

INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

14<sup>TH</sup> MEETING

La Jolla, California (USA)

15-19 May 2023

DOCUMENT SAC-14-INF-H

IMPLEMENTATION OF AN ELECTRONIC MONITORING SYSTEM (EMS)  
UPDATED STAFF CONSIDERATIONS AND DRAFT RECOMMENDATIONS –  
PROGRESS REPORT

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SUMMARY

In accordance with the Commission-approved workplan for the implementation of an Electronic Monitoring System (EMS) for the tuna fisheries of the EPO, the purpose of this document is to present a report on the progress made during the 4<sup>th</sup> and 5<sup>th</sup> EMS workshops on the technical standards and data collection priorities of an EMS, and on the EMS Financial considerations, in that order. The feedback of the workshop participants is summarized and reflects their thoughts on topic-based discussions that were stimulated by a series of presentations and preliminary recommendations made by the staff, with the understanding that these recommendations may evolve over time, after each successive workshop, as a result of the feedback resulting from the discussion.

1. INTRODUCTION

As a general background, it is important to note that the IATTC has recognized and endorsed the use of electronic monitoring (EM) as a promising tool for addressing data gaps, improving data collection, and monitoring both purse-seine and longline vessels that do not carry onboard observers, as well as vessels with observers onboard as a means of complementing the observer's data collection (Resolution [C-19-08](#); Document [SAC-07-07f.i](#)). As a result, in response to Recommendation 3.1 from the Scientific Advisory Committee (SAC) at its 10th meeting in 2019, which was endorsed by the Commission, and in compliance with Resolution C-19-08, paragraphs 9 and 10, the staff prepared Document [SAC-11-10](#) "*An electronic monitoring system for the tuna fisheries in the eastern Pacific Ocean: objectives and standards*" and presented it at the 11th meeting of the SAC. This document contained information on the potential of an Electronic Monitoring System (EMS), a description of its potential components, a comprehensive evaluation of the minimum standards for these components, and the actions required for its implementation. On that basis, the IATTC staff proposed that the [1<sup>st</sup> Workshop on Implementation of an Electronic Monitoring System](#) further discuss some of the elements contained in document SAC-11-10 and the recommendations compiled in the document [EMS-01-01](#).

As a complement to these recommendations, Document [EMS-01-02](#) (Rev.) proposed a workplan (Table 1; Figure 1), that consists of several workshops focusing on different components and subcomponents of EMS analyzed in a logical and chronological order. The objective of these workshops is to educate participants, encourage communication and discussions, generate ideas, and work towards a common understanding among stakeholders on EM matters. They also aim to identify areas where participants broadly agree and those where there are strongly held differences that may pose future challenges. As a

result, during its 98<sup>th</sup> meeting in August 2021, the Commission adopted Resolution [C-21-02](#), which established the Terms of Reference for these workshops, and on a provisional basis, adopted the definitions recommended in the document EMS-01-01 to facilitate discussions in the EMS workshops (Resolution [C-21-03](#)).

In observance of Resolution C-21-02 and the workplan adopted for implementing an EMS in the EPO, the staff organized in the fall of 2021 the 2<sup>nd</sup> Workshop of an EMS in the EPO to discuss aspects on the institutional structure, goals and scope of the EMS ([EMS-02-01](#), [EMS-02-02](#) Rev.) Subsequently, a 3<sup>rd</sup> Workshop was held in the spring of 2022 to discuss issues related to the management of an EMS for the EPO (see [EMS-03-01](#)). During the SAC-13, the staff presented a compilation of workshop participants' comments and concerns and revised their preliminary recommendations accordingly ([SAC-13-INF-D](#)). The staff and the SAC proposed the establishment of an *ad hoc* working group on EM (EMWG) to assist delegations in negotiating, through a Member-appointed Chair, formal recommendations for the Commission adoption. As such, the Commission adopted the EMWG via Resolution [C-22-07](#) at its 100<sup>th</sup> Meeting. In accordance with the adopted EMS workplan, the 4<sup>th</sup> Workshop was held in December 2022 to discuss technical standards and data collection priorities for an EMS ([EMS-04-01](#), [EMS-04-02](#)). Subsequently, the 5<sup>th</sup> Workshop was held in the Spring of 2023 to address the financial considerations of an EMS ([EMS-05-01](#)).

This document provides an overview of the background and rationale of the recommendations put forward in the EMS-04-01, EMS-04-02, and EMS-05-01 documents, which were presented during the 4<sup>th</sup> and the 5<sup>th</sup> EM workshops. This document summarizes the discussions that took place during these workshops and revises the recommendations as necessary. A summary of the recommendations covered up to date are compiled in the Appendix 1.

## **2. WORKPLAN ON THE IMPLEMENTATION OF THE EMS IN THE EPO**

### **2.1. Technical standards and data collection priorities of an EMS**

The [4<sup>th</sup> Workshop of an Electronic Monitoring System in the eastern Pacific Ocean: Technical standards and data collection priorities](#) was held to address issues related to the technical standards (document [EMS-04-01](#)) and data collection priorities (document [EMS-04-02](#)) of an Electronic Monitoring System for tuna fisheries in the eastern Pacific Ocean. It was noted that the conclusions and recommendations reached at this workshop could impact other elements and actions to be considered for the other EMS components and subcomponents to be discussed in the future workshops (e.g., financial considerations of an EMS, EM review rate, EM coverage rate)

#### **2.1.1. Technical standards**

##### *General aspects of the technical standards*

Document EMS-04-01 outlines the specifications for selecting, installing, operating and maintaining the EM equipment (cameras, sensors, data storage devices, etc.) and the associated software aboard vessels, with clear and specific standards that are flexible enough, and performance-oriented as to accommodate technological advances, changes in priorities, and the particular requirements of vessels of different sizes, gears, and fishing practices.

Workshop discussion on this topic. As indicated in the document [WSEMS-04 Discussion summary](#), there was general agreement that the technical standards should focus on performance, allowing for high-quality EM records and generating high-resolution EM data, rather than prescribing specific technical attributes for achieving these goals. Some participants highlighted the importance of high-resolution data for fisheries management and suggested that the collected data should be more precisely defined. Additionally, one participant supported the second recommendation of the topic but suggested replacing

the word 'all', with 'to the extent possible'.

The IATTC staff agrees with these comments, and considers that the first recommendation reflects the opinions expressed. Therefore, the staff considers that the recommendations will remain as originally proposed:

*The standards need to be purpose and performance oriented, flexible enough and periodically reviewed by the Commission to accommodate technological advances and changes in priorities, as well as the particular requirements of vessels of different sizes, gears, and fishing practices.*

The IATTC staff considers that obtaining high-quality EM records requires adaptive EM equipment that interacts with the vessel's hardware and software, and that some flexibility should be included when common standards are adopted. Given these considerations, the staff suggests the recommendation would remain as originally proposed:

*Unless (or until) common standards are adopted, the EM equipment installed should be capable of working with all existing hardware and software and be adaptable to future technological developments.*

#### *Cameras*

As indicated in document EMS-04-01, cameras are the core of the EMS, they must be sufficient in number, quality and capability to record both video and still images in high definition and clarity to enable species identification in order to meet the requirements of the EMS. In addition, they must cover all the fishing activities carried in the tuna fisheries in the EPO (e.g., purse seine, longline, transshipments).

Workshop discussion on this topic. There were a range of different opinions on camera specifications. Some suggested that cameras shouldn't cover the surroundings of the vessel, as the images might not be clear or informative enough, while others asked whether the cameras were strong enough to withstand the conditions at sea and record the surroundings. Others remarked the need to move towards performance standards for the entire EM equipment functionality, rather than being very prescriptive on the operational specifications of the EM equipment. One participant asked whether the staff has defined the number and installation locations of cameras on purse seiners. Regarding longliners, some participants commented that three cameras on large longline vessels work very well, while others pointed out the three cameras would be not enough to record other longline EM data requirements such as the branchline material type (steel, monofilament, etc.). Finally, regarding the recommendation on CPCs requiring their vessels to cooperate with the installation of the EM equipment, two participants suggested to also include the "other stakeholders and relevant authorities involved".

The IATTC staff emphasized the importance of having a comprehensive view of all the activities surrounding the vessel, such as FADs drifting near the vessels, or identifying species or taxa interactions without bringing the animals on board. The staff clarified that it was not their intention to prescribe specific locations and numbers of the components of the EM equipment, including cameras. Instead, the staff aimed to share observations and lessons learned from the purse seine and longline pilot projects. There are too many variables and actions that should be covered when monitoring vessels and fishing operations. However, all of them must aim to images with high-resolution and clarity as to facilitate fishing activities and species identifications. Also, the staff considered the number of cameras proposed as a minimum to cover all the fishing activities both in purse seine and longline vessels, although is aware that the number and location of the cameras should be tailored for each vessel. Taking into account all opinions and the rationale provided, the staff maintains these recommendations as originally proposed:

*Cameras must be sufficient in number and quality to meet the data requirements of the EMS, with high-resolution images that allow the identification of species, specific fishing activities and the vessel's surroundings, and durable enough to withstand conditions at sea.*

Cameras should be capable of recording both video and still images, with a minimum frame rate of 15 frames per second (15 fps) and a minimum image capture interval of no more than 2 seconds, respectively.

For purse seine vessels, the cameras should cover, at a minimum, the working deck (both port and starboard sides), the net sack and the brailer, the foredeck or amidships, and (if applicable) the well deck and conveyor belt. A first proposal for location of cameras in class 2-6 purse seiners is provided in Annex 1, based on the experience of the pilot project [D.2.a](#).

On longliners, the cameras should provide, at a minimum, a view of all hooked fauna, both those brought aboard the vessel and those discarded or released without landing them on the vessel. A first proposal for the location of cameras on longliners is provided in Annex 2, based on information provided by the pilot project [C.2.b](#), EM service providers and other international initiatives.

Regarding the suggestion that a reference to "other stakeholders and relevant authorities involved" be included in the following recommendation, quoted below, the staff emphasized that the Flag CPC is the only single entity that may, through its relevant authority or authorities adopt and enforce the referred requirement. Consequently, the staff maintains this recommendation as originally suggested:

CPCs will require their vessels to cooperate with and facilitate the installation, maintenance and repair of cameras and other EM equipment according to the device placement design plan for their vessel or vessel type.

### *Sensors*

Sensors are used to collect additional information on vessel gear, navigation, and environmental data. It is essential that sensor data integrates time and geolocation information from the GPS receiver into the EM records, regardless of vessel and gear type. In vessels where cameras do not record continuously, fishing operations must be triggered by sensors to monitor activities of interest. The EM equipment should also be capable of integrating with general sensors, enabling the incorporation, activation, and recording of data from technological expansions currently in development, such as sensors that could remotely identify satellite buoys or scale sensors in the brail.

Workshop discussion on this topic. One participant expressed dissent over this recommendation, stating that the sensor equipment is highly specialized and sophisticated and that any damage could affect or even stop fishing operations. Hence, alternative methods such as using the information from the VMS could be used to detect fishing activities. Another participant mentioned that the recommendation states "may also include" and is not a requirement as written. Thus, the participant preferred to keep the sensor language as drafted.

Overall, the staff explained that the sensors indicate when to turn the some of the elements of the EM equipment on and off to record the start and end of a fishing activity, for example, which helps to reduce data storage. This data collection type and intention differ from that collected by VMS. Moreover, in some cases, the EM equipment may be recording all the time and sensors could just flag events in the records. Therefore, the staff considered leaving this recommendation as originally suggested:

*EM equipment may also include sensors for recording non-visual data (e.g. vessel movement, hydraulic pressure, environmental information), and also possibly mechanisms for activating/disactivating cameras so as to focus visual data collection during activities of interest.*

### Data storage

To ensure the secure archiving of all required imagery and sensor information (i.e. EM records) for a certain period, the EM equipment must have sufficient storage capacity. It is also recommended to use solid-state devices (SSD) and backup data storage devices to safeguard the integrity of the EM records. Provisions should also be made for vessels that exhaust their data storage capacity.

Workshop discussion on these topics. One participant suggested the need to define "fishing trip" since some fishing trips could last from a few days to several months, which would have implications for data storage. Other participants commented on the requirement for multiple data storage devices and noted that many hard drives would be required. They suggested that this should be an optional recommendation rather than a requirement.

The staff is aware that these data storage recommendations are essential to ensure that the generation of EM records is not compromised throughout the duration of the trip. Therefore, the staff considered leaving these recommendations as originally proposed:

*EM equipment should include sufficient capacity to store all required EM records, at a minimum, for the duration of a fishing trip.*

*Vessels should have onboard enough blank data storage devices (preferable solid-state drives) in case these must be replaced at sea. A specially trained crew member may need to replace the devices during a fishing trip if the data storage capacity is exhausted, always in coordination with the EM service provider.*

*EM equipment should include separate duplicate backup devices, to ensure that data are not lost if one device fails.*

### Compatibility

The IATTC databases have been designed and structured to incorporate and relate information from different sources such as vessel logbooks, observers' data, tuna tracking, etc. and to accommodate further data needs, including EM data. However, for the incorporation to be possible, the EM data must be compatible with the formats and protocols used by the IATTC data processing and storing tools.

Workshop discussion on these topics. Some participants noted that the longline data are collected by the flag State and the flag State must send the summarized data to the Secretariat. They emphasized that EMS should be considered only as a complementary program to the human observer program and only for scientific purposes.

The IATTC staff has repeatedly stressed that the 5% of data currently obtained from longliners with observers on board is not sufficient for scientific analyses. The staff believes that the EMS may bridge this gap in coverage, but EM data formats that are not standardized can be challenging to handle. Furthermore, they might not have the required resolution needed for fishery management based on science, unless or until performance-based standards are adopted. Moreover, the institutional structure of the EPO-EMS has not been decided yet by the Commission, and thus harmonization and compatibility of files should be promoted at this stage. Therefore, it is desirable to convert EM data to a format that is

compatible and easily usable for its integration into the IATTC databases. In this sense, the staff maintains its recommendations as originally drafted:

*EM equipment should use and generate records and/or data in a format compatible with IATTC databases and IT resources.*

#### *Malfunction/tampering*

Unlike malfunction and tampering recommendations proposed in document EMS-03-01 (rather related to management-like considerations), this recommendation aims to provide hardware and software requirements for the EM equipment and EM records to minimize potential equipment malfunctions or tampering events.

Workshop discussion on these topics. Opinions were divided on this topic. Some argued that the language should not require the equipment to be tamper-evident, and there were concerns about additional costs for the fishermen if automatic alerts were implemented. On the other hand, others suggested maintaining the recommendation as originally proposed, pointing out that automatic alerts are already built into the EM equipment and these costs are essentially already built into all vendor equipment.

The IATTC staff recognized the importance of verifying whether the EM records were collected reliably for generating EM data, and therefore, it is crucial to know whether the EM equipment has been altered or tampered with. Therefore, the staff suggests the recommendation would remain as initially proposed:

*EM equipment should be tamper-evident/resistant and send automatic alerts in real time to the appropriate EM program in cases of malfunctions, manual activation/shutdown, manual data input, external data manipulation, or attempts to tamper with the equipment or EM records. It should also be possible for data recording to be controlled manually, but only in case the EM equipment fails to start or stops automatically, and any manual activation should trigger an automatic alert. Manual shutdown should not be permitted.*

#### *Data encryption*

The staff has suggested that EM records should be encrypted to ensure the confidentiality of sensitive or proprietary data, as is done with other confidential data. Encryption could also provide a secure way of transmitting EM records to the EM review center.

Workshop discussion on these topics. One participant argued that this recommendation was unnecessary since the EMS is not currently used for compliance purposes, only for scientific purposes, and that EM analysis should be performed by the flag State. Therefore, there would be no need to encrypt images for transmission.

While the use of EMS for compliance purposes is still to be determined by the Commission, IATTC staff believes that encrypting data is important to ensure confidentiality. There is also a need to consider the possibility of illegal appropriation of information, and encryption can help prevent this problem. Given these considerations, the staff maintains this recommendation as originally proposed:

*EM equipment should be capable of transmitting EM records in encrypted form.*

#### *EM equipment maintenance*

In document EMS-04-01, it was also stated that provisions should be put in place to ensure the correct servicing, maintenance, and replacement of the EM equipment before reaching its specified life-span limits or if affected during normal fishing activities. These provisions should be coordinated with EM service providers to ensure that the EM equipment is properly maintained, replaced or repaired, either

on land or at sea, in accordance with the agreed technical standards.

Workshop discussion on these topics. A participant suggested that the term “official technician” might be misinterpreted and recommended a different term. The discussion then shifted to the importance of camera lens cleaning, with several participants emphasizing the need for clear, high-quality images. They noted that lenses get splashed and fogged after each set, so efforts should be made to obtain high-quality images. Although some participants felt the recommendations were very specific, they agreed that CPCs should ensure that each vessel provides quality information. However, one participant expressed concerns about crew safety issues due to the cameras’ high locations. In response, another participant pointed out that cameras susceptible to getting dirty or splashed are not in high locations, so safety should not be a concern.

No specific feedback was provided on the following recommendation; hence the staff maintains the original recommendation:

*At sea, all maintenance, repairs and replacement activities of EM equipment should be conducted by a specially trained vessel crew member, only in coordination and when instructed to do so remotely by the EM service provider.*

The staff has recognized that the modification suggested would enhance the clarity of the recommendation, and has agreed to use the term "approved technician" instead of "official technician". As a result, the recommendation has been revised and edited accordingly:

*On land, all maintenance, repairs and replacement activities of EM equipment should be conducted by an approved technician, in coordination with EM service provider.*

The staff acknowledges that the clarity and quality of EM records is ensured by regularly cleaning the camera lenses to meet the required performance-oriented standards without specific prescriptions. However, the protocols mentioned in this recommendation were based on experiences from the pilot projects on purse seine and longline vessels, with the objective of obtaining high-quality EM records. Therefore, the staff has decided to maintain this recommendation as originally proposed:

*Each vessel must have a designated crew member responsible for routine camera lenses cleansing, per a specific protocol, to ensure the clarity of EM records. The protocol should include the following instructions: i) the lenses of cameras operating within 10 meters of any fishing activity must be wiped clean before every set; ii) the lenses of all other cameras must be wiped clean once every week. Appropriate cleaning materials must be used to avoid lenses damage and should always be available onboard.*

### **2.1.2. Data collection priorities**

#### *Overview of priorities in data collection*

As indicated in document EMS-04-02, the main objective of an EPO-EMS is to improve the quality and availability of data that the IATTC staff needs to carry out the functions stipulated in Article XIII of the [Antigua Convention](#). However, some of the data required for their conservation and management are either not collected or not accessible to the staff, and there are disparities among fisheries and fleets in terms of data availability. The catches and discards of target and non-target species, by species and size, as well as the information of fishing effort and fishing operations are data of greatest value to the staff to identify the best species management options for their conservation. However, the staff is mindful that the priorities for collecting this information should be flexible to meet research objectives, needs and advances, and should go in line with the evolving Commission’s priorities, the Strategic Science Plan (SSP),

and staff's scientific needs. Differences in the priority-level of variables for data collection, as well as the feasibility to collect them with EM, were also presented in the document EMS-04-02.

Workshop discussion on this topic. Although, as stated in document WSEMS-04 Discussion Summary, a participant noted that the purpose of EMS is not necessarily compliance monitoring but rather for scientific data collection. The participant argued that if the purpose of EMS were to include compliance monitoring, the government would have to bear the costs, as the EM review rate could rise to 100%. Therefore, the participant proposed excluding all matters related to compliance. Another participant agreed with these comments and added that funding research activities and sensors activated to monitor fishing activities on longliners should not be supported by the Commission since the EPO-EMS is not intended for compliance purposes. However, they noted that this may be different for purse seine vessels.

Although the staff acknowledges the views expressed by participants and highlights that the Commission has yet to decide on the goals of the EPO-EMS, whether they are for scientific and/or compliance purposes, they wish to emphasize that the objective of the Antigua Convention is "to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention, in accordance with the relevant rules of international law." Moreover, Article XVIII on implementation, compliance, and enforcement by Parties stipulates that each Party shall, "authorize the use and release, subject to any applicable rules of confidentiality, of pertinent information recorded by on-board observers of the Commission or a national program" and ensure that vessel owners and captains allow for the collection and analysis of "information necessary for carrying out the functions of the Committee for the Review of Implementation of Measures Adopted by the Commission."

In implementing the Antigua Convention, including these specific provisions, IATTC staff analyzes all available data sources, including observer data to monitor compliance with active resolutions, and considers EMS data to be a valuable Monitoring Control and Surveillance (MCS) tool that could help the CPCs implement their obligations under the Convention. Therefore, despite the concerns expressed by some participants, the staff maintains its original recommendation:

*Priorities for EM data collection should be established, taking into account, among others, the provisions of the Antigua Convention, the IATTC Strategic Science Plan, the status and vulnerability of species, and the needs for compliance monitoring.*

*The Commission should support and ensure the funding of research activities that would improve EM data collection for scientific and compliance purposes (e.g., sensors that could remotely identify satellite buoys attached to FADs, accurate identification of certain fishing activities, other fishery components).*

#### *Purse seine vessels*

For this fishery, the pilot project D.2.a, provided a baseline for evaluating which data fields might be reliably recorded by EM as a basis for later analysis (see Appendix 2, modified from Annex 1, EMS-04-02; using Emery et al. (2018) 'ready/possible' categories).

There were no comments resulting from this recommendation, thus the recommendation remains as originally proposed:

*Recognize, on a provisional basis, the need to collect for the purse seine fishery, at a minimum, the fields presented in Appendix 2.*

#### *Longline vessels*



The staff noted that for the longline fishery, they do not typically obtain longline logbooks or other catch and effort data directly from vessels. Instead, this information is collected, analyzed, and reported in a summarized form by CPCs. As a result, there is limited information on gear characteristics, discards, and bycatches. However, through Resolution C-19-08, the staff is now receiving detailed operational-level observer data, with complete catch and discard information. It should be noted that this data is submitted under a 5% observer coverage basis, which is considered not enough for scientific matters (below the recommended 20% coverage level). The staff discussed the potential of EM to collect the minimum data fields specified in C-19-08 ([option \(i\)](#)- WCPFC harmonized), as summarized in Appendix 3 (modified from Annex 2 of document EMS-04-02 using Emery et al. (2018) 'ready/possible' categories). The staff emphasized that the data established in Appendix 3 are still provisional/preliminary, and are useful at least until a better position to assess the capabilities of EPO-EM on longline vessels is reached, following the completion of the pilot project (C.2.b).

Workshop discussion on this topic. Regarding data collecting fields included in Appendix 3, one participant suggested that collecting information on the geographical location of vessels every two seconds is excessive for longliners.

Regarding this observation, the staff explained that it is regular practice that the central computer of the EM equipment is capable of automatically watermarking the GPS location data at two-second intervals. Additionally, using this capability could eliminate the need for a separate vessel monitoring system, such as VMS equipment, since it records location information with even higher resolution. Therefore, the staff stands by their original recommendation:

*Recognize, on a provisional basis, the need to collect for the longline fishery, at a minimum, the fields presented in Appendix 3.*

## 2.2. Financial considerations of an EMS

The staff organized the [5<sup>th</sup> Workshop of an Electronic Monitoring System in the eastern Pacific Ocean: Financial considerations](#) to discuss the multiple economic variables involved in financing an EPO-EMS, and the administrative mechanisms and role that the Commission should play in determining the financial aspects of an EMS. The staff acknowledged that these implementing an EMS would require additional resources and costs for the CPCs. Therefore, the multiple economic variables should aim for a cost-efficient system that meets the purposes identified by the Members, with associated costs being shared in a transparent manner and monitored by a suitable body. These aspects are described in detail in the [EMS-05-01](#).

### *Assessing the economic implications of an EMS for the tuna fisheries in the EPO*

In document EMS-05-01, the staff explains the rationale for conducting a cost-benefit analysis to assess the economic implications and value of the EPO-EMS. The document presents two examples of fisheries, other than the EPO tuna purse-seine, that reported high levels of economic benefits relative to costs.

While highlighting these studies, the staff emphasizes that conducting a cost-benefit analysis for the purse-seine fishery in the EPO is necessary to fully understand the economic value of EM and to consider its use for all EPO tuna fisheries. Additionally, Rogers et al. (2021) suggest that the economic variables considered as significant sources of value may differ between fisheries and RFMOs. Therefore, lessons learned from one fishery may not be fully applicable to others, including the purse-seine fishery in the EPO.

There were no comments resulting from this recommendation, thus the recommendation remains as originally suggested:

*Consider the results of the cost-benefit analysis for longline fisheries, as reported in Rogers et al. (2021), and conduct a similar analysis for purse seine fisheries to facilitate a more efficient implementation of an EMS in the EPO.*

#### *Establishing financing, cost-allocation procedures and responsibilities for EMS and its components*

Document EMS-05-01 also stressed the need to identify all the associated costs and establish procedures, mechanisms, and responsibilities for effectively financing an EMS implemented and maintained in the long term. Towards this end, some approaches were presented, with emphasis on 'Cost-recovery', including some of its types, some key elements to consider when optimizing these costs aiming to add economic value to EM, and the need to explore options and design guidelines for the recovery of costs of an EPO-EMS.

Workshop discussion on this topic. Several opinions were expressed regarding cost-recovery in relation to EM programs. One participant expressed concern about how to explain cost-recovery to fishers, suggesting that the term "cost-justification" might be more appropriate. The IATTC staff responded that they could not provide many details on what a cost-recovery plan should look like at this stage, but that they were informing participants of existing alternatives and successful examples in other regions and fisheries. The staff also noted that cost-recovery did not necessarily have to be implemented at the IATTC program level but could be coordinated through the IATTC at the national level following the AIDCP model. Another participant asked which program the recommendations were aimed at, and a staff member suggested that a possibility could be a hybrid system where centralized EM programs would be used for purse seine fisheries, and national-based EM programs for longlines. However, these details are still to be discussed and decided. Participants also noted that costs would need to be considered at the Commission level for data derived from national programs.

Participants agreed that, given the nature of the EM workshops, they should not try to limit options but should instead provide options for discussion in policy meetings. They suggested removing the word "procedures" from the first recommendation related to this topic. It was also noted that it is difficult to discuss specific details on many of these financial matters before the institutional structure of the EMS has been adopted.

Finally, participants expressed support for focusing EM on longliners first, as robust observer programs are already in place for purse seine vessels. The participants suggested that cost-benefit analyses for purse-seines should focus more on EM to further increase observer coverage, particularly for smaller purse seine vessels that don't bring observer on board. Overall, support was expressed for the first recommendation.

The staff, mindful of the modification suggested for the recommendation below to improve clarity, revised the recommendation to read as follows:

*Establish cost-allocation and financing options for all expenses related to implementing and maintaining an EMS and its components (e.g. EM equipment, installation, technical assistance both at sea and at EM review centers, and EM analysis, including training, hardware and software).*

As for the second recommendation, the IATTC staff is mindful that it is difficult to provide specific details regarding what a cost-recovery plan would look like for the IATTC at this stage, and therefore, it cannot recommend a specific financial approach. Instead, the staff is providing information on the various alternatives provided by other studies, including EM programs that have been implemented with specifically tailored cost-recovery plans. Toward this end, the staff advocates the need to consider that a cost-recovery plan and guidelines are included as part of the EMS implementation and supports cost-recovery studies to identify all the associated costs and establish mechanisms for cost-sharing

arrangements and other relevant financing aspects. Consequently, the recommendation remains as originally proposed:

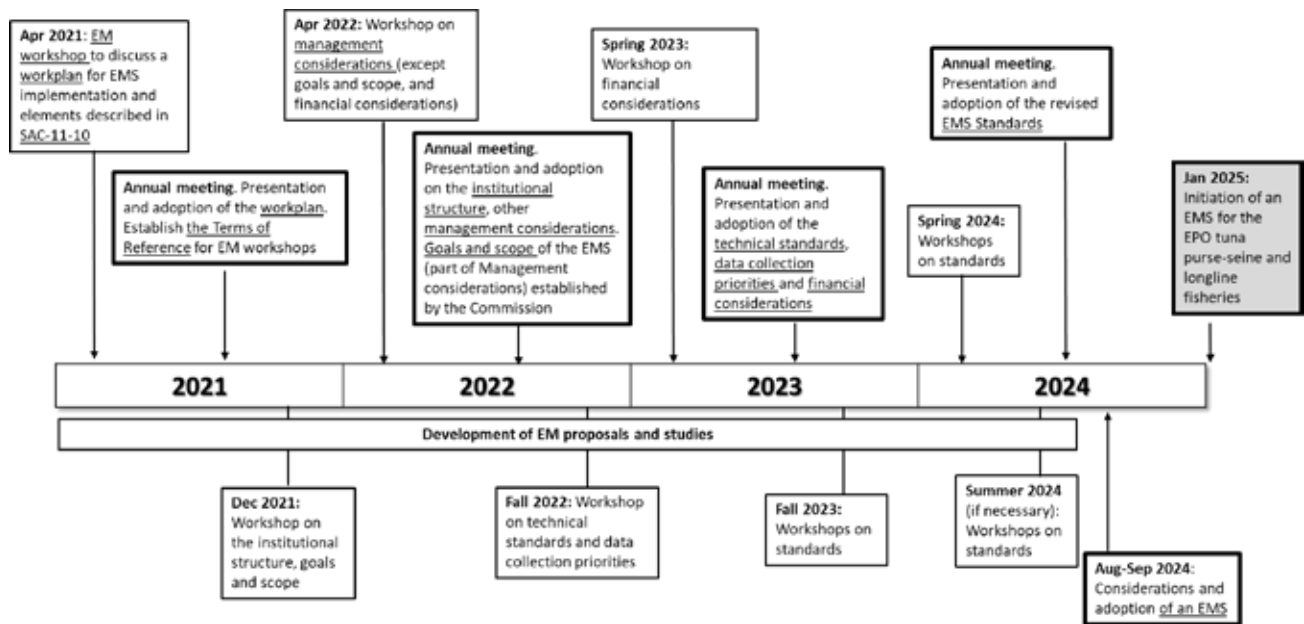
*Conduct cost-recovery studies to explore options, and develop guidelines, for the recovery of costs of an EPO-EMS.*

*Committee reviewing and monitoring the EPO-EMS*

Document EMS-05-01 described the need for EMS to be monitored and reviewed by a suitable body. In the case of the IATTC, the staff considers reasonable that the Committee on Administration and Finance (CAF) could be required to undertake this task as it is responsible for advising and recommending on all the matters related to the financial administration of the Commission.

This recommendation was not the subject of substantive comments, and thus, it remains as originally proposed:

*The Committee on Administration and Finance (CAF) should review and monitor the financial and administrative aspects of the EMS, and subsequently submit relevant recommendations to the Commission.*



**FIGURE 1.** Commission’s adopted workplan on the implementation of an EMS for the tuna fisheries in the EPO.  
**FIGURA 1.** Plan de trabajo adoptado por la Comisión para la implementación de un SME para las pesquerías de atún en el OPO.

**TABLE 1.** Timetable of activities in the workplan adopted by the Commission.

**TABLA 1.** Calendario de actividades del plan de trabajo adoptado por la Comisión.

2021													
Semester 1						Semester 2							
Month 1	2	3	4			5	6	7	8	9	10	11	12
Jan 1, 2021. Cont. Pilot project of EM in the purse-seine fishery (D.2.a).													
Feb. Pilot project of EM in the longline fishery (C.2.b).													
Mar. Exploring technologies for remote FAD identification (C.1.a).													
						Jun: Cost-benefit analysis of EM for tuna fisheries in the EPO.							
Spring. EM workshop to discuss a work plan for EMS implementation and elements described in SAC-11-10.						Annual meeting. Presentation and adoption of the workplan. Establish the Terms of Reference for EM workshops.			Fall. Workshop on the institutional structure and EMS objectives and scope.				
Development of new EM proposals and studies													
2022													
Semester 3						Semester 4							
Month 13	14	15	16		17	18	19		20	21	22	23	24
Jan 1, 2022. Cont. Pilot project of EM in the longline fishery (C.2.b).													
Jan. Cont. Exploring technologies for remote FAD identification (C.1.a).													
Jan. Analysis to define EM sampling coverage and EM data review rates (purse-seine fishery). <i>(subject to/pending decisions on EMS objectives)</i>													
Spring. Workshop on management considerations (except Goals and scope, and financial considerations)						Jul/Aug. Annual meeting. Presentation and adoption on the institutional structure, other management considerations. Goals and scope of the EMS (part of Management considerations) established by the Commission			Fall. Workshop on technical standards and data collection priorities.				
Development of new EM proposals and studies													
2023													
Semester 5						Semester 6							
Month 25			26	27	28	29	30	31	32	33	34	35	36

Jan 1, 2023. Cont. Pilot project of EM in the longline fishery (C.2.b).																
Jan. Analysis to define EM sampling coverage and EM data review rates (longline fishery). (subject to/pending decisions on EMS objectives)																
						Spring. Workshop on financial considerations		Jul/Aug, annual meeting. Presentation and adoption of the technical standards, data collection priorities and financial considerations.		Fall. Workshop on standards (1)						
Development of new EM proposals and studies																
2024																
Semester 7						Semester 8										
Month 37	38	39	40	41	42	43	44	45	46	47	48					
			Spring. Workshop on standards (2)		Jun. Workshop on standards (3) *if necessary	Jul/Aug, Annual meeting. Presentation and adoption of the revised EMS Standards.										
								Aug/Sep. Final consideration and adoption by the Commission of the whole set of EMS components for the purse-seine and longline fishery on the basis of the conclusions and recommendations of the EMS workshops as well as the discussion and decisions of the Commission during its intervening meetings as described in the workplan and in this timetable.  The EM equipment should be installed and the EMS operative before Jan 1, 2025, or on a date to be agreed upon by the Commission based on the conclusions and recommendations of the EM workshops described in the workplan and in this timetable.								
Development of new EM proposals and studies																
2025																
Semester 9						Semester 10										
Month 49						50	51	52	53	54	55	56	57	58	59	60
Jan 1, 2025, or on a date agreed upon by the Commission, initiation of an EMS for the tuna fisheries in the EPO																
Development of new EM proposals and studies																

## APPENDIX 1

List of the revised recommendations presented in the EMS workshop documents EMS-02-01, EMS-02-02, EMS-03-01, EMS-04-01, EMS-04-02 and EMS-05-02.

### Institutional structure

#### *Structure of the EMS program*

Establish a single, unified EMS Program for the EPO following the International Dolphin Conservation Program (IDCP) model, in which databases, standards, procedures and protocols are standardized across all components/individual programs and are compatible with existing IDCP and IATTC practices.

#### *Rules and procedures: standardization and compatibility*

Agree that national EMS programs that may be set up to complement the IATTC EMS Program, can be fully or partially contracted out to third parties, but only if they apply the common standards, protocols, procedures, and databases of the overarching EPO EMS Program.

#### *Harmonization and compatibility of EPO EMS with WCPFC EMS*

To the extent practical, seek to ensure harmonization and compatibility of EPO EMS with WCPFC EMS procedures and standards among others to facilitate cooperation and exchange of information as appropriate and necessary between the two organizations.

#### *Data: integration, access and sharing*

Agree that all EM data resulting from national EMS programs (and, if required for research purposes, the underlying EM records) be shared with the IATTC staff.

Task the IATTC staff with coordinating the EPO EMS and integrating all derived EM data for their future utilization and analysis, as appropriate.

### Goals and scope

#### *Goals*

The EPO EMS should generate data to be made available for use in both scientific and compliance related activities, as defined by the Members.

#### *Scope*

The EPO EMS should include the following types of vessels operating in the IATTC Convention Area: tuna purse-seine vessels of all sizes; all longline vessels of 12 meters in length or more and motherships of longline vessels less than 12 meters in length, and transshipment authorized carriers.

### EMS Management considerations

#### **Coordination and compatibility**

The EPO EMS should, to the extent practicable, be designed to operate as part of, or in close coordination with, the existing observer programs and other relevant data-collection programs, to maximize efficiency and avoid unnecessary duplication of effort and/or data collected.

## Confidentiality

The Commission should consider whether it is necessary to clarify or amend IATTC and AIDCP data confidentiality rules to ensure that they are adapted to the circumstances and requirements related to the implementation of an EMS, in particular to guarantee the personal and commercial privacy and confidentiality of EM records and EM data.

## Compliance

### *Non-compliance with measures adopted by the IATTC*

Non-compliance with EM standards and requirements established pursuant to other IATTC decisions (e.g., IATTC Resolutions) should be referred to the relevant Members for investigation and further consideration, and also reported to the Review Committee for recommended improvements to increase compliance, or other actions, as appropriate.

### *Regulation-adapting process*

The Commission will take all appropriate measures to promote and improve compliance, including through the appropriate capacity building activities.

## EM equipment

### *EM equipment installation, malfunction and manipulation*

The Commission should establish policies and procedures for installation, use, and repair of EM equipment malfunctions, and prevention of tampering.

The EM equipment should be capable of detecting, recording and reporting malfunctions, and instances of possible tampering.

### *Robustness of the equipment*

EM records storage devices should be capable of securely storing, and preventing external data input or manipulation. Cameras and other sensors should be weather and tamper-evident as well, but also capable of allowing repair by vessel crew when at sea in coordination with EM service providers, as needed.

### *Provisions when EM equipment is nonfunctional*

Vessels should be prohibited from leaving port unless their EM equipment is functioning properly.

If the EM equipment ceases to record useful or sufficient data, the vessel should be required to return to port in a reasonable timeframe when at-sea repair is not feasible.

## EM coverage and review rate

### *EM coverage*

The objective of EM coverage should be 100% coverage for all longline and purse-seine vessels and trips, with an interim objective of making sure that programmatic coverage at less than 100% must be representative of all fleets and fishing strategies.



## *EM review rate*

When a vessel has operational EM equipment, it should be used to monitor all fishing activities conducted by that vessel for the entire trip.

Separate EM review rates should be established for compliance and for science, taking into account costs and feasibility.

For those EM data fields that do not require an EM review rate of 100%, the review rate should be established on a scientific basis (e.g., through the analysis of EM data provided by the Projects D.2.a, C.2.b). Results should be discussed in a workshop (possibly in fall 2022) involving stakeholders with experience in fisheries EM programs and presented to the SAC, before being transmitted to the Commission.

EM review rates should be reviewed periodically so that they are revised, if necessary, following results of analysis of EM data.

## **Technical standards**

### *General aspects of the technical standards*

The standards need to be purpose and performance oriented, flexible enough and periodically reviewed by the Commission to accommodate technological advances and changes in priorities, as well as the particular requirements of vessels of different sizes, gears, and fishing practices.

Unless (or until) common standards are adopted, the EM equipment installed should be capable of working with all existing hardware and software and be adaptable to future technological developments.

### *Cameras*

Cameras must be sufficient in number and quality to meet the data requirements of the EMS, with high-resolution images that allow the identification of species, specific fishing activities and the vessel's surroundings, and durable enough to withstand conditions at sea.

Cameras should be capable of recording both video and still images, with a minimum frame rate of 15 frames per second (15 fps) and a minimum image capture interval of no more than 2 seconds, respectively.

For purse seine vessels, the cameras should cover, at a minimum, the working deck (both port and starboard sides), the net sack and the brailer, the foredeck or amidships, and (if applicable) the well deck and conveyor belt. A first proposal for location of cameras in class 2-6 purse seiners is provided in Annex 1, based on the experience of the pilot project [D.2.a](#).

On longliners, the cameras should provide, at a minimum, a view of all hooked fauna, both those brought aboard the vessel and those discarded or released without landing them on the vessel. A first proposal for the location of cameras on longliners is provided in Annex 2, based on information provided by the pilot project [C.2.b](#), EM service providers and other international initiatives.

CPCs will require their vessels to cooperate with and facilitate the installation, maintenance and repair of cameras and other EM equipment according to the device placement design plan for their vessel or vessel type.

### *Sensors*

EM equipment may also include sensors for recording non-visual data (e.g. vessel movement, hydraulic pressure, environmental information), and also possibly mechanisms for activating/disactivating cameras so as to focus visual data collection during activities of interest.

### *Data storage*

EM equipment should include sufficient capacity to store all required EM records, at a minimum, for the duration of a fishing trip.

Vessels should have onboard enough blank data storage devices (preferable solid-state drives) in case these must be replaced at sea. A specially trained crew member may need to replace the devices during a fishing trip if the data storage capacity is exhausted, always in coordination with the EM service provider.

EM equipment should include separate duplicate backup devices, to ensure that data are not lost if one device fails.

### *Compatibility*

EM equipment should use and generate records and/or data in a format compatible with IATTC databases and IT resources.

### *Malfunction/tampering*

EM equipment should be tamper-evident/resistant and send automatic alerts in real time to the appropriate EM program in cases of malfunctions, manual activation/shutdown, manual data input, external data manipulation, or attempts to tamper with the equipment or EM records. It should also be possible for data recording to be controlled manually, but only in case the EM equipment fails to start or stops automatically, and any manual activation should trigger an automatic alert. Manual shutdown should not be permitted.

### *Data encryption*

EM equipment should be capable of transmitting EM records in encrypted form.

### *EM equipment maintenance*

At sea, all maintenance, repairs and replacement activities of EM equipment should be conducted by a specially trained vessel crew member, only in coordination and when instructed to do so remotely by the EM service provider.

On land, all maintenance, repairs and replacement activities of EM equipment should be conducted by an official technician, in coordination with EM service provider.

Each vessel must have a designated crew member responsible for routine camera lenses cleansing, per a specific protocol, to ensure the clarity of EM records. The protocol should include the following instructions: i) the lenses of cameras operating within 10 meters of any fishing activity must be wiped clean before every set; ii) the lenses of all other cameras must be wiped clean once every week. Appropriate cleaning materials must be used to avoid lenses damage and should always be available onboard.

## Data collection priorities

### *Overview of priorities in data collection*

Priorities for EM data collection should be established, taking into account, among others, the provisions of the Antigua Convention, the IATTC Strategic Science Plan, the status and vulnerability of species, and the needs for compliance monitoring.

The Commission should support and ensure the funding of research activities that would improve EM data collection for scientific and compliance purposes (e.g., sensors that could remotely identify satellite buoys attached to FADs, accurate identification of certain fishing activities, other fishery components).

### *Purse seine vessels*

Recognize, on a provisional basis, the need to collect for the purse seine fishery, at a minimum, the fields presented in Appendix 2.

### *Longline vessels*

Recognize, on a provisional basis, the need to collect for the longline fishery, at a minimum, the fields presented in Appendix 3.

## Financial considerations

### *Assessing the economic implications of an EMS for the tuna fisheries in the EPO*

Consider the results of the cost-benefit analysis for longline fisheries, as reported in Rogers et al. (2021), and conduct a similar analysis for purse seine fisheries to facilitate a more efficient implementation of an EMS in the EPO.

### *Establishing financing, cost-allocation procedures and responsibilities for EMS and its components*

Establish cost-allocation and financing options for all expenses related to implementing and maintaining an EMS and its components (e.g. EM equipment, installation, technical assistance both at sea and at EM review centers, and EM analysis, including training, hardware and software).

Conduct cost-recovery studies to explore options, and develop guidelines, for the recovery of costs of an EPO-EMS.

*Committee reviewing and monitoring the EPO-EMS*

The Committee on Administration and Finance (CAF) should review and monitor the financial and administrative aspects of the EMS, and subsequently submit relevant recommendations to the Commission.

**Appendix 2.** A first assessment of data fields that should be collected, at a minimum, for the purse seine fishery, based on SAC-11-10 and the pilot project [D.2.a](#).

**1) Trip information**

- a) Depart port, arrival port.
- b) Depart date/time, arrival date/time.

**2) Vessel activity**

- a) Speed and geographical position of the vessel every 2 seconds.

**3) Set information**

- a) Type of the set.
- b) Date/time of the start of the set, rings up, and the end of the set.
- c) Position (latitude and longitude, in decimal degrees) of the set.
- d) Wind speed (Beaufort scale).
- e) The time and date, as well as potential reason, of any major malfunction that stops or delays the setting maneuver.

**4) Target species**

- a) Total catch, size and discards per set for skipjack, and for yellowfin and bigeye, as feasible as EM technology allows. In cases where species identification is not possible, the combined catch may be reported. For sizes, weight categories shall be used whenever possible (i.e. small <2.5 kg., medium >2.5 kg.- <15kg., large >15 kg.).

**5) Non-target species**

Catch, size and fate of individuals: requiem sharks, hammerhead sharks, thresher sharks, lamnid sharks, whale shark, mobulid rays, billfishes, scombrids, carangids, triggerfishes, sea turtles, sea birds, and marine mammals, where each individual will be identified to the lowest taxonomic resolution possible (i.e., species), as feasible as EM technology allows. In cases where species identification is not possible, the animal may be identified to a broader taxonomic resolution (e.g., genus, family). Wherever possible, individuals shall be measured to the nearest cm as follows: sharks in total length, billfishes in post-orbital fork length, fishes in fork length, rays in disc width, turtles in curved carapace length. In cases where individual measurement is not possible, the animal may be classified by size category (i.e., small, medium, large) following IATTC observer practices.

**6) Floating objects/FADs**

- a) Location, date, time for each FAD deployment.
- b) Location, date, time for each FAD retrieval.

**Appendix 3.** A first assessment of data fields that should be collected, at a minimum, for the longline fishery, based on SAC-11-10.

The ability of EM to collect the data specified in C-19-08 ([option \(i\)](#)) is summarized in Appendix 3 of [SAC-11-10](#). However, the staff has no practical experience of EM on longline vessels and, since fisheries are region-specific, it will be in a better position to assess the capabilities of EM on longline vessels after the proposed pilot study (Project [C.2.b](#)) is completed. For the purposes of this document, and although it could be revised in the future, the recommendations of the IATTC staff on the observer data fields for longliners that EM should collect, at a minimum, are as follows:

1) **Trip information**

- a) Depart port, arrival port.
- b) Depart date/time, arrival date/time.

2) **Vessel activity**

- a) Speed, geographical position of the vessel, at a minimum, every 2 seconds.

3) **Set information**

- a) Date/time of the start, and the end of the set.
- b) Position (latitude and longitude, in decimal degrees) of the start and end of the set.
- c) Date/time of the start, and the end of the hauling.
- d) Position (latitude and longitude, in decimal degrees) of the hauling.
- e) Haul direction.
- f) Use of blue-dyed bait (Yes-No).
- g) Total number of baskets or floats.
- h) Total number of hooks used.
- i) Wire traces on some or all of its branch lines (Yes-No).
- j) Number of shark lines (branch lines running directly off the longline floats or drop lines).

4) **Target and non-target species**

- a) The species identification of each individual caught.
- b) Size of each individual caught, using the recommended measurement approach and the appropriate measurement code (standard, furcal, post-orbital, width of the disc, etc.) for the species.
- c) The estimated condition of the individual when caught, brought on deck and released.
- d) Fate of the individual brought on deck (e.g. retained, discarded, etc.)
- e) Tag recovery information.

The type of interaction with the catch (e.g. entangled, hooked internally, hooked externally, interaction with vessel only.)