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

Online, 15 - 17 November 2021

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ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
AIS	Automatic Identification System
ALDFG	Abandoned, Lost or otherwise Discarded Fishing Gear
ALB	Albacore tuna
BET	Bigeye tuna
BLM	Black marlin
BLT	Bullet tuna
BUM	Blue marlin
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
COM	Narrow-barred Spanish mackerel
CPCs	Contracting parties and cooperating non-contracting parties of the IOTC
CPUE	Catch Per Unit of Effort
DGCF	Directorate General of Capture Fisheries (Indonesia)
DFAD	Drifting FAD
DFAR	Department of Fisheries and Aquatic Resources (Sri Lanka)
DOI	Digital Object Identifier
EEZ	Exclusive Economic Zone
EM	Electronic Monitoring
EMS	Electronic Monitoring System
ERA	Ecological Risk Assessment
ETP	Endangered, Threatened, and Protected species
EU	European Union
FAD	Fish aggregating device
FAO	Food and Agriculture Organization of the UN
FIRMS	Fisheries and Resources Monitoring System
FOB	Floating OBject
FRI	Frigate tuna
GEF	Global Environmental Facility
GUT	Indo-Pacific king mackerel
GTA	FIRMS Global Tuna Atlas
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IEO	Instituto Español de Oceanografía (EU,Spain)
IFREMER	Institut Francais de Recherche pour l`Exploitation de la Mer (EU,France)
IOC	Indian Ocean Commission
IOTC	Indian Ocean Tuna Commission
IRD	Institut de Recherche pour le Développement (EU,France)
I.R. Iran	Islamic Republic of Iran
ISSF	International Seafood Sustainability Foundation
KAW	Kawakawa
LOT	Longtail tuna
MLS	Striped marlin
MMAF	Ministry of Marine Affairs and Fisheries (Indonesia)
NARA	National Aquatic Resources Research and Development Agency (Sri Lanka)
OFCF	Overseas Fishery Cooperation Foundation (Japan)
OPAGAC	Organización de Productores de Atún Congelado (EU,Spain)
PET	Protected, Endangered and Threatened species
RFMO	Regional Fisheries Management Organization
ROS	Regional Observer Scheme
SC	IOTC Scientific Committee
SFA	Seychelles Fishing Authority (Seychelles)
SFA (fish)	Indo-Pacific sailfish
SSI	Species of Special Interest
SWO	Swordfish
Taiwan,China	Taiwan Province of China
USTA	Unité Statistique Thonière d'Antsiranana (Madagascar)
VMS	Vessel Monitoring System
WPB	Working Party on Billfish of the IOTC
WPDCS	Working Party on Data Collection and Statistics of the IOTC

WPEB	Working Party on Ecosystems and Bycatch of the IOTC
WPTmT	Working Party on Temperate Tunas of the IOTC
WPNT	Working Party on Neritic Tunas of the IOTC
WPTT	Working Party on Tropical Tunas of the IOTC
WCPFC	Western and Central Pacific Fisheries Commission
WWF	World Wide Fund for nature
YFT	Yellowfin tuna

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: ***From a subsidiary body of the Commission to the next level in the structure of the Commission:***
RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g., from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: ***From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:***
REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: ***General terms to be used for consistency:***
AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.
NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g., **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 1st Session of the Indian Ocean Tuna Commission's (IOTC) Ad-hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS) was held online on Zoom from 15 - 17 November 2021. A total of 79 participants attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the interim Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

The following are the recommendations from the WGEMS01 to the Working Party on data Collection and Statistics, which are provided in Appendix VI.

Review of CPCs EMS pilot projects and programmes

WGEMS01.01: **NOTING** the delay in the completion of the small-scale EMS pilot project due to the insurgence of the CoViD pandemic, the WGEMS **RECOMMENDED** that the project continues, with future activities included in the WPDCS work plan, and that similar studies are prioritized in the workplan of IOTC WGEMS as well. The WGEMS also **REQUESTED** EM technology providers to liaise with the Secretariat to assess the possibility that EMS data are exported in an electronic format compatible with the ROS electronic formats, for future incorporation within the IOTC databases (Para. 52).

Development of the TORs of the WG - General discussion

WGEMS01.02: The WGEMS **NOTED** the progress made during the current meeting to discuss issues related to Electronic Monitoring Systems but also **NOTED** that much work is required in the future. As such the WGEMS **RECOMMENDED** that the WPDCS endorse the continuation of the ad hoc Working Group on Electronic Monitoring Systems Standards (Para. 81).

Next Meetings

WGEMS01.03: **NOTING** that the WCPFC Commission has agreed the objectives and the scope of the EM program to facilitate the development of EM standards, the WGEMS **RECOMMENDED** that early in the process a workshop including scientist and managers is organized to advance dialogue on these issues (Para. 84).

WGEMS01.04: The WGEMS **NOTED** that although the focus in the current meeting is on the scientific aspects of EMS as required by IOTC Resolution 11/04 on a Regional Observer Scheme, there is a potential to use EMS to address compliance issues as well. The WGEMS therefore **RECOMMENDED** that future WGEMS meetings include participation of scientists as well as compliance experts to advance the discussions on the benefits and use of EMS in the IOTC (Para. 85).

1. Opening of the Meeting

1. The 1st Session of the Indian Ocean Tuna Commission's (IOTC) Ad hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS) was held online on Zoom from 15 - 17 November 2021. A total of 79 participants attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the interim Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

2. Adoption of the Agenda and arrangements for the session

2. The WGEMS **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WGEMS are listed in Appendix III.

3. Background and Objectives of the Working Group

3. The WGEMS **NOTED** a brief presentation provided by the chair on the background and objectives of the current Working Group. The presentation described the various requirements on IOTC Resolutions in relation to the implementation of Electronic Monitoring Systems in IOTC. For example, Resolution 11/04 on a Regional Observer Scheme and Resolution 16/04 on the Implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC.

4. The WGEMS **NOTED** that following a consultation workshop in 2018, convening experts from several oceans and fisheries, the IOTC Commission endorsed in 2019 the ROS minimum standard data fields for scientific observer data collection, however, as of today no specific minimum data collection standards for EMS have been identified (in terms of minimum coverage levels for both observation and analysis) nor an evaluation has been attempted to determine whether EMS can effectively collect all of the adopted ROS minimum standard data fields.

5. The Chair also **PRESENTED** the short history of the work on Electronic Monitoring by the IOTC SC and how the intersessional Working Group on the development of EM Programme Standard was constituted to further progress with the definition of EMS minimum standards. With this background, this presentation set the scene and defined the objectives of the meeting for further discussion.

4. The IOTC Regional Observer Scheme and Regional Observer Pilot Project

6. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-09 which included an update on the Implementation of the IOTC Regional Observer Scheme (ROS).

7. The WGEMS **NOTED** the estimates of observer coverage for purse seine and longline fleets for the last five years (2016-2020) and **ACKNOWLEDGED** that several of them do not reach the minimum required observer coverage as per Res. 11/04.

8. Therefore, the WGEMS **SUGGESTED** that a combination of EMS and human observers be considered as a way to improve overall performances in this regard.

9. The WGEMS **NOTED** the process followed for developing Regional Observer Scheme scheme standards including an expert workshop that developed those minimum standards that were, subsequently, endorsed by the SC and the Commission. The WGEMS **AGREED** that it could be a good example for developing EM standards.

10. The WGEMS **NOTED** that ROS observer coverage is calculated based on human observer coverage. The WGEMS was **INFORMED** that for the EU PS fleet, observer coverage is estimated on the data submitted for human observers only. For the Australian longline fleet however, data are submitted for EMS which has not to date been used to estimate observer coverage due to the fact that Res 11/04 only refers to human observers.

11. The WGEMS also **SUGGESTED** that when observer data is submitted to the IOTC Secretariat, the source of the data is clearly identified as EMS or human observer based.

5. EMS Programme Progress in Tuna RFMOs

5.1 IATTC

12. The WGEMS **NOTED** paper IOTC-2021-WGEMS02-INF04 which provided information on an electronic monitoring system for tuna fisheries in the EPO: structure, IATTC workplan, and pilot EM studies. The following abstract was provided by the authors:

"*In October 2020, per request made during the 10th meeting of the Scientific Advisory Committee and pursuant to the Resolution C-19-08, the IATTC staff presented the document SAC-11-10 "An Electronic Monitoring System for the tuna fisheries in the eastern Pacific Ocean: Objectives and Standards". In this presentation, all the components of the structure of the EMS for the tuna fisheries in the EPO: definitions, institutional structure, management, and standards, as well as the workplan involving each of these components for the implementation of an EMS, and reflected in the document EMS-01-02 were presented. Noting the key importance of standards in data collection and data analysis and reporting, pilot EM studies have been conducted for small and large tuna purse-seine and for longline vessels in order to identify which type of fishing data EM is capable to reliably collect. The motivation for EM trials on the small tuna purse-seine vessels was also noted. Some significant results on the entire tuna purse-seine fleet, showed that EM seems to be ready to reliably collect 83.4% of the data, and for vessels with camera access to the wet deck the total number of sharks recorded by EM almost doubled the number recorded by the human observer. The identification of FAD buoys is not yet possible to be collected by EM. In this regard, a study for exploring technologies for remote identification of FAD buoys is currently in progress, not only for improving the EM data quality but also to expedite the time of EM analysis. Regarding the pilot EM project for the longline fishery, cameras are currently collecting EM records aboard the three participant vessels, and no EM data have been yet generated.*"

13. The WGEMS **THANKED** the author for sharing the IATTC experience on EMS with the working Group.

14. The WGEMS **NOTED** that the IATTC has launched a work plan to set key milestones and timelines for the implementation of EMS aiming for adoption by the Commission by 2025. The WGEMS also **NOTED** the number of pilot EMS trial project being carried out on a purse seine and a longline vessel.

15. The WGEMS **NOTED** that the intent of the pilot EM studies on purse seine vessels in the IATTC was to test EM as a means to complement observers in a manner that relieves observers of some duties and allows them to focus on other duties, leaving EM to collect some data that observers normally would.

16. The WGEMS **NOTED** that the IATTC would not be seeking to require integration of EM requirements into national legislation of IATTC members per se, but members would be required to meet any EM conditions in IATTC resolutions.

17. The WGEMS **NOTED** that on purse seiners one of the most challenging and important issues encountered in the IATTC is the need to differentiate juvenile yellowfin and bigeye tuna, which is already challenging for human observers and potentially more so for EM.

18. The WGEMS **NOTED** that costs of EM is a key consideration in program development and the IATTC has a targeted workshop to consider cost analyses and financial considerations.

19. The WGEMS **NOTED** that EMS is also an important part of transshipment monitoring and therefore this work can benefit both compliance and science.

20. The WGEMS **NOTED** that the IATTC view that the setting of science and compliance related objectives for EM implementation needs to be driven by the member countries (specifically the Commissioners). The WGEMS **DISCUSSED** the need to engage with Commissioners in the IOTC on this issue and to bring scientific and compliance experts together, with managers and Commissioners. Specifying a mechanism in the workplan would be useful to educate managers and policy makers regarding the issue so they can make informed decisions regarding the scope and use of EM in IOTC fisheries.

5.2 ICCAT

21. The WGEMS **NOTED** paper IOTC-2021-WGEMS02-INF05 which details the Progress and planning from the ICCAT Sub-group on EMS. The following abstract was provided by the authors:

"*The WGEMS was presented with the progress of the ICCAT/SCRS Subgroup on Electronic Monitoring Systems, which is currently a Sub-Group of the ICCAT Sub-Committee on Statistics (SC-STATS). This sub-Group has noted the status of EMS trials and previous work in purse seine fisheries for ICCAT. Recommendations with regards to minimum standards for purse seine fleets wishing to voluntarily implement EMS are mentioned in the 2016 and 2017 SCRS reports (SCRS, 201, 2017), and details are provided by Ruiz et al (2017). With regards to longline or other fisheries, the SCRS does have at this stage recommendations for minimum standards on EMS. Therefore, this Subgroup was created, with the aims of 1) collecting and analyzing past studies comparing data products from observers and EMS; 2) beginning to describe the status of knowledge on EMS;*

3) identifying possible knowledge gaps and the need for additional experimental trials; and 4) reviewing the draft EMS guidelines produced by the ICCAT IMM (Integrated Monitoring Measures), when needed. This subgroup will continue to work in later 2021 and during 2022, aiming to try to provide a response to the SCRS in 2022."

22. The WGEMS **THANKED** the author for sharing the ICCAT experience on EMS.

23. The WGEMS **NOTED** that ICCAT SCRS is developing EM standards for LL/PS and other ICCAT fisheries to complement and increase the coverage of ICCAT observer programs with scientific objectives.

24. The WGEMS **NOTED** that some Atlantic longline vessels use EM, and ICCAT has recommended that all tropical tuna purse seine vessels voluntarily implement EM. The WGEMS further **NOTED** that EM deployment to longline vessels and other fishing gear has been delayed.

25. The WGEMS **NOTED** that ICCAT's current work is primarily focused on comparing EM with data collected by human observers. The WGEMS also **NOTED** that these comparisons suggest that EM can fill certain data gaps and can be used as a complement to human observers, but not as a substitute.

26. The WGEMS **NOTED** that EM can provide data for both scientific and compliance purposes. In fact, many of the data fields in EM reporting are designed for compliance. The WGEMS **NOTED** that ICCAT SCRS also focuses on the scientific aspects of EMS, while the Integrated Monitoring Measures (IMM) working group focuses primarily on compliance issues, and the two groups work very closely together

5.3 WCPFC

27. The WGEMS **NOTED** paper IOTC-2021-WGEMS02-INF06 which details the information on the WCPFC Electronic Reporting and Electronic Monitoring Working Group. The following abstract was provided by the authors:

"*In WCPFC, EM is recognised as a system of technologies and can include sensors and cameras or sensors only and reflected that vessel monitoring systems are an example of EM. One of the early pieces of work was to undertake a comprehensive assessment of the data needs of the Commission against the various data collection and verification tools to determine what data fields can be collected by EM. This analysis, known as Project 93, provided a good foundation for determining the priority areas but also provided a useful broadscale analysis of the Commission's data collection and verification tools. Similarly to ICCAT and IATTC, WCPFC also undertook a comparison of data collected by EM technology compared to data collected by observers. The analysis reinforced the point that EM technologies cannot collect all the data that observers can collect and similarly observers cannot collect all the data that EM technologies can collect (EM can work 24 hours and the footage can be viewed multiple times - this can be particularly important for identification of bycatch species). The Commission agreed to prioritise EM in areas where data collection and verification is low with transhipment monitoring and high seas long line fishing key focus areas. In 2019, the Commission agreed to an objective for a WCPFC EM program - to collect verified catch and effort data, other scientific data, and additional information related to the fishery from the Convention Area and to monitor the implementation of the conservation and management measures adopted by the Commission. The objective was deliberately broad to ensure it accommodated the priorities of members as they develop their use of EM technology. The adoption of a Commission wide objective and priority areas has paved the way for progress on a standards based EM conservation and management measure. The draft standards draw from established WCPFC programs (such as VMS, ROP) and cover program, technical, logistics and data analysis. The intention is to ensure that a WCPFC EM programme is as inclusive as possible to allow members to adopt the technology to suit their domestic objectives. Work over the coming year will continue to focus on developing WCPFC standards.*"

28. The WGEMS **NOTED** that in the WCPFC the primary focus for near future implementation of EM is on the longline fishery and in the high seas, noting that the purse seine fishery has 100% observer coverage in normal circumstances. The WGEMS also **NOTED** the need for some flexibility in EM implementation noting that across fisheries it is not a situation of one size fits all.

29. The WGEMS **NOTED** that, like the IATTC, the WCPFC has discussed and agreed on EM definitions that will allow the avoidance of misunderstandings and will facilitate harmonization among programmes.

30. The WGEMS **NOTED** that the WCPFC approach considers EM as one of a suite of data collection tools which should work together to improve the data available. The WCPFC objectives are also broad, spanning both science

and compliance, with the key EM objectives agreed already by the WCPFC Commission along with the scope and priorities and the need for a standards-based approach.

31. The WGEMS **NOTED** that the WCPFC approach may result in two CMMs, one focussed on the program and one on the standards, with the WCPFC looking to learn from the existing VMS and observer programs structure and approach, given they have been in place for a long time.

32. The WGEMS **NOTED** that the WCPFC is looking at options for EM to observe transhipment events, and finally noted the importance of the WGEMS continuing to look at progress and processes in RFMOs as well as collaboration with other tuna RFMOs where possible.

5.4 Others

33. The WGEMS **NOTED** paper IOTC-2021-WGEMS02-03 on the ACAP Guidelines on Fisheries Electronic Monitoring Systems (ACAP). The following abstract was provided by the authors:

> "*As fisheries with seabird interactions increasingly use electronic monitoring (EM) systems to meet monitoring requirements, ACAP recognizes the need for guidelines for EM systems to meet objectives of monitoring seabird interactions. These can then serve to inform and strengthen the development of guidelines and minimum standards for full EM systems (e.g., under development by some of the tuna regional fisheries management organisations) by accounting for the partial, seabird-related requirements of EM systems.*
>
> *Fisheries monitoring programmes supply data required for fundamental scientific, compliance monitoring and ecological and social sustainability assessment applications. EM systems are increasingly being used to complement and replace conventional human onboard observer programmes and to initiate at-sea monitoring where none previously existed. There have been 100 fisheries EM pilot projects since the first in 1999. There are now 12 fully implemented programmes. EM has the capacity to fill a vast gap in monitoring the world's 4.6 million fishing vessels.*" – see document for full summary.

34. The WGEMS **THANKED** the author for providing the ACAP experience related to EMS.

35. The WGEMS **NOTED** the ACAP Guidelines on Fisheries Electronic Monitoring Systems that can be used to inform the development of EM in the IOTC fisheries. The WGEMS **NOTED** the suggestions included in the paper to use EM to monitor the bycatch of seabirds as well as the implementation of seabird mitigation measures.

36. The WGEMS **NOTED** that some of the data fields and illustrative data collection protocols for electronic monitoring systems for pelagic longline fisheries to meet objectives of monitoring seabird interactions are not included in the ROS data minimum data fields and **REQUESTED** the authors to liaise with IOTC WPEB and WPDCS so as to consider the need to include those in the ROS minimum data requirements.

6. EMS PROGRAMME INITIATIVES IN IOTC

6.1 Review of CPCs EMS pilot projects and programmes

37. The WGEMS **NOTED** paper IOTC-2021-WGEMS02-04_Rev1 on the EMS programs conducted by AZTI and DATAFISH in the Spanish tuna fisheries. The following abstract was provided by the authors:

> "*Advances in technology have led the electronic monitoring (EM) to be positioned as a tool capable of improving fisheries monitoring. Tuna RFMOs (Regional Fisheries Management Organizations) are currently discussing the potential use of this technology as an alternative data collection tool, which could lead to a higher and more efficient at sea monitoring coverage. In this context, there are several EM programs and initiatives that have been developed in Spain in recent years. This document aims to comprehensively describe three of these EM programs in the purse seine, longline, bait boat and troll Spanish tuna fisheries. In addition, a SWOT analysis has been carried out, to finally make a series of recommendations for the implementation of the EM based on the experience gained during the last years*."

38. The WGEMS **NOTED** the rapid expansion of EM pilot studies and full programs across the world since the early 2000s and the increasing range of fishing gears (purse seine, baitboat, trolling, longline) covered by Spanish EM studies since 2012.

39. The WGEMS **NOTED** the analysis of strengths, weaknesses, opportunities, and threats and the set of recommendations for EM made by the authors.

40. The WGEMS **NOTED** that the process of EM data review depends on the fleet, equipment (e.g., number of cameras) and fishing activities concerned but that it takes for PS fleet (for example) an average rate of about 5 days for a typical 30-day fishing trip at sea.

41. The WGEMS **QUERIED** whether some comparison and cross-validation was made between logbooks and EM for purse seiners's activities included in the project to identify discrepancies, understand causes, and implement potential improvements to data collection when required. The WGEMS **NOTED** that no comparison was made for the data presented in this study as the logbooks were not made available by the fishing companies but that comparisons between human observers and EM collected data have been made in several EM projects on purse seiners (see document IOTC-2021-WGEMS01-INF01_Rev1). The WGEMS further **NOTED** that such comparisons showed that substantial differences exist between data sources at the vessel level depending how EM system have been installed in each vessel, underlining the importance to tailor the EM installation to each specific vessel. Moreover, data quality control are routinely performed for some of the EM data collected on Spanish and Seychelles-flagged purse seiners (with R scripts

42. The WGEMS **NOTED** that the direct comparison of EM data with logbook data for large-scale purse seiners may be not relevant, and could be misleading to some extent, as the catch composition reported in the logbooks is known to be biased for small tunas due to issues of species mis-identification; which is corrected based on species composition port sampling.

43. The WGEMS **NOTED** that the validation procedure based on comparisons of data collected with EM and other data sources needs to be carefully defined and may vary according to the fisheries and the species caught in each fishery.

44. The WGEMS **ACKNOWLEDGED** the potential major interest in the methodology of size measurements estimated by EM to augment the collection of size data on tuna fishing vessels, **NOTING** that the calibration area depends on the vessel (i.e., where the fish is hauled or processed) and on the review software.

45. The WGEMS **NOTED** that some size measurements have recently been derived from deep-learning methods applied to pictures of tunas collected on the conveyor belts of some purse seiners with standard and 3D digital cameras and that these have showed good consistency with port sampling data.

46. The WGEMS further **NOTED** that the conversion of the data to the ST09 format for export to the ICCAT and IOTC is straightforward as the EM data are managed with the same database structure as is used for the observers at sea for which a module of export was already implemented.

47. The WGEMS **NOTED** that the current review rate of data collected through the EM routine programme onboard purse seiners by Datafish is 100% in order to capture the high variability in catch levels and composition between fishing sets. The WGEMS also **NOTED** that the review rate for the EM trials on longliners is 100% but that this could change when full programmes are implemented.

48. The WGEMS **NOTED** that it is generally difficult to identify bycatch species from the cameras located around the area where the brailing operations take place in purse seiners, particularly marine turtles but also sharks to a lesser extent, and that there is some ongoing work to address this issue, e.g., increasing the resolution of the pictures to provide the ability to zoom in to identify the species.

49. The WGEMS **QUERIED** the accuracy of the data collected with EM on the sex of elasmobranch species in longliners, which is derived from the presence/absence of claspers on the videos/pictures, as claspers may be difficult to observe in small shark specimens as so this could result in female-biased sex ratio.

50. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-05_Rev1 on the Pilot Project on Electronic Monitoring System (EMS) for small fishing vessels (<24m) operating in Sri Lanka (2018-2021), including the following summary:

> "*The objective of the project is to assist Sri Lanka to meet the obligations of IOTC in terms of monitoring fisheries activities at-sea through scientific data collection and reporting. The Project aims to support the current efforts by DFAR in establishing an at-sea scientific observer programme and supplement it through a number of activities, including:*

i. Facilitate the training of on-board observers through the development and delivery of a comprehensive and standardized training programme for observers, and observer programme managers (coordinators).

ii. Develop electronic reporting tools to facilitate the data entry, processing, and validation of observer data.

iii. Installation of an electronic monitoring system (EMS) on vessels where safety is a concern (i.e., vessels under 24 meters in high seas) to assess the feasibility of collecting observer's data via EMS and meet the mandatory coverage."

51. The WGEMS **NOTED** that the EM disconnected due to interferes with radio signal as a result of the AC to DC power inverter and extra battery drainage and the WGEMS **NOTED** that the project is working to solve this issue in a follow-up trial in another vessel.

52. **NOTING** the delay in the completion of the small-scale EMS pilot project due to the insurgence of the CoViD pandemic, the WGEMS **RECOMMENDED** that the project continues, with future activities included in the WPDCS work plan, and that similar studies are prioritized in the workplan of IOTC WGEMS as well. The WGEMS also **REQUESTED** EM technology providers to liaise with the Secretariat to assess the possibility that EMS data are exported in an electronic format compatible with the ROS electronic formats, for future incorporation within the IOTC databases.

53. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-06 on developing Electronic Monitoring System (EMS) standards to collect scientific data: learning from experience with French and associated fleets of the Indian Ocean, including the following abstract provided by the authors:

"During the last decades, Electronic monitoring (EM) has been progressively implemented and tested in tuna fisheries and various pilot projects have confirmed the potential of EM to collect scientific information, that could be useful to fulfil data requirements of the Regional Observer Scheme in the Indian Ocean. Nevertheless, as for any new tool, it is critical that EM minimum standards are discussed and adopted, before validating the wide use of EM in the Indian Ocean. The aim of the present document is to contribute to the definition of EM minimum standards for scientific data collection on tropical tuna purse seine fleets of the Indian Ocean. This document reports on the shared experience of scientists, fleet managers, EM analysts and EM vendors in various EM pilot projects covering the French and associated tropical tuna purse seine fleet since 2014. Here, we review the results obtained for two types of scientific data collection needs : (i) data collection on discards, that is currently undertaken routinely to compensate for a lack of onboard observation, and (ii) data collection on retained catches, that is currently in development. Lessons learned from the two types of projects are used to make recommendations that could be used as guidelines when adopting EM minimum standards for scientific data collection purposes in IOTC."

54. The WGEMS **NOTED** that EM is used as a complementary tool for human observers at sea in the French and associated purse seine fleet of the Indian Ocean, mainly to address the issue of space availability onboard some French purse seiners due to the boarding of private security guards in relation with piracy threat. The WGEMS further **NOTED** that the three Mauritian purse seiners only rely on human observers while preference is always given to human observations at sea over EM when both systems are in place (e.g., for the purse seiner from EU,Italy).

55. The WGEMS **NOTED** that some good progress has been made in the development of compatibility between the different EM providers available (i.e., exchange formats and common interfaces) which aims to allow for data (e.g., video footage) collected with a specific EM to be analysed with another system. The WGEMS however **NOTED** that the formats of the data collected at sea are more complex than for data collected with VMS for instance as there are several services added to the data collection (e.g., alerts, artificial intelligence, etc.), further **NOTING** that the technology has developed very quickly over the recent years, with the systems evolving quickly and independently between companies.

56. The WGEMS **ACKNOWLEDGED** that little work has been done so far to assess the effect of dry observers (i.e., experience, skills, commitment, etc.) on the review of EM data and **ENCOURAGED** CPCs involved in EM projects to explore such effects in the future to quantify this component of the uncertainty on variables of interest such as catch estimates.

57. The WGEMS **NOTED** that there have been some recent applications of Artificial Intelligence (AI) to the EM observations in fisheries but that it is still very preliminary and not operational, with a major focus currently on the development of training data sets (e.g., tagged pictures) which is the very first step of any AI approach.

58. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-08 on E-monitoring implementation in Australian pelagic longline fisheries, including the following abstract provided by the authors:

> *"The Australian Fisheries Management Authority (AFMA) introduced electronic monitoring (e-monitoring) for all pelagic longline boats operating in the Eastern Tuna and Billfish Fishery (ETBF) during 2015. Prior to the introduction of e-monitoring independent validation of reporting was achieved through a human observer program with 5% coverage. The introduction of the e-monitoring program has resulted in substantial improvements in data collection, compliance and fishers behaviour that have resulted in improved overall management of the fishery and increased transparency. E-monitoring also identified that the treatment of bycatch could be improved to increase survivability and resulted in new fishing conditions."*

59. The WGEMS **NOTED** that although the presentation focused on tuna fisheries off the East coast of Australia, the same protocols are in place in the tuna fisheries off the West coast in the Indian Ocean.

60. The WGEMS **NOTED** that it is a legal requirement for vessels operating with pelagic longlines in the Indian Ocean tuna fishery to have EM onboard.

61. The WGEMS **NOTED** that the primary objectives of the EM are to: determine the catch composition of fish caught in the fishery; detect seabird interactions in hauls; and detect deployment of mitigation devices during fishing operations. The WGEMS further **NOTED** that the objective is to cover a minimum of 90% of fishing effort with EM.

62. The WGEMS **NOTED** that the minimum review rate is 10% of fishing events saved on each hard drive and 10% of all yearly fishing effort for each vessel. The WGEMS further **NOTED** that at least one haul per month is reviewed but this is scaled up if there are any concerns about misreporting.

63. The WGEMS **NOTED** that the initial installation costs were covered by the government of Australia but now the ownership rests with the vessel owners and the maintenance costs are covered through management levies paid by industry in order to access the fishery. The WGEMS **NOTED** that no issues of tampering with equipment have been seen to date and further **NOTED** that data on the hard drives is encrypted so it is only accessible to AFMA and the EM contractors meaning that it is a tamper-proof system. The WGEMS **NOTED** that the government retains footage from the EMS in the majority of cases except where the system is privately owned.

64. The WGEMS **NOTED** issues associated with storing such huge quantities of data and **NOTED** that Australia deals with this by destroying data after it has been retained for six months unless exceptional circumstances require it to be retained for a longer period.

65. The WGEMS **NOTED** that there is a process to sign off on the installation of the system to ensure that it meets the requirements as well as function tests which are carried out prior to a vessel commencing with fishing operations to ensure the system is working correctly. The WGEMS also **NOTED** that the data system provides a health statement in one-hour increments providing feedback during system operation.

7. EMS PROGRAMME STANDARDS

7.1 EMS capabilities to collect ROS Minimum Data Standards

66. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-INF03 on the IOTC Regional Observer Scheme (ROS) data fields requirements for collecting and reporting purposes.

67. The WGEMS **NOTED** that the intent of the paper was to highlight the data fields required by the ROS and assess which of these data fields can be covered by EM.

68. The WGEMS **ENCOURAGED** any researchers and EM vendors working on trials of EM systems to provide any new information on the capabilities of EM to collect ROS minimum data fields that were previously considered "not possible" to be observed. The WGEMS also **SUGGESTED** that a workshop be convened to bring together EM experts and service providers and experts in human observers to assess how ROS data requirements can be met by EMS. The WGEMS **NOTED** that the issue of EM covering data reporting requirements have been discussed by other RFMOs such as WCPFC who have produced similar tables considering data needs and capabilities of EM to collect observer data.

69. The WGEMS **NOTED** that some of the data fields originally agreed upon as being mandatory for collection may have been included to fulfil a specific need (e.g., to determine whether tori lines are an effective mitigation

measure) and these may now be obsolete or outdated. The WGEMS **NOTED** that these data requirements were endorsed by the SC after the ROS 2018 expert workshop and any change will require SC agreement.

70. The WGEMS **NOTED** the issues related to the use of the terminology 'optional for reporting' which is confusing and has led to issues with the submission of ROS data from CPCs. The WGEMS strongly **REQUESTED** that the terminology should be changed and updated by the WPDCS for SC endorsement.

7.2 EMS Programme Standards

71. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-07 on 5 Key elements for designing an Electronic Monitoring Program, including the following abstract provided by the authors:

> *"Across the globe, regional fisheries management organizations (RFMOs) are responsible for overseeing the catch of highly migratory fishes that traverse the waters of many nations. To ensure that these fisheries are sustainable, RFMOs need reliable data on what, how, and where fish are caught, and whether rules and regulations are being followed. Although many RFMOs have mandated that observers be on board purse seine vessels to gather such data, it can be challenging to collect it from other types of vessels, which in turn can make scientific and compliance processes less effective. As RFMOs seek to improve oversight of their fishing fleets, electronic monitoring (EM) can be an effective way to meet their goals. EM systems—a combination of cameras, computers, GPS, and gear sensors on a vessel—can complement coverage by human observers. EM can also be used to collect data on fleets that have not been independently monitored. Many entities using these systems have created an EM program and set standards for how the information is collected, transferred, analysed, and stored. Managers, scientists, and vessel owners can then use this data to effectively manage the fisheries.*
>
> *Many trials have shown that EM is a powerful driver of compliance and improved reporting. A recent study in Australia, for example, found that reports of discarded catch and interactions with protected species—including safe handling and release—significantly increased on vessels that had adopted the systems. EM programs are usually limited to a local or national fleet. RFMOs face challenges when designing and implementing the programs, including needing to incorporate a wide variety of fishing vessels, many nations, and large geographical areas. This fact sheet includes elements RFMOs should consider when creating an EM program and several examples of design options. It can serve as a resource for stakeholders, including political leaders, RFMO staff, national fishery managers, industry members, and non-governmental organizations"*

72. The WGEMS **NOTED** that it is important to decide on the main objective of EM (i.e., science or compliance) in the early stages of developing an EM system while trials are being implemented and while a comprehensive assessment of the capabilities of EM have not been determined. The WGEMS **NOTED** that conservation trade-offs are thought to be very important and should be fully considered.

73. The WGEMS **NOTED** paper IOTC-2020-SC23-12_rev2 on Minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries, including the following abstract provided by the authors:

> *"In addition to catch and effort fishery-dependent information collected through logbooks and/or port-sampling of commercial vessels, observer data is key to compile, complement and verify fishery activity information. Electronic monitoring (EM) using cameras and other sensors is a proven technology that has been widely used for various purposes on fishing vessels, primarily in industrial fleets. EM systems include equipment that tracks a vessel's position and activity, together with cameras that record key aspects of the fishing operations. EM has been used extensively for this purpose to obtain reliable information on catches and their composition, as well as to monitor and collect data on bycatches of protected species (ETP).*
>
> *EM pilot tests in different regions on tuna purse seiners and longline vessels, as well as in small-scale artisanal fisheries, have demonstrated the validity of this technology to improve the collection of fishery. However, before considering the wide application of any EM in general, and particularly in tuna fisheries, EM minimum standard for the installation, collection, analysis and storage of data are needed. Moreover, it is also particularly important to assess the congruence between EM and observers-collected fishery data, to verify the capability, and ensure the replicability and accuracy of the information collected through EM (e.g. collection of the same data fields, with information comparable to those collected by human observers) with the purpose of improving the stock assessment and management process.*

Thus, this document aims to progress on the development of EM minimum standards, including specifications and procedures, for the implementation of Electronic Monitoring Systems for IOTC fisheries, as well as evaluate EMS' capabilities to collect the ROS minimum standards data fields as per latest requirements."

74. The WGEMS **NOTED** that the scope of this working group has not yet been defined and so it was not clear whether the focus is solely on onboard video based EM systems or if it should be extended to include other forms of EM such as those that can aid in improving data reporting through logbooks or those that can be used for port sampling purposes. The WGEMS **NOTED** that the Terms of Reference for the group needed to be finalised but that the general understanding was that the scope of the group is focused on contributing to the needs and objectives of Resolution 11/04 on the ROS and any broadening of the scope would require approval from the Commission.

75. The WGEMS **NOTED** the importance of considering the needs of small-scale fisheries within this set of minimum standards. The WGEMS further **NOTED** that EM could contribute significantly to improving data from port sampling in coastal states and highlighted that the WPDCS has previously requested that support is provided for such schemes.

76. The WGEMS **NOTED** that there may be some discrepancies between the data requirements set out in Resolution 11/04 and Resolution 15/01 and highlighted the need to align these and other data requirement Resolutions.

77. The WGEMS **NOTED** that there is still limited data originating from the drift gillnet fisheries, some of which may be operating on the high seas and **NOTED** that there have been some trials conducted on the use of EM on gillnet vessels to assess the capability of the systems to collect data. The WGEMS **ENCOURAGED** those with information from these trials to share this at the WPDCS.

78. The WGEMS again **NOTED** the utility of a workshop to review in depth what EM systems are capable of compared with human observers. The WGEMS **NOTED** that developing technologies in Artificial Intelligence systems could transform what EM systems are able to collect and further **NOTED** that some flexibility needs to be built into EM systems in order to accommodate the changes that these technologies could bring.

8. Plan and Future Meetings

8.1 Development of the TORs of the WG - General discussion

79. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-10 on the Draft Terms of Reference for the ad hoc Working Group on the Development of Electronic Monitoring programme Standards (WGEMS).

80. The WGEMS **NOTED** that having agreed Terms of Reference is crucial to guiding the ongoing work of the WG and clearly stating the objectives and expectations for the WG. As such, the document was reviewed by the participants and **ENDORSED** by the WGEMS as in Appendix IV.

81. The WGEMS **NOTED** the progress made during the current meeting to discuss issues related to Electronic Monitoring Systems but also **NOTED** that much work is required in the future. As such the WGEMS **RECOMMENDED** that the WPDCS endorse the continuation of the ad hoc Working Group on Electronic Monitoring Systems Standards.

8.2 Revision of the WG Program of Work (2022–2023)

82. The WGEMS **NOTED** paper IOTC-2021-WGEMS01-11 on the WGEMS Program of Work (2022–2026)

83. The WGEMS NOTED that a defined workplan that is consistent with the previously reviewed Terms of Reference is important for guiding the future work of the WG and justifying the continued need for the Group. The WGEMS therefore reviewed and **ENDORSED** the Program of Work that can be found in Appendix V

8.3 Next Meetings

84. **NOTING** that the WCPFC Commission has agreed the objectives and the scope of the EM program to facilitate the development of EM standards, the WGEMS **RECOMMENDED** that early in the process a workshop including scientist and managers is organized to advance dialogue on these issues.

85. The WGEMS **NOTED** that although the focus in the current meeting is on the scientific aspects of EMS as required by IOTC Resolution 11/04 on a Regional Observer Scheme, there is a potential to use EMS to address compliance issues as well. The WGEMS therefore **RECOMMENDED** that future WGEMS meetings include participation of scientists as well as compliance experts to advance the discussions on the benefits and use of EMS in the IOTC.

8.4 Election of a Chairperson and Vice-Chairperson for the next biennium

Chairperson

86. The WGEMS **NOTED** that the Dr Hilario Murua (ISSF) had kindly agreed to chair the meeting on an ad interim basis, pending the election of Chairperson for the next biennium during the meeting.

87. **NOTING** the Rules of Procedure, the WGEMS **CALLED** for nominations for the position of Chairperson of the IOTC WGEMS for the next biennium. Dr Murua was nominated, seconded and elected as Chairperson of the WGEMS for the next biennium.

Vice-Chairperson

88. The WGEMS **NOTED** that no Vice-Chairperson had been engaged on an ad interim basis for the current WGEMS meeting.

89. **NOTING** the Rules of Procedure, the WGEMS **CALLED** for nominations for the position of Vice-Chairperson of the IOTC WGEMS for the next biennium. Dr Don Bromhead (Australia) was nominated, seconded and elected as Vice-Chairperson of the WGEMS for the next biennium.

9. OTHER BUSINESS

9.1 Review of the draft, and adoption of the Report of the 1st Session of the WGEMS

90. The report of the 1st Session of the Ad-hoc Working Group on the Development of Electronic Monitoring Programme Standards (IOTC–2021–WGEMS01–R) was **ADOPTED** via correspondence.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
MEETING AGENDA

Date: 15 – 17 November 2021
Location: Online
Venue: Zoom
Time: 12:00 – 16:00 (Seychelles time) daily
Chairperson (ad interim): Dr. Hilario Murua

1. OPENING OF THE MEETING

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. BACKGROUND AND OBJECTIVES OF THE WORKSHOP

4. THE IOTC REGIONAL OBSERVER SCHEME AND REGIONAL OBSERVER PILOT PROJECT
- 4.1 Current projects related to Electronic Monitoring and Electronic Reporting

5. EMS PROGRAMME PROGRESS IN TUNA RFMOs
- 5.1 IATTC
- 5.2 ICCAT
- 5.3 WCPFC
- 5.4 Others

6. EMS PROGRAMME INITIATIVES IN IOTC
- 6.1 Review of CPCs EMS pilot projects and programmes

7. EMS PROGRAMME STANDARDS
- 7.1 Review of CPCs EMS pilot projects and programmes
- 7.2 EMS capabilities to collect ROS Minimum Data Standards
- 7.3 EMS Programme Standards
  - i. Objectives and Institutional arrangements
  - ii. EM Data Standards (systems, collection, storage, review, reporting, etc.)

8. PLAN AND FUTURE MEETINGS
- 8.1 Development of the TORs of the WG - General discussion
- 8.2 Revision of the WG Program of Work (2022–2023)
- 8.3 Next meetings
- 8.4 Election of the Chair and Vice-Chair for 2022-2023

9. OTHER BUSINESS
- 9.1 Review of the draft, and adoption of the Report of the 1st Session of the WGEMS

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC–2021–WGEMS01–01a	Draft Agenda for the Ad-Hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS)
IOTC–2021– WGEMS01–01b	Draft Annotated Agenda for the Ad-Hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS)
IOTC–2021– WGEMS01–02	List of Documents for the Ad-Hoc Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS)
IOTC–2021– WGEMS01–03	ACAP Guidelines on Fisheries Electronic Monitoring Systems (ACAP)
IOTC–2021– WGEMS01–04	EMS programs conducted by AZTI and DATAFISH in the Spanish tuna fisheries (Ruiz J, Krug I, Martinez de Lagos E, Canive I and Santos M)
IOTC–2021– WGEMS01–05	Pilot Project on Electronic Monitoring System (EMS) for small fishing vessels (24m>) operating in Sri Lanka (2018-2021) (Department of Fisheries and Aquatic Resources Sri Lanka)
IOTC–2021– WGEMS01–06	Developing Electronic Monitoring System (EMS) standards to collect scientific data: learning from experience with French and associated fleets of the Indian Ocean (Maufroy A, Bonnieux A, Denoize A, Godefroy R, Goujon M, Lebranchu J, Le Couls S, Moëlo P, Pinault L, Querné B, Wain G, Yon A and Briand K)
IOTC–2021– WGEMS01–07	5 Key Elements for Designing an Electronic Monitoring Program (PEW)
IOTC–2021– WGEMS01–08	E-monitoring implementation in Australian pelagic longline fisheries (MacDonald B et al.)
IOTC–2021– WGEMS01–09	Update on the Implementation of the IOTC Regional Observer Scheme (Secretariat)
IOTC–2021– WGEMS01–10	Draft Terms of Reference for the ad-hoc Working Group on the Development of Electronic Monitoring programme Standards (WGEMS) (WGEMS Chair and IOTC Secretariat)
IOTC–2021– WGEMS01–11	5 Key Elements for Designing an Electronic Monitoring Program (WGEMS Chair and IOTC Secretariat)
Other documents	
IOTC-2020-SC23-12	Minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries (Murua H, F. Fiorellato F., Ruiz J., Chassot E., Restrepo V.)

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

OBJECTIVES

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

SPECIFIC OBJECTIVES

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

FUNCTIONING

- The working group shall be open to all Commission Members, Cooperating non-members and observers and constituted preferably scientist, experts, EMS designers/vendors, other stakeholders, and, whenever possible, include the participation of managers.
- The working group shall conduct its work electronically as well as by presential meeting(s), whenever possible, that should be annually or bi-annually organized.
- The working group shall consider existing and proposed EM Programme standards and EM minimum standards and formats in other regional bodies and tuna RFMOs.
- The working group shall collaborate and communicate with the EM working groups of other tuna RFMOs as well as take into account the Kobe III recommendations and recommendations by relevant EM International groups.
- The working group shall consider the impacts of EM technologies on the broader work of the Commission/Secretariat and look at ways to minimize data collection and management costs.

- The working group shall report to the WP on Data Collection and Statistics and the Scientific Committee, where its advice and recommendations shall be discussed and endorsed for Commission consideration,
- The working group could consult or seek advice from technical experts including EM vendors as necessary.
- The working group shall be supported by the Secretariat. In particular, the Secretariat shall provide technical advice and engage relevant stakeholders in providing input into the work of the working group.

REPORTING and PROGRESS

- The working group and its progress will be annually report and reviewed at the IOTC WPDCS as well as to inform the Compliance Committee of its progress.
- Consistent with outcomes from EM workshop, a phased in approach to the implementation of these technologies should be considered by the Commission as specified in the workplan described in Appendix V.

APPENDIX V
AD HOC WORKING GROUP ON THE DEVELOPMENT OF ELECTRONIC MONITORING PROGRAMME STANDARDS (2022–2026)

The Program of Work consists of the following, noting that a timeline for implementation would be developed by the SC once it has agreed to the priority projects across all of its Working Parties:

Table 1. Priority topics for obtaining the information necessary to deliver the necessary advice to the Commission. Resolution 11/04 and 16/04 elements have been incorporated as required by the Commission.

					Timing				
Topic	**Sub-topic and project**	**Priority**	**Ranking**	**Lead/ Participation**	**2022**	**2023**	**2024**	**2025**	**2026**
1. EMS Pilot Projects	Facilitation of EMS pilot projects in IOTC fisheries (LL, PS, PL, GN, and others) to ensure that ROP minimum data requirements are collected by EMS Cross validation of EM information with other data sources Identify needs and encourage pilots for new electronic tools and systems.	High	3	Scientist					
2. EM Minimum data Standards[1]	Agree on definitions	High	2	Scientist, vendors, experts, stakeholders and managers					
	Minimum technical specifications and equipment								
	Data collection (including EM capabilities to collect ROP minimum data requirements) and storage								
	Data transfer and logistical specifications								
	Data analysis specification and data submission								
	EM maintenance and functioning,								
	EM data analysis, validation and quality control specifications								

[1] To be discussed at a first WGEMS expert workshop with the participation of scientist, experts, vendors and stakeholders.

	Roles of EM users								
3. EM Programme Standards[2]	Objectives and Scope of the Programme	High	1 (In parallel with Item 2)	Managers, scientist, experts.					
	Institutional structure and management								
	EMS coverage and data review coverage								
	Roles and responsabilities								
	Specifications and Procedures								
	Timeframe for EMS implementation								
	Accreditation of EMS Systems/vendors								
	Data confidentiality, access and use								
	EMS Program cost								
4. Compatibility and Interoperability	Compatibility of IOTC databases and other collection platforms (e.g. VMS)	Medium	4	Secretariat/ scientist					
	Interoperability among different vendor's EMSs	Medium	5	Secretariat/ scientist					
5. Development of tools and innovative strategies	Artificial Intelligence and Machine learning for EMS data analysis	Low	7	Scientist/ Secretariat					
6. Capacity building	Capacity building	High	6	Secretariat/ Scientist/ managers					

[2] To be discussed at a second WGEMS expert workshop between managers, scientist, and stakeholders.

APPENDIX VI
CONSOLIDATED RECOMMENDATIONS OF THE 1ST SESSION OF THE AD-HOC WORKING GROUP ON THE DEVELOPMENT OF ELECTRONIC MONITORING PROGRAMME STANDARDS

Note: Appendix references refer to the Report of the 1st Session of the Ad-hoc Working Group on the Development of Electronic Monitoring Programme Standards (IOTC–2021–WGEMS01–R)

Review of CPCs EMS pilot projects and programmes

WGEMS01.01: Noting the delay in the completion of the small-scale EMS pilot project due to the insurgence of the CoViD pandemic, the WGEMS **RECOMMENDED** that the project continues, with future activities included in the WPDCS work plan, and that similar studies are prioritized in the workplan of IOTC WGEMS as well. The WGEMS also **REQUESTED** EM technology providers to liaise with the Secretariat to assess the possibility that EMS data are exported in an electronic format compatible with the ROS electronic formats, for future incorporation within the IOTC databases (Para. 52).

Development of the TORs of the WG - General discussion

WGEMS01.02: The WGEMS **NOTED** the progress made during the current meeting to discuss issues related to Electronic Monitoring Systems but also **NOTED** that much work is required in the future. As such the WGEMS **RECOMMENDED** that the WPDCS endorse the continuation of the ad hoc Working Group on Electronic Monitoring Systems Standards (Para. 81).

Next Meetings

WGEMS01.03: Noting that the WCPFC Commission has agreed the objectives and the scope of the EM program to facilitate the development of EM standards, the WGEMS **RECOMMENDED** that early in the process a workshop including scientist and managers is organized to advance dialogue on these issues (Para. 84).

WGEMS01.04: The WGEMS **NOTED** that although the focus in the current meeting is on the scientific aspects of EMS as required by IOTC Resolution 11/04 on a Regional Observer Scheme, there is a potential to use EMS to address compliance issues as well. The WGEMS therefore **RECOMMENDED** that future WGEMS meetings include participation of scientists as well as compliance experts to advance the discussions on the benefits and use of EMS in the IOTC (Para. 85).