become overly restrictive over time. Many standard elements were also found to be overly wordy and unclear. A consensus emerged on the need to move away from a narrative-style format towards a structured approach, such as the one used in the comparison document, with streamlined sections and bullet points.

**Clarity in language and requirements.** Extensive discussion took place regarding the appropriate use of terms like “shall,” “must,” “should,” and “could.” It was noted that requirements were often misaligned within the documents, leading to confusion and potential risks for EM providers and RFMOs. The group agreed that future standards should distinctly separate mandatory requirements from guidelines as done in IATTC standards.

**Audit and assurance protocols.** The risk of lacking harmonization in audit and assurance protocols was recognized as a critical issue. The group acknowledged the need to proactively develop such protocols to stay ahead of t-RFMO requirements.

**Emerging technologies.** The need to adapt standards to accommodate AI, cloud-based, and wireless technology was a recurring theme. EM providers stressed the urgency of integrating these advancements into the EM standard framework.

**Voluntary versus mandatory requirements.** Concerns were raised about the inclusion of mandatory elements in an EM program intended to be voluntary. For example, requiring vessels to remain in port if EM is malfunctioning contradicts the voluntary nature of the program, unless the vessels intend, and are permitted, to use EM to meet the data reporting requirements.

Several key recommendations were identified and agreed during the workshop.

- **Outcome-oriented approach.** EM standards and/or regulations should focus on desired outcomes (e.g., performance-based) rather than specific technological specifications to encourage innovation.
- **Scalability consideration.** EM programs should avoid legacy systems that limit expansion and cost-efficiency.
- **Enhanced security measures.** Encryption and digital signatures, and real-time system health checks should be mandatory components to safeguard EM records.
- **Clarification of objectives.** t-RFMOs should explicitly state whether EM is intended for scientific research, compliance, or both; and consider, as appropriate, the potential for EM programs to be used to evaluate compliance.

## SUMMARY OF MAIN RECOMMENDATIONS

- **Use of multiple data sources to achieve ROS requirements.** t-RFMOs should recognize the potential to use a range of monitoring tools (e.g. port and at-sea inspections, market sampling), alongside EM and at-sea observers, to achieve their data and verification requirements, and consider providing flexibility to those responsible of EM programs (e.g. flag states or RFMOs under a regional program) to decide a preferred approach for certain data fields.
- **Harmonized definitions.** t-RFMOs should include, align, and harmonize EM terminology and definitions to ensure consistency across regions. T-RFMOs should also ensure that the terminology used in EM standards is consistent with that used in relevant EM Resolutions and Management Measures.
- **Roles and responsibilities.** incorporate roles and responsibilities into EM standards and VMPs, clarifying the roles of EM service providers, ensuring CPC accountability, and establishing a structured t-RFMO collaboration process.
- **Data confidentiality, ownership and sharing.** If an EM program transitions to a regional level, a structured approach for data confidentiality, ownership, sharing and security must be established.

### Harmonization of key minimum requirements

- The purpose of the vessel monitoring plan (VMP) should be to describe the EM system specifications that will allow the system to comply with and allow the collection of the mandatory EM data fields.
- Develop a universal VMP that would allow vessels operating under multiple t-RFMOs to use a single document that meets all relevant requirements, including a set of core minimum requirements, such as those included in the IOTC vessel monitoring plan (VMP), while placing lower-priority issues in an appendix as best practices (e.g. dedicated software) as well as timelines for revisions and updates.
- Develop VMPs for each specific vessel and that this requirement be considered by each t-RFMO in the next revision of their EM standard.
- Differentiate VMPs minimum requirements based on program objectives (science vs compliance), as audit and EM records storage requirements will differ accordingly.
- Ensure the ability of EM systems to remotely and in real-time monitor the equipment's health status and to ensure there is no interference with other onboard equipment.

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- Request EM providers to continue developing interoperability features that would allow EM records (i.e. video footage) to be reviewed across different EM review platforms; and
- Establish data storage and transmission requirements that ensures traceability of EM records but allows for flexibility; for instance, avoiding implicit mandates for hard drive use when other transmission methods may be more cost-effective depending on the context.

### EM data management and review

- Request EM providers to assess timeframes for retrieving, reviewing, and submitting EM data to the relevant flag states and/o RFMOs based on fleet operations and strategies; which could then be used to establish data revision and submission timelines by RFMOs.
- T-RFMOs to establish clear requirements and standardized EM data forms for submitting EM data. CPCs should adhere to these adopted formats when submitting their EM data.

### Audit and assurance process development

- Initiate the development of a unified audit and assurance process for EM implementation among Tuna RFMOs.
- Ownership of EM records and data should be clarified to ensure accountability and adherence to t-RFMO regulations.
- Conduct a survey among t-RFMOs to assess existing audit processes in other areas and use this as a basis for harmonization.
- Establish a framework for cross-RFMO certification where one t-RFMO-approved EM systems can gain recognition across multiple t-RFMOs and organizations.
- Organize a dedicated workshop in approximately 18 months focusing on EM implementation and audit protocols. The agenda should include reviewing audit processes, discussing harmonization strategies, and recommending a standardized audit protocol for Tuna RFMOs.

## SUMMARY OF MAIN RECOMMENDATIONS

### Enhancing standards format and language

- Transition to a more structured format for EM standards, replacing narrative descriptions with bullet points and clearly defined sections.
- Ensure clear distinction between mandatory requirements and guidelines to avoid confusion and misinterpretation.
- Reevaluate the use of “shall/must/should/could” terminology to align with intended regulatory and operational objectives.

### Integration of emerging technologies

- Update EM standards to reflect advancements in AI, cloud-based, and wireless technologies.
- Engage with EM providers and technology experts to ensure standards remain adaptive to technological progress.

This comparative analysis underscores the need for harmonization, scalability, and secure data management in EM programs while balancing scientific and compliance requirements. By implementing these recommendations, stakeholders can ensure that EM standards remain clear, flexible, and aligned with evolving technological and regulatory needs.

# NEXT STEPS

The ABNJ 2, Common Oceans Project provided the long overdue opportunity for EM leads from across the five t-RFMOs to meet with EM providers to talk about EM standards and the steps necessary to ensure the successful roll-out of EM across the world's tuna fisheries.

Participants found the meeting extremely valuable, especially due to the groundwork undertaken by TNC and the ISSF in undertaking a comparative analysis of EM standards across the t-RFMOs.

Recommendations were made for the consideration of t-RFMOs, and these are provided in section 3.

To maximize the dissemination of workshop outcomes, the steering committee will seek opportunities to present the outcomes through the appropriate forum for each of the t-RFMOs.

The Common Ocean Project has funding for a second workshop which is planned early 2026. The focus of this workshop will be to review progress on EM implementation, assess advancements in EM implementation, refine strategies moving forward, and address the recommendations by this working group.

# APPENDICES

This section includes supplementary material, parts of which can be downloaded as separate files. To download an appendix, just click on the link of the document that you're interested in.

→ *The Pacific bluefin tuna are one of three bluefin species, including the Atlantic bluefin (*Thunnus thynnus*) and the Southern bluefin (*Thunnus maccoyii*).*

# APPENDIX 1

## AGENDA

### DAY ONE – 10 December 2024

09.00–09.15	<b>OPENING and WORKSHOP INTRODUCTIONS</b>	
	Official Welcome	Dr Hilario Murua (ISSF)
	Chair's Introduction	Dr Shelton Harley (Chair)
	Introductions	
09.30–10.15	<b>CONTEXT SETTING – Tuna RFMO standards</b>	
	CCSBT EM progress and EM Standards	Frank
	IATTC EM progress and adopted EM Standards	Marlon
	ICCAT EM progress and adopted EM Standards	Rui Coelho
	IOTC EM progress and adopted EM Standards	Hilario Murua
	WCPFC EM progress and in discussion EM Standards	Shelton Harley
10.15–11.00	<b>CONTEXT SETTING – the view of providers and data analyst</b>	
	Satlink/DOS	
	Integrated Monitoring	
	Thalos	
	Zunibal	
	Flywire	
	Datafish	
11.00–11.30	<b>BREAK</b>	
11.30–12.00	<b>EM STANDARDS COMPARISON (General)</b>	CEA
	Similarities and differences among adopted/in progress EM Standards	
12.00–13.00	<b>EM PROGRAM standards comparison.</b>	
	Introduction of the comparison	CEA
	Group exercise. compare EM Program Standards	Group exercise
	Report to the plenary	Plenary
13.00–14.30	<b>LUNCH</b>	
14.30–15.45	<b>EM PROGRAM standards comparison. DEFINITIONS</b>	
	Introduction of the comparison	CEA
	Group exercise. compare EM Standards definitions	Group exercise
	Report to the plenary	Plenary
15.45–16.15	<b>BREAK</b>	

## AGENDA

16.15-16.45	<b>EM standards comparison. LOGISTIC/TECHNICAL STANDARDS</b>	
	Introduction of the comparison	CEA
	Group exercise. participants compare the EM logistic/technical standards	Group exercise
	<ul style="list-style-type: none"> <li>· Onboard systems</li> <li>· EM installation/operation/maintenance minimum requirements</li> <li>· vessel monitoring plans</li> <li>· Data storage</li> </ul>	Plenary
	Report to the plenary	
16.45-17.00	WRAP UP DAY 1 - CLOSE	Shelton Harley

## DAY TWO – 11 December 2024

09.00-09.15	<b>OPENING - Day 1 reflections</b>	
09.15-11.00	<b>EM standards comparison. LOGISTIC/TECHNICAL STANDARDS (continued)</b>	Shelton Harley
	Group exercise. participants compare the EM logistic/technical standards	Group exercise
	<ul style="list-style-type: none"> <li>· Onboard systems</li> <li>· EM installation/operation/maintenance minimum requirements</li> <li>· Vessel monitoring plans</li> <li>· Data storage</li> </ul>	Plenary
	Report to the plenary	
11.00-11.30	BREAK	
11.30-13.00	<b>EM standards comparison. MINIMUM DATA REQUIREMENTS</b>	
	Introduction of the comparison	CEA
	Group exercise. participants compare the EM data requirements standards	Group exercise
	<ul style="list-style-type: none"> <li>· Are the requirements similar/different?</li> <li>· Is EM able to collect all data requirements?</li> <li>· What are the alternatives?</li> <li>· How to ensure collection of all data requirements?</li> </ul>	Plenary
	Report to the plenary	
13.00-14.30	LUNCH	

 APPENDIX 1

13.30–15.00	<b>EM standards comparison. EM RECORD ANALYSIS STANDARDS</b>	
	Introduction of the comparison	CEA
	Group exercise. participants compare the EM records analysis	Group exercise
	<ul style="list-style-type: none"> <li>· Data transfers</li> <li>· Data management</li> <li>· Training quality</li> <li>· Data review &amp; review centers</li> <li>· Software for data review</li> <li>· AI</li> </ul>	
	Report to the plenary	Plenary
15.45–16.45	BREAK	
15.30–16.45	<b>EM standards comparison. EM DATA AND PROGRAM REPORTING</b>	
	Introduction of the comparison	CEA
	Group exercise. participants compare the EM data reporting standards	Group exercise
	<ul style="list-style-type: none"> <li>· Data quality assurance</li> <li>· Data format</li> <li>· Reporting guidelines</li> <li>· Databases</li> </ul>	
	Report to the plenary	Plenary
16.45–17.00	WRAP UP DAY 2 - CLOSE	Shelton Harley

**DAY Three – 12 December 2024**

09.00–09.15	<b>OPENING - Day 2 reflections &amp; Day 3 overview</b>	Shelton Harley
09.15–10.30	<b>EM standards comparison. ROLES and RESPONSABILITIES</b>	
	Introduction of the comparison	CEA
	Group exercise. participants compare the EM PROGRAM ROLES and RESPONSABILITIES	Group Exercise
	<ul style="list-style-type: none"> <li>· CPCs</li> <li>· Secretariats</li> <li>· Vessels/Companies</li> <li>· EM providers</li> </ul>	
	Report to the plenary	Plenary
11.00–11.30	<b>BREAK</b>	
11.30–13.00	<b>EM standards comparison. REVIEW and OUTCOME</b>	Plenary
	<ul style="list-style-type: none"> <li>· Summary of EM STANDARD comparison</li> <li>· Similarities/differences</li> <li>· Way forward and recommendations</li> <li>· Future steps</li> <li>· Next workshop</li> <li>· Report</li> </ul>	
13.00–14.30	<b>LUNCH</b>	
14.30–15.30	<b>EM standards comparison. REVIEW and OUTCOME (continued)</b>	Plenary
15.30–16.00	<b>WORKSHOP CLOSING</b>	S. Harley & H. Murua

## APPENDIX 2

### LIST OF PARTICIPANTS

NAME	AFFILIATION
Álvaro Núñez	Zunibal
Dan Gilmete	NORMA
Frank Meere	CCSBT
Gala Moreno	ISSF
Gonzalo Legorburu	DOS
Guillermo Moran	Tunacons (IATTC WGEMS Co-Chair)
Hilario Murua	ISSF (IOTC WGEMS Chair)
Holly McBride	NOAA
Itziar Canive	Datafish
Jacob Isaac-Lowry	Flywire
Jamie Gibbon	Pew
Jenny Moffet	CEA
Jon Ruiz	AZTI
Josh Wiersma	Integrated Monitoring
Karine Brian	IRD
Lucia Pierre	IOTC
Luis Cocas	Gobierno de Chile
Manuel Menchaka	Satlink
Marlon Roman	IATTC
Rebecca Darcy	AFMA
Romain Godefroy	Thalos
Rui Coelho	IPMA (ICCAT SCRS EMS-Subgroup Chair)
Shelton Harley	WCPFC WGEM Chair
Tetsuya Kawashima	Fisheries Agency Japan



## APPENDICES TO DOWNLOAD

Appendix 3 → [Tuna RFMOs EM standard presentations](#)

Appendix 4 → [EM provider and data review center presentations](#)

Appendix 5 → [Tuna RFMO EM standards and requirements comparison document](#)

Appendix 6 → [Tuna RFMO EM standards and requirements comparison presentation](#)



## COMMON OCEANS | Tuna project

Food and Agriculture Organization of the United Nations (FAO)

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The Common Oceans Tuna project brings together a global partnership dedicated to sustainable tuna fisheries aiming to advance responsible tuna fisheries management and biodiversity conservation in areas beyond national jurisdiction (ABNJ). Funded by the Global Environment Facility (GEF) and led by the United Nations Food and Agriculture Organisation (FAO), it works in collaboration with five regional tuna fisheries management organizations, national agencies and intergovernmental organizations and initiatives, the private sector, civil society and academia.

IN COLLABORATION WITH: Commission for the Conservation of Southern Bluefin Tuna (CCSBT), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), Western and Central Pacific Fisheries Commission (WCPFC), Agreement on the Conservation of Albatrosses and Petrels (ACAP), BirdLife International (BLI), Conservation International (CI), INFOPECSA, International MCS Network (IMCSN), International Pole and Line Foundation (IPLF), International Seafood Sustainability Association (ISSA), International Seafood Sustainability Foundation (ISSF), International Whaling Commission (IWC), Marine Stewardship Council (MSC), Mercator Ocean international (MOI), Pacific Community (SPC), Pacific Islands Forum Fisheries Agency (FFA), Secretariat of the Pacific Regional Environment Programme (SPREP), The Nature Conservancy (TNC), The Ocean Foundation (TOF), The PEW Charitable Trusts, US National Oceanic and Atmospheric Administration (NOAA), World Wide Fund for Nature (WWF).