

Report of the First Meeting of the Electronic Monitoring Systems Working Group (WG-EMS)
(Online, 15 February 2023)

1. Opening of the meeting and meeting arrangements

Mr. Camille Jean Pierre Manel the ICCAT Executive Secretary welcomed all participants to the 2023 First Meeting of the Electronic Monitoring Systems Working Group (WG-EMS). The Chair of the WG-EMS, Mr. Neil Ansell also welcomed everyone and opened the meeting.

2. Nomination of Rapporteur

In the absence of any CPC nominations the ICCAT Secretariat agreed to act as Rapporteur.

The Executive Secretary reemphasised the need for CPCs to volunteer rapporteurs for future meetings due to the additional burden it placed on the Secretariat. The Executive Secretary noted two circulars that had been circulated in this regard.

3. Adoption of Agenda

The Chair summarized the points of the agenda and opened the floor to call for any other matters under Agenda item 10. The Agenda was adopted (**Appendix 1**).

The List of Participants is included as **Appendix 2**.

4. Consideration of information from the pilot project on processing vessels

The Chair opened the agenda item noting that the pilot project was launched by *Resolution by ICCAT Establishing a Pilot Project for the Implementation of Remote Electronic Monitoring (REM) on Bluefin Tuna Processing Vessels (Res. 21-17)*. He then introduced the representatives of the global technology solutions company Satlink who gave a presentation ('Electronic Monitoring Solutions for Fisheries Management') on the progress of the pilot project.

The presentation provided a brief overview of Satlink – its history, credentials, and work – in addition to describing the features of the company's EMS system. The presenters then discussed the development of the two-phase pilot project through Phase 1 carried out on two vessels including pre-installation, ports of installation, on board hardware (with additional hardware planned for Phase 2), analysis results, possible challenges (e.g., 24-hour vs. on-demand connection), and per vessel cost. The Chair thanked Satlink and opened the floor for questions and comments.

The European Union (EU) thanked the Chair and Satlink for its presentation and posed a question relating to the transshipment analysis and the discrepancies noted in the weight estimations. Satlink responded by stating that for larger specimens any small differences in length could translate into significant differences in weight and although the overall result was similar, there was approximately 24% difference in some cases. They expect significantly improved accuracy in Phase 2 as they intend to calibrate the area where the fish will be landed in addition to using measuring boards.

The EU also thanked the ICCAT Secretariat for its work on the project and expressed interest in the next phase (Phase 2) of the project which will provide additional refinement for crane scales and more accurate ways to assess the size with the implementation of measuring boards. The EU noted favourable justification for 24-hour monitoring and the value of pilot projects tasked with testing EMS for more accurate scientific data and improved compliance.

5. Review of any other new information/trials available since the last meeting of the Working Group

The Chair opened the Agenda item with a brief discussion of the relationship between the WG-EMS and the SCRS and how the cooperation has been ensured. The Chair then introduced Dr. Rui Coelho (EU), Chair of the SCRS Technical Sub-group on Electronic Monitoring Systems (TSG-EMS) and invited him to present an update on the work of the TSG-EMS since the last meeting of the WG-EMS. The presentation, *Report of the SCRS Sub-group on Electronic Monitoring Systems (EMS)* is included as **Appendix 3**.

Dr. Coelho emphasized the ways that EMS systems are being implemented to enhance the capture of scientific data with the intention of serving as complements and not replacements for at-sea human observers (HO). He also noted the respective complements and differences between EMS and HOs and why both are necessary. In 2022, the work of the TSG-EMS focused on two main tasks:

- Comparison of what can be obtained with HOs versus EMS (using ST-09 data forms to report fishing, catch, and biological data).
- Draft and adoption of the minimum standards (mostly focusing on the technical aspects, such as number and location of cameras).

The TSG-EMS developed SCRS Minimum Technical Standards for EMS on pelagic longline vessels with the following objectives:

- Priority of implementing EMS that allows the collection of fisheries data to be used for scientific purposes.
- Design that complements, and to the extent possible is consistent with what is currently collected by HOs.
- Scientific data must often be collected at a finer resolution (e.g., spatial, temporal) than is required for compliance. As such, the minimum requirements needed for scientific purposes may also be applicable for compliance purposes.

One of the questions yet to be decided would be to determine who would be responsible for oversight and maintenance of minimum standards. Two options were presented along with each option noted benefits and challenges:

- Option 1 (Recommended): A decentralized system where each CPC would be responsible for implementation of EMS in its own fleets, including recording, processing, data extraction, and data submission to ICCAT. This is like how national HO programs are conducted for scientific purposes. The costs for this would be borne by the CPC with little financial cost to the Commission and less administrative burden to the ICCAT Secretariat. One major issue is potential inconsistencies in implementation of EMS requirements across all ICCAT members as has been the case with minimum standards for scientific observer programs.
- Option 2: A centralized system that would be coordinated and maintained at the ICCAT Secretariat level. The benefits would be more consistent implementation across ICCAT membership, but the challenges include a greater financial cost to the Commission and an increased administrative burden on the ICCAT Secretariat. There are also issues of confidentiality (e.g., raw videos) that would need to be addressed.

EMS should be subject to periodic review including regular evaluations with opportunities to incorporate new technologies and revised objectives. There should also be a review of the developed framework (review and update of minimum standards) for greater efficiency in implementation.

The TSG-EMS also developed minimum technical standards for onboard EMS technology including standards for equipment (camera system requirements, installation, and maintenance); data storage requirements (and the data subject to such provisions); standards for data collection, review, and transmission to ICCAT; and standards for data protection and privacy.

The Chair thanked Dr. Coelho and opened the floor for questions and comments and noted that some of this discussion under this Agenda item would be revisited under Agenda item 7 regarding the next steps for presentation to the Commission.

In addition to a copy of the presentation, Brazil requested an official report that cited relevant resolutions and recommendations that could serve as additional reference points for the proposed implementation of EMS. The Chair noted *Resolution by ICCAT for the establishment of an ICCAT Working Group on the use of Electronic Monitoring Systems (EMS) (Res. 21-22)* and gave a brief overview of the objectives of the EMS-WG including ongoing activities agreed in previous EMS-WG meetings. He also noted that the SCRS work on EMS began prior to the adoption of *Res. 21-22*, however it would now feed into the work of the WG-EMS as the body designated by the Commission on EMS matters.

The United States (US) thanked Dr. Coelho and the SCRS for the presentation and echoed the point that EMS should be complementary to HOs and that the data should not be constraining. The US noted the importance of capacity building and targeted training and how this would be identified and provided to CPCs.

Japan emphasized the need for flexibility in the transmission of data and asked for clarification with regard to sensors other than GPS being optional for the duration of recordings or only for the start/end of recordings due to the amount of footage needed for data collections and from perspective of scientific data collection.

In response to Japan, Dr. Coelho commented that the need for sensors would be dependent upon the fleet. Additional sensors would be more of a challenge for smaller vessels. Given the goal of reducing recording times, one possible solution is that the EMS could be adapted to begin collection when the fishing gear is engaged.

The EU echoed the points made by the US and noted that there need to be two equal sets of EMS minimum standards for longline and purse seine questioning why form ST-09 was less prescriptive with regard for purse seine compared to longline.

Dr. Coelho responded by stating that form ST-09 seeks to compare the data that is collected by EMS and HOs, with the goal of collecting as much data as possible by both. He noted that it is difficult to collect data on mortalities and discards. The intention was to use ST-09 as much as possible and there is room for revision. Form ST-09 provides minimum standards for purse seine but the SCRS can explore the addition of more prescriptive data fields as determined by the WG-EMS.

The SCRS Chair Dr. Craig Brown, indicated that the SCRS can undertake a review of minimum data reporting fields for purse seine if the WG-EMS determines that it is needed.

The EU reiterated that there appears to be a gap in the reporting fields between longline and purse seine and thanked and welcomed the willingness of the SCRS to close this gap. The EU expressed the desire to have minimum EMS standards for longline and purse seine adopted and ready for presentation at the 28th Regular Meeting of the Commission in November 2023 in accordance with the workplan agreed by the WG-EMS.

Brazil spoke in support of the points raised by the US. It reemphasized that implementation of EMS should be complementary to HOs. Brazil further suggested that EMS be an optional standard item due to cost and the amount of training involved.

Following other interventions made by CPCs and in an effort to address some apparent confusion, the Chair concluded that the use of EMS by CPCs is currently optional in ICCAT considering that none of the Recommendations in force impose it. He noted that if CPCs however decided to implement EMS, presumably it would need to be done in a common or uniform way across ICCAT. He concluded that this will be further discussed under item 7 of the Agenda.

A presentation 'Electronic Observation on Fishing Vessels Requirements' was then given by the *Organización de Palangreros Guardeses (OR.PA.GU)* providing an overview of the EMS activities implementing on longline fishing vessels in this association. He noted the standard's background requirements and stakeholders and identified EMS standard equipment and components (cameras, sensors, GPS, communications systems, power supply, etc.), data collection, data analysis, trouble shooting, vessel monitoring plans, data processing and reporting, privacy, and business requirements.

The Chair opened the floor for questions and comments and noted that the presentation was available on the meeting document site.

6. Consideration of the output of the informal drafting group for the development of minimum standards (longline and purse seine)

The Chair opened Agenda item 6 by introducing a presentation from the informal drafting group for the development of minimum standards (longline and purse seine) given by the European Union, noting that the draft was available as 'Minimum Standards and Program Requirements for EMS onboard Longline vessels' **Appendix 4**.

The draft was created over two drafting meetings in March 2022 and February 2023 for the purpose of establishing minimum standards for EMS for longline and purse seine fishing for scientific and compliance purposes. Prior to discussing the major points of the draft, the EU emphasized that the goal of the informal drafting group was to have the drafts finalized and approved for presentation at the 2023 Annual Meeting.

The informal group followed a methodology that sought to clarify rather than invent and incorporate and build on several guidelines established by the European Fisheries Control Agency (EFCA) and work by other RFMOs (Indian Ocean Tuna Commission, IOTC). The idea is that the instrument will have the same structure both for longline and purse seine.

The draft adopts two sets of minimum standards and notes the similarities between the two. The body of the draft includes a common set of rules for the minimum standards in two parts. Part 1: EMS coverage and general system requirements, and Part 2: Annexes (3) that address compliance and scientific objectives.

The EU noted additional points still open for consideration and discussion that focus on the substance of the draft.

Open points regarding the substance of the draft (2):

1. Currently, there are no requirements in the ICCAT body of rules that cover the use of EMS for transshipment activities. For this reason, it is the position of some CPCs that the draft should not include transshipment activities as part of minimum standards.
2. The inclusion of minimum standards for technical equipment for sensors also remains under consideration.

Open points regarding general issues related to the draft (3):

1. What will be the role(s) of the ICCAT Secretariat and the WG-EMS (e.g., if a CPC reports implementation of the EMS, additional clarity is needed regarding the entity that provides oversight and review (ICCAT Secretariat/IMM/WG-EMS).
2. It is important to have review clauses to accommodate the possibility of future technological developments that will inform minimum standards.
3. The need to discuss the form of the final draft/instrument (i.e., resolution versus recommendation).

The Chair thanked the EU and emphasized the goal to have minimum standards adopted at the 2023 Annual Meeting and complimented the drafting committee for its ongoing continuing work.

The EU indicated that the US and Japan provided written comments in response to the last drafting session. The comments will be published. The EU also invited comments from other CPCs following upcoming drafting meetings.

Brazil noted that the proposed minimum standards adopt the scientific data reported in form ST-09 as a new standard and hence seems over prescriptive in terms of compliance. Uruguay voiced their agreement with Brazil and noted their view that the standards should take the form of a resolution and not a binding recommendation.

The US expressed concern that there seemed to be a fundamental misunderstanding regarding the purpose of the proposed minimum standards and noted that the adoption of requirements in other ICCAT Recommendations implies that there must be a common agreed set of standards for any EMS that a CPC chooses to implement to meet those requirements. For instance, the increase of observer coverage from 5% to 10% in the tropical measure allows CPCs to choose the use of either EMS or HO to meet that required increase. Implementation of expanded HO coverage to meet that requirement must be done in accordance with the data reporting and other provisions of *Recommendation by ICCAT to Establish Minimum Standards for Fishing Vessel Scientific Observer Program (Rec. 16-14)*. It is, therefore, implicit that if a CPC chooses to meet the expanded observer coverage requirement using EMS, there needs to be agreed EMS minimum standards adopted by ICCAT that CPCs must follow. The United States stressed that a recommendation is the only way to ensure consistent implementation of EMS within ICCAT and, accurate and robust data collection and reporting by those CPCs that choose to implement the tool. Such a binding measure would serve a similar purpose as [Rec. 16-14](#) does for domestic human observer programs. A nonbinding resolution cannot ensure the same degree of consistency and robustness in the implementation of EMS. Given the clear precedent that exists in ICCAT for developing binding minimum standards to ensure standardized and consistent implementation of monitoring and control tools by CPCs for use in ICCAT fisheries, including for observer program, VMS, port State measures, and more, the United States underscored the need for ICCAT to take the same approach for EMS and begin the process of transforming the current working document of minimum standards into a binding recommendation.

Other CPCs expressed the view that EMS should not completely replace human observers as they were essential for some tasks. It was recalled that the minimum standards in themselves did not mandate the use of EMS to meet any level of required observer coverage; they simply sought to establish the minimum standards that would become mandatory if a CPC chose to implement EMS to meet expanded observer or other requirements specified in other ICCAT conservation and management measures, such as the tropical tuna Recommendation.

The Chair reminded CPCs that the addition of annexes could include specific information (to science/compliance) while the main body of the document could capture information that was applicable to both. He also concurred that the nomenclature and final structure of the document was important moving forward.

The EU raised additional points regarding the subsequent role and responsibilities of the Commission and the WG-EMS once the document is adopted. The EU proposed that the WG-EMS should monitor all existing EMS programs and that the draft should embed a clause for the purpose of creating space for updates and revision and create a reporting framework for the CPCs. Finally, the EU stated that the draft should also include a provision for the assessment and evaluation of EMS data reporting by CPCs and the role of the ICCAT Secretariat.

Japan stressed the desire to delete the inclusion of at-sea transshipment because there has been no adopted recommendation regarding the monitoring of at sea transshipment by EM, and that other than GPS sensors remain optional in order not to invalidate their ongoing pilot project.

The US requested clarification from Japan about its intervention regarding the applicable / appropriate use of sensors and inquired as to how an EMS can provide minimum data without appropriate sensors beyond GPS. Specifically, the United States asked if Japan intended to record images through its EMS 24/7, making sensors other than GPS unnecessary. In response, Japan saw no reason why minimum standards could still not be met and confirmed it was recording images 24/7. Japan noted that their current pilot project would not meet the minimum standards if sensors were mandatory despite the fact that they were collecting all the relevant data. Moreover, Japan is considering the use of AI in their pilot project, but have not yet done

it. Brazil supported Japan's position on sensors and requested that sensors be optional in the draft. The EU stated that in their view sensors make EMS more efficient and workable in so far as data storage and handling. The EU called on Japan to report the final results on its pilot program when they become available.

Satlink summarized some of the general findings for EMS cameras during longline fishing events (the camera operates 24-hours/day; increased installation costs; potential sensor failure; dependent upon conditions, sometimes sensors help; sometimes sensors do not help).

7. Finalization of minimum standards for consideration by SCRS and possible adoption by the Commission

The Chair opened this Agenda item by summarizing the way forward and enquiring on an appropriate target date for the completion of the draft standards and planning of intersessional work. He went on to note the importance of the 16th Meeting of the Working Group on Integrated Monitoring Measures (IMM) (7-9 June 2023) in which the WG-EMS would report on the status of their work including the development of the standards.

The SCRS Chair underlined the importance of the ongoing collaboration between WG-EMS and the SCRS on the development of the standards and indicated his desire to follow support where necessary both in the drafting sessions and further meetings on the run-up to the 2023 Annual meeting.

The EU thanked the Chair of the SCRS for his ongoing contribution and called on the SCRS to work on the data fields for purse seines as discussed. He also confirmed their intention to continue with the drafting sessions in order to keep the momentum with a view of finalising the standards by the June IMM meeting. They informed on possible dates for two drafting sessions, the first during the week of 20 March 2023 and a second in late April/early May 2023. The United States reiterated its commitment to the development of the EMS minimum standards and the need to begin the process to transform the current working document into a draft recommendation. The United States expressed its interest in working with the European Union intersessionally to begin the transformation.

The SCRS Chair agreed to review language in later drafts and participate where possible in drafting meetings and at the IMM meeting. He went on to note that a review of purse seine data fields that follows the same approach as those for longlines was not in the SCRS workplan and hence may increase the already heavy workload of the SCRS. Nonetheless, he noted the importance for SCRS to prioritize the review of the purse seine data fields but will need to seek the view of the SCRS more broadly before committing by when this could be done. Some CPCs underlined the importance of this contribution from the SCRS and thanked the Chair for his efforts.

The Chair summarised the agreed way forward and noted the importance of the drafting sessions. He encouraged active participation and noted its usefulness given the technical nature of the issues and various views expressed.

Brazil expressed their desire in joining the drafting sessions in order that they may provide additional rationale for their positions already provided. They also reiterated their concerns on the binding nature of any agreed standards.

Uruguay echoed the view expressed by Brazil and questioned the need for a binding set of minimum standards especially if they were to be applied in the short to medium term. The Chair repeated that the option to use EMS was already contained in some ICCAT measures including for both tropical tunas and billfish; hence, if CPCs were to elect to use EMS it was understandable that it should be done in a uniform way across ICCAT. If the minimum standards were to be voluntary everyone may apply EMS differently which may be contrary to existing measures that provide for the use of EMS, and, therefore, may need to be taken up by the Commission. If no agreement could be made on this point, he suggested it should be taken up by the IMM and if needed the Commission.

The International Seafood Sustainability Foundation (ISSF) supported the ongoing work of the WG-EMS and the development of the standards intersessionally. They informed the Working Group that the IOTC uses a common set of terms and definitions which may be useful for the work of ICCAT and ensure there is common terminology across RFMOs in the domain of EMS.

The Chair concluded this point and encouraged active participation in the drafting sessions led by the EU and encouraged substantive discussion on the run-up and during the IMM.

8. Possible suggestions of new EMS projects

The Chair opened this Agenda item by stating that the Agenda items 8 and 9 were taken from the Tentative 2022-2024 workplan. The Chair then opened the floor for questions and comments.

The EU noted the [*Resolution by ICCAT establishing a pilot project to test the use of stereoscopic cameras during first transfer and the automation of video footage analysis \(Res. 22-15\)*](#) for a pilot project for the use of stereoscopic cameras that was adopted for BFT fishing. The pilot project is paid for by the EU and directed by the ICCAT Secretariat. The findings from the project will be finalized and implemented in 2024.

9. Consideration of other elements to improve coordination and synergies between monitoring, control and surveillance (MCS), and scientific applications of EMS

The Chair opened this Agenda item referencing the helpful interventions regarding cooperation and collaboration with other RFMOs and noted that the documents in the WG-EMS repository are useful. The Chair noted the points made on developing and adopting uniform terminology and then opened the floor for discussion.

Brazil requested clarification regarding past discussions about the implementation of the statistical control process, indicating that for developing countries it is difficult to have a broad range of trained HOs. The Chair stated that some existing EMS is for establishing scientific controls and clarified that the WG-EMS is still discussing the need for EMS in compliance and other management measures.

The SCRS Chair indicated that there is some statistical element regarding coverage and that everything is reviewed on a case-by-case basis. The SCRS Chair indicated that even with these measures, full reporting with regard to dead and discarded fish is not taking place. The US intervened stating that anything that could be done to improve data reporting should be done and suggested that Brazil's question should be raised in the IMM meeting in June 2023.

The US proposed that the WG-EMS obtain feedback from the EMS service providers at an appropriate time and before finalizing the measure given their expertise in the area, which could help improve the final product. Specifically, the United States suggested that the WG-EMS could solicit feedback to ensure that the work that has been done by the WG-EMS is thorough, relevant, and feasible in terms of the WG-EMS objectives. The United States noted that, if this idea was agreeable, the process for obtaining such feedback should be discussed. The Chair supported this suggestion and noted that, though there may not be a broad range of available resources, it should be possible to seek feedback from those EMS service providers working on existing projects.

10. Other matters

No other matters were raised.

11. Adoption of report and closure

The Chair thanked all participants and noted the next meetings of the drafting committee and the IMM Working Group. It was agreed that the report would be adopted by correspondence. The Chair thanked the interpreters and the Secretariat for their hard work in supporting the meeting and adjourned the meeting.

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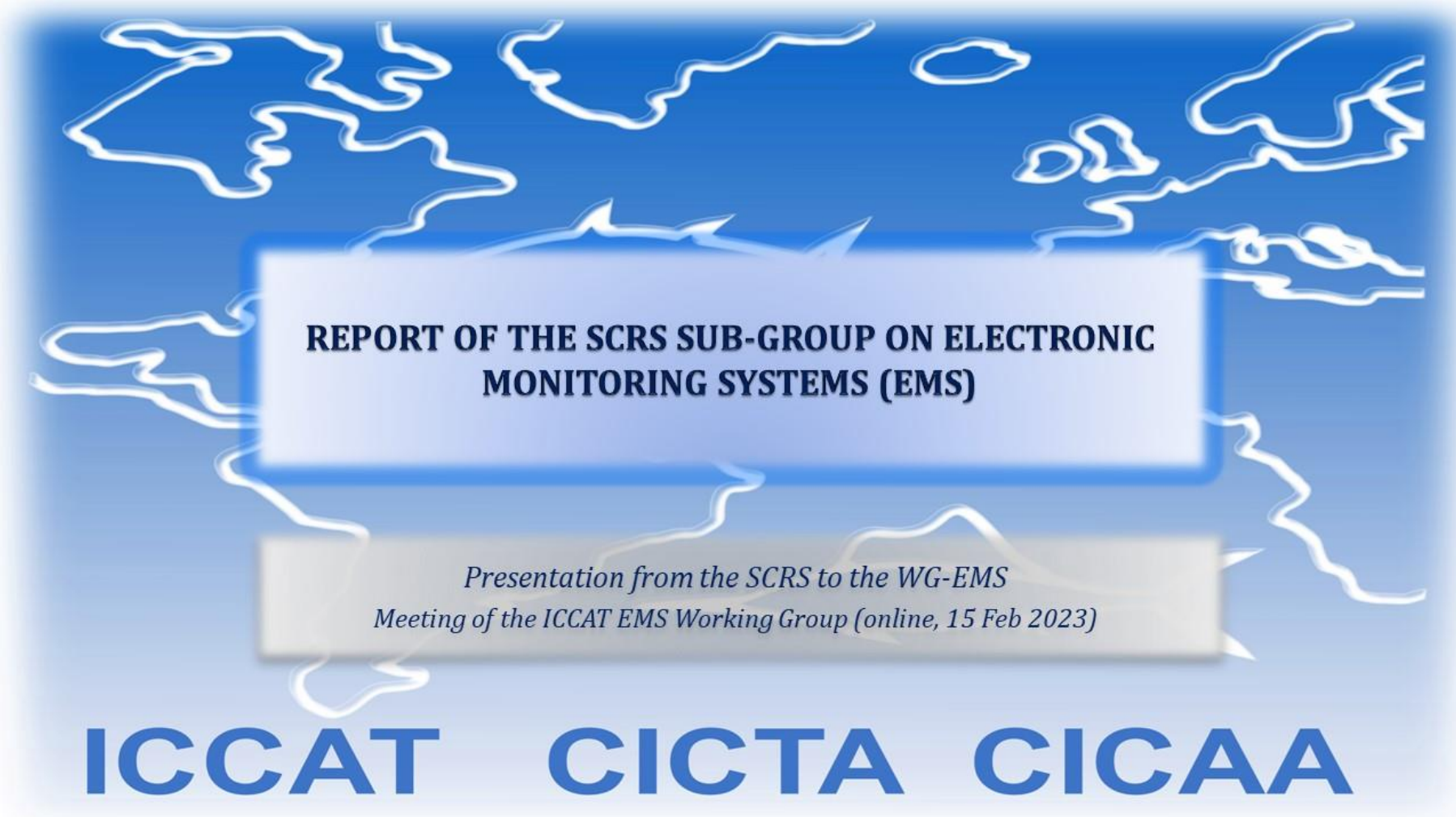
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Report of the SCRS Sub-group on Electronic Monitoring Systems (EMS)



**REPORT OF THE SCRS SUB-GROUP ON ELECTRONIC
MONITORING SYSTEMS (EMS)**

*Presentation from the SCRS to the WG-EMS
Meeting of the ICCAT EMS Working Group (online, 15 Feb 2023)*

ICCAT CICTA CICAA



SCRS Technical Sub-group on EMS - Background

- In 2019 ICCAT, established Recs 19-02 and 19-05 (pertaining to tropical tunas and billfishes):

The Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG), in cooperation with the SCRS, shall work to develop recommendations on the following issues for consideration at the 2021 Annual Meeting of the Commission:

a) **Minimum standard for an electronic monitoring** system such as:

- (i) the minimum specification of the recording equipment (e.g., resolution, recording time capacity, data storage type, data protection)
- (ii) the number of cameras to be installed at which points on board

b) **What shall be recorded**

c) **Data analysis standards** (e.g., converting video footage into actionable data by the use of artificial intelligence)

d) **Data to be analyzed** (e.g., species, length, estimated weight, fishing operation details)

e) **Reporting format** to the Secretariat

In 2020 **CPCs are encouraged to conduct trials** on electronic monitoring and report the results back to the PWG and the SCRS in 2021 for their review.



Technical Sub-group on EMS

- The Technical Sub-group on EMS was created during the 2021 Intersessional Meeting of the Billfishes Species Group (March 2021)
- Multiple online/zoom (1 day) meetings in 2021 and 2022 and much intersessional work done by the Sub-group participants
- 2021 work:
 - Literature revision with main conclusions presented to the SCRS (SCRS/2021/165)
- 2022 work:
 - Comparison between EMS and HO for scientific ICCAT data (from ST-09)
 - Draft proposal for the pelagic LL minimum standards for EMS
 - Presentation and adoption by the SCRS (SCRS/2022/165)



Summary of the literature revision work

The following points have been NOTED IN 2021 (presented in SCRS/2021/165):

- EM systems **hold promise for resolving some problems with data gaps in fisheries monitoring, but it cannot substitute for a human observer**. As such, integrated EM systems are likely to be **used as a complement rather than a replacement** in at-sea observer programs.
- One limitation is that the **cameras record only what is in their field of view and cannot prioritize** among elements in the images they are recording.
 - However, one advantage is that the images can be reviewed multiple times for data extraction
- It is important to also note that **at-sea observers can perform other tasks not covered by EM Systems, such as biological sampling**



Summary of the literature revision work

- EM systems need to address the **challenges associated with processing and analyzing very large volumes of data**, which are different to the challenges encountered when dealing with human observers and their data
 - It is possible that **improvements in artificial intelligence, machine learning/deep learning algorithms**, hardware and software can mitigate some of the current limitations with data collection and analysis
- Integrated EM systems must be able to **meet both national and international requirements to ensure data collection, continuity, veracity and precision are not compromised and that scientists have the required data to ensure they can continue to provide accurate scientific advice to managers.**



2022 work – Started in later 2021 and carried out in 2022

- **Sub-group main tasks during 2022:**

- Comparison of what can be obtained with human observers versus EMS (using ST-09 data forms);
- Draft and adoption of the minimum standards (mostly focusing on the technical aspects, such as n^o and location of cameras, etc.)



ST-09 – FISHING DATA (Form A)

Most “Fishing characteristics data” can be obtained with EMS

ST-09A DATA FIELDS		Possible to collect by human observers?	Possible to collected by EMS?	Notes	
Fishing operations & fleets	Fish. Oper. (FO)	Not applicable	Not applicable	Coding variable applied post-processing	
	Fleet attributes	Flag of Vessel (cod)	Yes	Yes	Obtained from EMS installation ID
		Base port/zone	Yes	Yes	Obtained from EMS installation ID
		Vessel (size class)	Yes	Yes	Obtained from EMS installation ID
Temporal attributes	Year, month/trimester	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard	
	T. Period (ID)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard	
Geographical attributes	Resolution and position (Lat, Lon)	Square type (cod)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		Lat (centroid) (± dd.ddd)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		Lon (centroid) (± dd.ddd)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
Effort attributes	All fishing gears	Gear group (cod)	Yes	Yes	
		Nº vessels	Not applicable	Not applicable	Grouping variable applied post-processing
		Nº Fish. Oper. (observed)	Not applicable	Not applicable	Grouping variable applied post-processing
		Fish Oper. Type (cod)	Yes	Yes	
		School type (cod)	Not applicable to LL	Not applicable to LL	Not applicable to LL
	Longline (LL) only	LL type	Yes	Yes	Possible with additional info from logbooks or the skiper. Should also be possible to detect the LL type/configuration with a camera recording the deployment
		Nº hooks (total)	Yes	Yes	Might be possible to get from logbooks. Could also count at deployment, as hooks/floats are seen with a deployment camera (but could be time consuming to count all hooks)
		No. hooks (observed)	Yes	Yes	
		Hook type (main)	Yes	Possible	Possible but need integration with additional info from logbooks or the skiper
		Set depth (hooks per basket)	Yes	Yes	Need to put cameras during deployment to count hooks between floats. Will also allow for total set effort (n hooks). Note that HBF might not be the best proxy for depth of setting
Mitigation measures (MM) on bycatch species	Seabirds	MM 1	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
		MM 2	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Other bycatch	MM 3	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Additional notes	Description (MM)	Yes	Yes	Optional field in ST-09. Possible to add information with any complimentary information



ST-09 – CATCH DATA (Form B)

Most “**Catch data**” can be obtained with EMS, but there might be the need for some adaptations

ST-09B DATA FIELDS		Collected by human observers?	Collected by EMS?	Notes	
Catch composition by fishing op	Fish. Oper. (FO)	Not applicable	Not applicable	Coding variable applied post-processing	
	Species (attributes)	FO group ID			EMS could have problems with identification of bycatch that are not brought onboard, and in those cases higher level taxa ID is likely needed. As a standard, the EMS system should have one camera for the retained species and another for the area close to the vessel in cases they cut the line for discarding. For the retained catch EMS systems record video that can be seen many times, while human observers have the advantage of being able to look into detailed taxonomic characteristics if needed.
		Species (cod)	Yes	Yes	
		Targeted (Y/N)?	Yes	Possible	
	Catches (retained)	Weight (kg)	Yes	Possible in some cases	Possible but need integration with additional info from logbooks or the skipper. Both HO and EMS could only do in vessels that have scales to weigh individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales, could put cameras facing the scales. Or there might be a way to connect the scales to the EMS directly
		Product type (cod)	Yes	Possible in some cases	Both HO and EMS could only do in vessels that have scales to weigh individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales, could put cameras facing the scales.
		Number (catch number)	Yes	Yes	
	Discards (Number)	Dead (DD)	Yes	Possible in some cases	Important to be collected (even for some management recommendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Alive (DL)	Yes	Possible in some cases	Important to be collected (even for some management recommendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Unknown	Yes	Yes	Important to be collected (even for some management recommendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release.
	Sampling (data)	Nº sampled	Yes	Yes	

Note: Many types of scientific data collected by observers are possible to collect through EMS, but some are much more labor intensive to obtain (e.g., reviewing many hours of video footage, placing catch in specific places for measurements, cameras at specific locations for discards, etc.).



ST-09 – BIOLOGICAL DATA (form C)

Collection of “**Biological data**” with EMS is more challenging and will need adaptations

ST-09C DATA FIELDS		Collected by human observers?	Collected by EMS?	Notes		
Specimens & fishing operations	Specimen identifier	Unique specimen ID	Not applicable	Coding variable applied post-processing		
		FO group ID	Not applicable	Coding variable applied post-processing		
		Species (cod)	Yes	Yes		
Biological data (observed)	Sex	Sex (cod)	Yes	Possible in some cases	With observers it is possible for elasmobranchs (externally) and bony fishes when they are eviscerated; With EMS might be possible for elasmobranchs with specific specimen position by the crew and cameras	
		Size	Length (cm)	Yes		Yes
	Weight	Size class type (cod)	Yes	Yes	Both HO and EMS can only do in vessels that have scales to weigh individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales the HO can take weights directly. For EMS might be possible to put cameras facing the scales, or there might be a way to connect the scales to the EMS directly	
		Weight (kg)	Yes	Possible in some cases but need adaptations		Both HO and EMS could only do in vessels that have scales to weigh individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales, could put cameras facing the scales. Or there might be a way to connect the scales to the EMS directly
		Product type (cod)	Yes	Possible in some cases but need adaptations		
	Samples obtained (Y/N)	Genetics (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc	
		Otoliths (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc	
		Stomach (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc	
		Gonads (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc	
	Release attributes and others	Condition (external injuries)	Released (YN)?	Yes	Possible in some cases	The operation is visualized by seeing the surrounding water. If the catch is not hoisted but part of the body is seen, it is sometimes possible to reach the level of the genus (e.g., Alopias, Sphyrna). Also in leatherback turtles. In other species (e.g., hardsheel turtles, other fishes), if they are not hoisted to remove the hook it is more complicated to reach the species or even genus. Depends also on the cleanliness of the cameras and the release maneuver.
Injuries (scale)			Possible in some cases	Possible in some cases	Injuries from depredation or from the fishing process can be seen sometimes. But if the specimens are released in the water it might be difficult for both HO and EMS	
Others		Tag number	Yes	No		Any additional notes can be input both by HO and EMS visualization
		Notes	Yes	Yes		

Note: Some scientific important aspects, such as biological samples, are not possible to take with EMS.



SCRS Minimum Technical Standards for EMS in pelagic LL

- Full/detailed text presented in 2022 in documents:
 - SCRS/2022/165 (Sub-group report to the SCRS)
 - Appendix 17 of the 2022 SCRS Report (minimum standards adopted by the SCRS)
- Here (in the following slides) we provide a summary of the main points



SCRS Minimum Technical Standards for EMS in pelagic LL

Objectives of the EMS

- At the SCRS level, the priority is **implementing EMS that allow the collection of fisheries data usable for scientific purposes.**
- Should be designed in a way which **compliments, and to the extent possible is consistent, with what is currently collected by human observers.**
- EM systems **may also be used for compliance and other purposes.**
- Scientific data often must be collected at a finer resolution (e.g. spatial, temporal) than would be required for compliance. **In such a situation, meeting the minimum requirements needed for science, would allow use in both scenarios.**



SCRS Minimum Technical Standards for EMS in pelagic LL

Structure (who is responsible - Commission to decide details)

Option 1: Decentralized system:

- **Each CPC is responsible for the EM system implementation in its own fleets**, including the recordings, processing and data extraction, and submission of data to ICCAT.
- **Similar to what currently exists for national human observer programs** for scientific purposes.
- Costs are borne by CPCs programme, so there would be **little financial costs for the Commission and less administrative burden on the ICCAT Secretariat**.
- Potential **issue with inconsistent implementation of the EM requirements across the ICCAT members** – as has been the case with regard to the implementation of ICCAT's minimum standards for scientific observer programs (Rec. 16-14).



SCRS Minimum Technical Standards for EMS in pelagic LL

Structure (who is responsible - Commission to decide details)

Option 2: Centralized system:

- A system that would be **coordinated at the Secretariat level**.
- Benefits are **more consistent implementation across the ICCAT membership**.
- More significant challenges associated with this approach, particularly related to the **financial costs to the Commission and the administrative burden on the Secretariat**.
- Issues of data sharing and **confidentiality (e.g., raw videos) would also need to be addressed**.

There are important trade-offs associated with the approach selected, which should be further considered by scientists and managers.

In consideration of data needs and given the significant financial costs and other development and implementation challenges associated with a centralized EM system, the Sub-group has focused on the development of input related to a decentralized system.



SCRS Minimum Technical Standards for EMS in pelagic LL

Periodic reviews

- EM systems should have **regular evaluations** to ensure it reaches the objectives outlined.
- These also **give opportunity to incorporate new technologies** (i.e., improved cameras, artificial intelligence) as they become available, as well as updated and incorporate new objectives.
- A **review framework should also allow a faster implementation** of the updated minimum standards, that can be reviewed and adapted as needed in the future.



SCRS Minimum Technical Standards for EMS in pelagic LL

Standards described in this presentation in the following slides

- 1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance;
- 2) Standards for data storage requirements and what data are subject to those provisions;
- 3) Standards for data collection, review and transmission to ICCAT;
- 4) Standards for data protection and potential privacy issues.



SCRS Minimum Technical Standards for EMS in pelagic LL

1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance

- Capable to **resist rough conditions at-sea with minimum human intervention.**
- Linked to a **receiver which records for e.g., coordinates, speed, and heading data** (e.g., GPS).
- **Battery backup** with capacity to allow proper shutdown and not corrupt the data if power from the vessel fails.
- **Proof against any manual data input or external data manipulation**, and record any attempt to tamper with the equipment or the archived data.
- **Administrative tools and data must be password protected.** The EMS must be proof against any manual data input or external manipulation.
- Specifications for EMS **should be based on performance standards** rather than being too prescriptive in terms of pure technical requirements.
- Cameras must be placed to **provide clear, unobstructed views of the areas that are being covered.**
- Vessels should be equipped with a **sufficient number of cameras to allow data collection to the required standards** (we provide an example of a 4-camera system next).



SCRS Minimum Technical Standards for EMS in pelagic LL

- Example of a 4 camera set-up for pelagic LL vessels scientific EMS

Camera location	Action covered	Possible data collected
Aft of the boat	Setting operation	Set position, date, time
		Total number of hooks, hook types, hooks between floats
		Bait type/species
		Bait ratio (%)
Work deck	Catch at hauling	Mitigation measures used (painted bait, tori lines, line weight)
		Species ID/composition
		Specimen sizes
		Condition (dead/alive)
		Fate (retained/discarded)
Processing area	Catch while processing	Predators observed
		Discards by set
		Discards ID/composition
		Species ID/composition
		Total catch by set
Surrounding water area	Discarding (if discarded in the water)	Specimen sizes
		Sex
		Weights?
		Product type (fresh/processed)
Surrounding water area	Discarding (if discarded in the water)	Discards by set
		Discards ID/composition
		Condition of discards?



SCRS Minimum Technical Standards for EMS in pelagic LL

1) Continuation: Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance

- Crew should ensure that all specimens caught, even the discards, are **handled in a manner that enables the video to record such specimens.**
- Assumed that most cases will be **using video are the primary data collection** method, but it **may be possible for some CPCs to collect the data with still images.**
- **Quality of the data must be sufficient to allow species ID and detailed measurements of specimens.**
- Suggested video with a minimum 720p resolution, and a minimum of 5-10 FPS. For still images, suggested a minimum resolution of 2MP, with a rate of image capture determined by the characteristics of each fishery.
- System should be **independent from the crew during the trip** (exception of some basic maintenance such as periodically cleaning the camera lenses).
- Usually not necessary to record 24h/day, but only when relevant operations are taking place, to save storage space. The EM system **could have sensors and be capable of recording** only during the period of gear deployment (aft camera) and gear retrieval (work deck, processing area, surrounding water cameras).



SCRS Minimum Technical Standards for EMS in pelagic LL

1) Continuation: Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance

- Include a **control box that receives and stores the raw data provided by the sensors and cameras.**
- Include a wheelhouse monitor with a user interface to **provide information about the functioning of the system and for the vessel operator to monitor the control box, and cameras.**
- The EMS should have a **self-diagnostic test for functionality of the system components**, and record the outcome of the tests.



SCRS Minimum Technical Standards for EMS in pelagic LL

2) Standards for data storage requirements and what data are subject to those provisions

- Must contain **data storage systems adequate for the trip duration** that each national program is designed to cover.
- Regulations relating to **data storage and transmission should be flexible as new technology may allow for different ways of storing or transmitting data** that are less logistically challenging or more efficient.
- System must be **verified to be functioning properly before the start of each trip, remain powered on and positioned correctly for the duration of each trip.**



SCRS Minimum Technical Standards for EMS in pelagic LL

3) Standards for data collection, review and transmission to ICCAT

- In decentralized system, **raw data (i.e, video/images) are managed by each CPC.**
- **Review of the video footage is done by the CPCs authorities and/or by a contracted EM service provider.**
- **EMS should be able to collect, to the extent possible, the observer data that is required to be submitted to ICCAT (ST-09), or any subsequent update of the form.**
- **EMS cannot fully replace all the functions of human scientific observers, such as biological sampling. EMS should be used as a complement or supplement to such programs, and a minimum human observer coverage should still be maintained for scientific purposes.** This is currently 5-10% for most ICCAT fisheries.
- There may be the **need for CPCs to train EM analysts for their programs. ICCAT Secretariat might be involved in providing standardized training** for EM analysts or approve training programmes followed by each CPC.
- For **size measurements** to be taken, **catch will need to be positioned by the crew onboard in one or more calibrated areas** (example provided in next slide).



SCRS Minimum Technical Standards for EMS in pelagic LL

3) Standards for data review and transmission to ICCAT

- **Example of a calibrated hatch onboard a commercial fishing vessel.** These areas will vary from vessel to vessel, depending on available surfaces and the species (sizes) being measured.





SCRS Minimum Technical Standards for EMS in pelagic LL

3) Standards for data review and transmission to ICCAT

- Once data is collected it should be subject a **quality control (QC) procedure**, as is standard with most observer programmes, to ensure data quality.
- **Any conversion factors (e.g., length-length or length-weight) should be the conversion factors adopted by the SCRS**, when available.
- **CPCs are responsible for reporting EMS data to the ICCAT Secretariat using ICCAT ST-09 forms**, or any other forms that in the future might be developed and approved by the SCRS for EMS data reporting.
- **Submission of EMS data should comply with the Task 1, 2, and 3 data submission deadlines** established by the SCRS and adopted by the Commission.



SCRS Minimum Technical Standards for EMS in pelagic LL

4) Standards for data protection and potential privacy issues

- With a decentralized program, **the aspects relative to potential privacy issues of the crew, depend on national regulations and legislation.**
- In such a system, **only the CPC that is responsible for the collection of the data has access to the original/raw video recordings.**
- What is **submitted to ICCAT is the data extracted from those original recordings.**
- Data submitted to the Secretariat should follow the **ICCAT Rules and Procedures for the Protection, Access to, and Dissemination of Data.**



Some main conclusions

- **EMS hold promise for resolving some problems with data gaps in fisheries monitoring, but it cannot substitute for human observers.**
 - EMS are likely to be used as a complement rather than a replacement.
 - A minimum coverage with human observers should be maintained (currently 5-10% for some ICCAT fisheries).
- **There are still challenges associated with processing and analyzing very large volumes of data**
 - Improvements in artificial intelligence, machine learning/deep learning algorithms, hardware and software can mitigate some of the current limitations with data collection and analysis.



Some main conclusions

- **Specifications for EMS should be based on performance standards** rather than being too prescriptive in terms of pure technical requirements.
 - Vessels should be equipped with a sufficient number of cameras to allow data collection to the required standards (we provide an example of 4 camera setup for pelagic LL).
 - Quality of the data must be sufficient to allow species ID and detailed measurements of specimens.
 - EMS should be able to collect, to the extent possible, the observer data that is required to be submitted to ICCAT (ST-09), or any subsequent update of the form.
 - Some adaptations will be needed from the onboard crew, such as the crew positioning the catch in one or more calibrated areas for size measurements.



Subgroup interactions with the Commission and other RFMOs

- **Interactions with the ICCAT Commission (keeping Commission updated on our work)**
 - Coordination with the IMM Chair since 2021
 - Presentation to IMM - 1 meeting in 2021 (14-17 June 2021)
 - Presentations to the ICCAT WG-EMS in 2022 – 2 meetings (28 Feb 2022; 6-7 June 2022)
 - Presentation to the ICCAT WG-EMS in 2023 – 15 Feb 2023 (this meeting)
- **Interactions with other RFMOs (scientific groups)**
 - IOTC – Presentations to the Working Group on EMS (15-17 Nov 2021, 5-7 June 2022)
 - IATTC – Presentation to the 3rd workshop for an EMS in the EPO (25-27 April 2022)



ICCAT CICTA CICAA



Thank you

Questions?
Suggestions?

Minimum Standards and Program Requirements for EMS onboard Longline vessels
(Submitted by the European Union)

(Based on EMS_JUN_03A/i2022 as amended by the Drafting Committee)

1. Background

During the first meeting of the Working Group on Electronic Monitoring Systems (EMS) on 28 February 2022, it was agreed to draft the Minimum Technical Standards for the implementation of EMS on longliners.

Several ICCAT Recommendations currently contemplate the use of EMS, in particular the Recommendation by ICCAT to replace the Recommendation by ICCAT replacing Recommendation 19-02 replacing Recommendation 16-01 on a multi-annual conservation and management programme for tropical tunas [Rec. 21-01], the Recommendation by ICCAT on the conservation of North Atlantic stock of shortfin mako caught in association with ICCAT fisheries [Rec. 21-09] and the Recommendation by ICCAT to establish rebuilding programs for blue marlin and white marlin/roundscale spearfish [Rec. 19-05].

EMS is a technology widely used nowadays which can make important contributions to improve the effectiveness of monitoring and control as well as the collection of scientific data. The possible use of this technology has been included in ICCAT Recommendations since 2019.

In this sense, the development of EMS minimum technical standards is a fundamental task to ensure that when these systems are used, there is a guarantee as to their effectiveness in achieving the purposes for which they are intended.

General objectives

This document aims to describe the common minimum technical standards and program requirements for Electronic Monitoring Systems (EMS) for longline fisheries activities that may be implemented by Contracting Parties, cooperating non-Contracting Parties, Entity or Fishing Entities (CPC) operating under the ICCAT framework. The document also describes additional specifications for particular programmatic objectives for the use of EMS (e.g., scientific data collection, compliance monitoring), including those objectives currently required in relevant ICCAT Recommendations.

EMS coverage

All EMS shall collect fishery data and associated metadata necessary to meet the requirements and/or check compliance with the rules laid out in ICCAT conservation and management measure, as well as the needs of the SCRS. When using EMS, the following data shall be recorded by the system:

- a) Vessel track: all EMS shall be provisioned with Global Positioning Systems (GPS) to allow the monitoring of the position, and speed [and course], of the vessel during the route of its fishing operations.
- b) Set location: EMS integrated GPS would allow the coordinates (latitude and longitude) of each of the sets during the fishing trips to be recorded.
- c) Haul back location.
- d) Number of sets.
- e) Date and time of fishing operations
- f) Data allowing estimation of fishing effort (i.e., use of winches used to set and haul the gear, speed of the vessel, etc.).
- g) Recording of the total catch per set: cameras shall be positioned to allow the recording of the number of individuals brought on board during the hauling operation.
- h) Estimation of the species composition: the recording of the hauling operation shall allow the proper identification of the individuals brought on board during the hauling operation.

- i) Data allowing bycatch estimation: camera placement and recording shall allow for proper estimation of bycatch species during a specific hauling operation on a specific set.
- j) Where applicable EMS may be used to monitor full retention/obligation to release certain species: EMS can be used to review the disposition of the species during the hauling operations (e.g., ICCAT Res. 09-07, ICCAT Res. 10-07, etc.).
- k) [Transhipments at sea: where applicable sensor information (i.e., GPS indicating that the vessel is stopped, sensors on cranes or hold hatches indicating that there may be transhipment activity) can trigger cameras and subsequent analysis of the video footage.]

A more detailed analysis of the several data fields to be covered on longline fisheries using EMS are listed under **Annex 2**, distinguishing the requirements of the system in case it is used for science purposes or for compliance purposes.

Vessel areas coverage

Although it will depend on the configuration of each particular vessel, EMS cameras [and where appropriate sensors] shall be installed in order to properly capture all relevant fishing activity, including the following:

1. General view of the fishing deck
2. Setting area (usually vessel stern site camera)
3. Catch handling area
4. Hauling area
5. Surrounding water area allowing to monitor discard events

Vessel Monitor Plan (VMP)

As each fishing vessel has a different or unique configuration (even if those vessels are listed under the same fleet segment), each individual vessel on which EMS is to be installed, should develop a unique Vessel Monitor Plan (VMP) that must cover all monitoring needs and protocols. The VMP should allow to adapt the installation to the vessel characteristics and optimize the quality of data and especially the video footage.

1. The vessel monitor plan shall be compulsory for each vessel and shall be delivered to the competent authorities.
2. The vessel monitor plan shall be developed in collaboration with the EMS provider, vessel owner and fishing authorities.
3. A survey of the vessel to have an EMS shall be carried out and the following factors shall be taken into consideration:
 - a) Camera positioning and settings.
 - b) Number of cameras to be installed to ensure optimization of the view of the catch-handling area.
 - c) Key areas to be surveyed are catch handling areas for species identification and storage of the individuals.
 - d) Cameras shall be positioned to allow the assessment of the quantities and species retained onboard.
4. The minimum sections to be contained in a VMP are:
 - Contact information: current contact information for the vessel owner, vessel operator and EMS service provider as long as the contract lasts.
 - General vessel information: basic information about the vessel and its fishing activities and operations (e.g., vessel name, registration number, target fishery, areas, fishing gear, LoA, etc.).
 - Vessel layout: equipment of the vessel with detailed information, plan of the vessel disposition and different areas (deck, processing, storage, etc.).

- EMS equipment set up: description of the settings of the EMS system, such as time running, number of cameras and areas covered, time recording for each of the cameras, number of sensors, [where applicable], software used, control box disposition, etc.
 - Catch handling procedures: description of the crew and their operations (number of fishermen and their job).
 - Any physical changes on the vessel, fishery, categorization of the vessel (fleet segmentation), catch handling deck, etc., should be reported to the Flag State authorities, and the VMP should be updated accordingly before the next fishing trip.
 - A shot and image taken by each camera should be inserted in the VMP.
5. The VMP should be signed off by the vessel owner and finally approved by the Flag State competent authority.
 6. The EMS equipment should not adversely affect vessel stability by posing risk to vessel operations, crew, or environment, nor should it impede the vessel's safe navigation.

A template of a VMP is detailed in **Annex 3**.

2. Basic program requirements

To ensure proper usage of the EMS under the ICCAT Framework by all parties involved:

Obligations of the Master

1. The Master of the vessel shall, within a prescribed period of time [of maximum 24 hours], report to the competent authorities if the systems fails to operate properly at sea or if a critical warning has been displayed.
2. The vessel shall not leave port in case the EM system does not operate properly.
3. The Master of the vessel shall ensure the proper transmission of the EMS data and on board access to the EMS if requested by and ICCAT-authorized observer and/or inspector.
4. If the transmission of the video footage is decided to be:
 - a) Via exchange of hard drive, the operator must ensure the secure and safe delivery of the hard drive to the competent authorities.
 - b) Via satellite or Wi-Fi transmission, the operator must ensure the proper connection for the whole content of the video footage to be delivered to the competent authorities or to the analyst, excepting port Wi Fi infrastructure which is the responsibility of the port authority. If port Wi Fi is unavailable, the operator must ensure footage is properly stored and delivered as soon as reasonably possible. This type of transmission must ensure proper encrypted data, when required/decided by national authorities.
5. The Master of the vessel must ensure that the cameras have an un-obstructed view and to clean the camera lenses, when necessary, following pre-established protocols.
6. The Master of the vessel shall ensure that the crew will not change the handling process to ensure the proper identification and estimation of the catch composition.
7. The Master of the vessel (and the crew by extension) shall not tamper with the EMS (e.g., disconnect the system, unauthorized rearrangement of cameras, disconnect sensors [where applicable], switch-off manually, unless so instructed by the authorities, intentionally breaking the system, etc.).
8. If the Master of the vessel is the owner of the data, they shall ensure proper storage of the video and the sensor data [where applicable], for at least 3 years.

Obligations of the CPC

1. In case ICCAT rules require the implementation of EMS, the CPC shall ensure that fishing vessels under its flag comply with the requirements established by the Commission for the purpose of ICCAT EMS implementation.
2. If the CPC applies EMS for compliance purposes, they shall ensure the proper notification and follow-up of the final reports regarding alleged infringements detected using EMS.
3. The CPC shall ensure that the video footage and the analysis of the data retrieved from the vessel is done by companies¹ or by institutions or authorities, with the necessary knowledge or experience to ensure effective data analysis.
4. CPCs shall require EMS analysts to be independent from all vessels and companies operating in the fishery.
5. If the CPC is owning the data of the EMS system, they shall ensure proper storage of the video and sensor data, [where applicable] to allow for historical data audit at least 3 years).
6. If the CPC is the owner of the data, they shall determine who will be the reviewer/analyst of the data.
7. The CPC shall ensure that national EMS Programs are independent, transparent and accountable.
8. The CPC shall document the roles and responsibilities of fisheries government authorities and vessel owner/crew with respect to inter alia installing and maintaining equipment, routine cleaning of cameras, sending storage devices, access to E-Monitoring records and data, responses to mechanical or technical failure of E-Monitoring system, including at sea, or data analysis.
9. CPC shall report to the ICCAT Secretariat, consistent with ICCAT reporting requirements, on their EMS national programmes as soon as they are finalised and upon any substantial changes.

[Rules and procedures should be established for the case the EM system fails]. Additional obligations or tasks for the analysts or EMS providers could be established.

ICCAT roles and responsibilities - ICCAT Commission

- To monitor and provide oversight of the implementation of the existing EMS programs.
- To adopt and revise, when necessary, minimum standards for EMS, technical specifications, and associated data collection.
- [To ensure sufficient financial resources for the effective implementation of ICCAT's EMS requirements including by developing CPCs.] [*Note: to be discussed in EMS working Group*]

[*Note: the following tasks could be entrusted to the EMS Working Group. To be discussed in the EMS Working Group*]

- [To review ICCAT's REM programs after an initial period (to be determined by the relevant ICCAT recommendation of implementation.)]
- [To evaluate that EMS CPCs Programs in accordance with ICCAT's EMS minimum standards and recommend improvements and adjustment to the EMS programs to ensure that data and monitoring requirements of the ICCAT Commission are met.]
- [To summarize and provide annual reports about the progress of EMS programs to the Commission.]

¹ [These companies must ensure that the reviewers have proper training on the ICCAT Observer Program, training in species identification and proper background on the legal basic concerning the general ICCAT Framework should be a must for the reviewers in order to identify alleged infringements].

ICCAT roles and responsibilities - ICCAT Secretariat

- [To collaborate with the CPCs to ensure that they report effectively.]
- [To engage in coordination on EMS activities and programs with other tuna RFMOs as required by the Commission.]

3. Data management***Data storage and retention***

Standards for where, how, and how long video footage will be stored after it has been reviewed, should be specified. Storage decisions should be based on the EM program's goals and the personnel who will need to access monitoring records, at what frequency, and for what purpose.

Depending on the program's objectives and standards, footage can range from video of an entire fishing trip to video stills from key fishing events [(e.g., transshipment)]. Once footage is reviewed, it should be stored for at least 3 years.

EM systems should have enough autonomy and capacity to safeguard and store all recorded images and sensor information for at least the duration of a complete fishing trip. Storage considerations shall include the size and number of hard-drives that record the EM data, whether the hard-drives need to be removable, or a cloud-storage service shall be in use, or the amount of time the data shall be stored.

[Standards for where, how, and how long EMS records and other data requirements will be stored, should be specified]. EMS records should have a compatible data output format (including usage of standardized, well-established code lists) to exchange collected information with current ICCAT data reporting format and standards and consistent with ICCAT data rules.

EMS records should contain the following information: EMS Record file name including, at a minimum, the vessel name and vessel ID and trip ID, camera number, geolocation data (date, time (UTC), latitude and longitude), sensor data [where appropriate], [camera recording status, EM system status], images.

Data transmission or retrieval

Once data is collected by EM systems on-board vessels, it will need to be transferred for review and analysis. Three options could be possible to transfer the data:

1. Memory device exchange;
2. Wi-Fi/4G/5G transmission: Wi-Fi transmission, including via mobile data networks;
3. Satellite transmission.

When EM records should be extracted or memory device replaced between trips, traceability of every memory device and information recorded on board should be guaranteed. The chain of custody of the EM system memory device should be assured. For chain of custody assurance and independence, it is necessary that the data are retrieved by a third party with no conflict of interest.

A detailed protocol on how to retrieve the data from the vessel to the authorities or to the data analyst shall be detailed and agreed on the vessel monitor plan by both the vessel owner, the respective authorities and the data analyst.

It should be noted that the transmission of the data should be done at the end of the fishing trip where possible or if not possible (due to port Wi Fi being unavailable, due to low transmission speed, etc.) the data must be securely stored and transmitted without unreasonable delay/at the earliest opportunity. If the transmission of the data is done by satellite or Wi-fi/4G/5G, the transmission should be done at the entry of port without delay.

Data review and reporting

The system should have dedicated software to assist in data review. This software should permit the analysis of all the stored data, images and sensor data, [where appropriate], in a synchronized way. At a minimum, analysis software should allow for the report of the minimum following:

- Identification of fishing operations date/time;
- Identification of set type;
- Estimation of the total catch by set;
- Estimation of target species catch composition and sizes;
- Detection of bycatch species and their fate; and
- Estimation of discards of target species.

When the system is to be used for scientific purposes, data should be submitted in a format that is compatible with, the ongoing National Observer Sampling Programs (including observer's databases), and RFMO data requirements and templates for data submission.

When the system is to be used for compliance purposes data analysis should be based on risk assessment. A list of potential non-compliances with ICCAT measures to be verified during the data analysis, should be agreed and made available to CPC appointed analysts. A protocol of reporting of alleged infringements detected using EMS shall be established by the CPCs or ICCAT, and the final report to be submitted to the authorities shall be reviewed and signed by an inspector or fisheries authority.

Minimum technical requirements

A. Minimum requirements for Control Box or EM Control Centre

The EM control centre is an onboard computer that acquires and stores all sensor and imagery footage (modified computer with possibilities to connect a number of different cameras and sensors). The following minimum requirements are required:

- GPS sensor or equivalent. The system must be able to record vessel position, speed, and course at a configurable time intervals from 1 minute.
- Fan-less passive cooling, with high temperature cut out.
- Sufficient data storage capability to store both sensor, [where appropriate], and imagery footage for the entire trip.
- At least one removable/swappable back-up data storage devices to ensure that data are not lost if a storage device fails.
- Where applicable, ability to transfer data to dedicated storage servers through 4G/LTE (prepared for 5G) mobile data connection and/or satellite connection (and possibly Wi-Fi connection, configured to connect to the harbour network when the vessel is docked).
- On-board screen connection for verification, including keyboard and mouse or touch screen.
- UPS (uninterrupted power supply), decreasing the risk of power loss. If possible, allowing the continuation of recording for relevant timespan (for e.g., 15 minutes). Controlled shutdown. Information on the power failure shall be automatically recorded to subsequent notification.
- Possibility for sensor and imagery data to be properly encrypted and compressed where necessary.
- Digital signature (date and time stamp, vessel name, vessel registration and GPS coordinates).
- The EM system incorporates a self-test function to allow remote verification of its functionality at all times. *[compliance only, subject to verification against SCRS min standards]*
- Near-real-time remote online "health statements" that assure that the data are recorded during the trip, which are sent to the supplier and/or authorities; and alerts when there is evidence of tampering. *[compliance only, subject to verification against SCRS min standards]*
- Support built in remote access/configuration for system configuration, updates, verification of system health and possible transmission requests of all or parts of recorded sensor data and video footage. *[compliance only, subject to verification against SCRS min standards]*
- Control box must prohibit tampering with registered vessel information and system setup. Administration rights must be required to access and modify these settings. The EMS should not generate or cause radio frequency interference with other on-board vessel communication, navigation, safety, geolocation devices (e.g., VMS) or fishing equipment.

B. Minimum technical requirements of cameras

The cameras shall be constructed out of material that resist harsh weather conditions on board and can resist tampering². Crew assistance should be required to clean the camera lenses when necessary.

- Type: Digital IP Cameras (IP= Internet Protocol)
- Ingress Protection: IP66 Rating. A higher IP for cameras exposed to heavy weather conditions is recommended
- Cabling: minimum CAT 5e Ethernet cable preferably CAT SFTP cable
- Resolution: minimum 2MP (1080P), depending on the purpose of each camera
- Specified range of fixed and zoom lens option cameras, with replaceable lenses
- Housing: replaceable camera dome/housing glass
- Video:
 - Compression: supports standard video compression formats. Minimum H264
 - [Remote configuration: *Note: check technical feasibility*] capability to configure the following parameters [both remotely and] on board:
 - FPS (Frames per second) adjustable depending on camera purpose
 - Image resolution
 - Image quality
 - Digital/optical zoom level
 - Automatic switching between day/night lighting conditions. Color / BW. Option for automatic face blurring, where needed. Dynamic face masking is recommended and preferred instead of blanking out parts of the field of view, as this would potentially blank out regions of interest
 - Possibility to set between video and still photographs and to set the time of taking those photographs
 - Measuring capability: capability to measure fish length for relevant cameras

In order to determine the number of cameras needed and the type, the following parameters shall be taken into consideration:

- Distance of the camera to the point of interest
- Aperture of the focal lens
- Required resolution needed for the purpose of the camera

² Using small cameras should be prioritized. Closure fittings need to be robust and durable.

C. Minimum technical requirements for sensors

[Sensors other than GPS are optional]. The minimum requirement for sensors depends on the type of vessel. Sensors must indicate when the gear is used and when fishing activity takes place, including, where appropriate, processing, storage or transshipment. Sensors should facilitate video footage revision and analysis. Several sensors shall be based on a common requirement independently from the type of vessel. The following sensors are recommended:

- Winch rotation with direction detection
- Hydraulic pressure
- Electric current
- Fish hatch/door open/close
- Temperature (fish hauls)
- Power block

Annex 2 to Appendix 4

Description of data fields to be collected using EMS on longliners

A more detailed analysis of the data fields that should be collected when using EMS are listed on the tables below.

Table 1 shows the data fields for an Electronic Monitoring System used for compliance purposes and

Table 2 shows the data fields for an Electronic Monitoring System used for science purposes.

Table 3 shows the general vessel and trip information and should be collected only when the Electronic Monitoring System scheme specifically requires it. This information is not collected by the EMS system directly and may be collected before or after the trip. The information may be included in the Vessel Monitoring Plan (VMP), attached to the VMP and/or in the post-trip report if the case this trip is evaluated.

Table 1. Data fields for ICCAT longline activities to be collected when an EMS system is to be implemented for compliance purposes.

Data field name	Data field description
1. Setting information	
Set number	A unique number to be allocated to each individual set. Internally generated. This should be a four-digit numerical code beginning 0001. Set numbers should be consecutive from the start of the first line set to the last line set of a particular trip.
Start setting date and time	Date and time the first buoy is thrown into the water to start the setting of the line. Use Coordinated Universal Time (UTC). Specify units (preferably hh:mm and YYYY/MM/DD).
Start setting position	Position in latitude and longitude for the start of the setting operation.
End setting date and time	Date and time the last buoy (usually has radio beacon attached) at the end of the mainline thrown into the water. Use Coordinated Universal Time (UTC). Specify units (preferably hh:mm and YYYY/MM/DD).
End setting position	Position in latitude and longitude for the end of the setting operation.
Use of mitigation measures or techniques	Where there are specific requirements on the use of mitigation techniques or devices in the applicable ICCAT legislation. i.e. Tori lines, low light night setting, branch line weighted, bird scaring lines, hook-shielding devices,...
Vessel speed during setting	Where there are specific requirements on the total number of hooks in the applicable ICCAT legislation. Vessel's average speed during setting (knots). Note: Collect vessel speed from the GPS/VMS several times during the operation and calculate the average.
Line setter speed	Where there are specific requirements on the total number of hooks in the applicable ICCAT legislation. Speed setting of the line setter (metres/second).
Length of mainline set	Where there are specific requirements on the total number of hooks in the applicable ICCAT legislation. Mainline total set length (i.e., the total deployed length of the mainline for the specific set). Usually calculated by multiplying the total time to set the line and the average line setter speed, taking into account any interruption times. This information can be obtained from the Fishing Master and cross checked against observer calculations. Note: specify units (preferably in metres).
Total number of floats set	Where there are specific requirements on the total number of hooks in the applicable ICCAT legislation.
Total number of hooks set	Where there are specific requirements on the total number of hooks in the applicable ICCAT legislation.
Hook type	Where there are specific requirements on the type of hooks in the applicable ICCAT legislation.

GPS information	Including a review of whether fishing activity may have occurred in closed areas or closed periods.
2. Hauling information	
Start hauling date and time	Date and time the first buoy is hauled back on board to start hauling the line. Use Coordinated Universal Time (UTC). Specify units (preferably hh:mm and YYYY/MM/DD).
Start hauling position	Position in latitude and longitude for the start of the hauling operation.
End hauling date and time	Date and time when the last component of the longline gear (usually buoy with radio beacon attached) is hauled back on board. Use Coordinated Universal Time (UTC). Specify units (preferably hh:mm and YYYY/MM/DD).
End hauling position	Position in latitude and longitude for the end of the hauling operation.
3. Catching details	
Set number	Unique number within a specific trip.
Catch number retained on board by species	Record/estimate the number of individuals per species caught and taken on board (for large fish). Analysts should record the species using FAO three figure alpha codes. If species FAO code is not available, record the species scientific name. Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.
Length of fish retained on board	Length dependable. The establishment of a calibrated area on the deck is usually necessary. May require the establishment of a protocol, which includes the cooperation of the crew.
Catch weight retained on board by species	Use the size-weight relationship established by ICCAT. For species where this relationship has not been established, indicate the correlation used and cite the source.
Bycatches discarded or released	Where there are specific requirements on discards in the applicable ICCAT legislation.
Condition of bycatches discarded or released	Where there are specific requirements on the condition of the bycatch in the applicable ICCAT legislation.

Table 2. Data fields for ICCAT longline activities to be collected when an Electronic Monitoring System is to be implemented for science purposes.

[The table will be based on the work carried out by the SCRS.]

Table 3. Data fields for ICCAT longline activities. General vessel and trip information. [A new column could be added describing whether each field is relevant only to science, to compliance or both.]

Data field name	Data field description
1. Vessel identification	
Name	Vessel full name as recorded on vessel official documentation.
Flag state	Record the name of country in which vessel is registered as shown on its registration documents. Where chartering occurs, record name of the chartering country.
Vessel ICCAT number	
Vessel registration number	
International radio call sign (IRCS)	
Vessel phone, fax and email	
Licensed target species	
2. Vessel attributes	
Tonnage	
Length overall	
Hull material	Record the vessel hull material (s) (steel, wood, aluminium, fibre glass, etc.)
Main engines power	Specify units (HP, Kilowatt or BHP).
Fish storage capacity	The vessel total maximum capacity to store catches. This should include blast freezer(s) capacity. Note: specify units (metric Tons (mT.) or cubic metres (m3)).
Fish preservation methods	
Freezing capacity	Indicate the maximum volume of fish the vessel can freeze per day.
Vessel autonomy	Record vessel autonomy, expressed by the time (days) a vessel can spend at sea without refuelling. If this information is not available, then record vessel range expressed in cruising distance (nautical miles). If a figure for the range cannot be obtained, the observer should calculate vessel range as follows. <Vessel range (nm)> = <Vessel average cruising distance per metric ton (nm/mT)> : <Tonnage of fuel carried (mT)> Note: specify units (days or nautical miles)
3. Vessel owner and personnel	
Registered owner	Owner's name, nationality and contact details.
Charterer/operator	Where the vessel has been chartered and is operated and managed by a company other than the owner. Record operator's full name (company or individual as appropriate), nationality and contact details.
Skipper	Skipper's name and nationality.
Fishing master	Fishing master name and nationality. Complete in case the fishing master and skipper are not the same person.
Crew number	Number of crew members.
4. Vessel electronics	
Global Positioning System (GPS)	
Vessel Monitoring Systems (VMS)	
Radars	
Track plotter	
Depth sounder	
Sonar	
Doppler current meter	
Expendable bathythermographs (XBT)	
VHF radios	

HF radios	
Satellite communication systems	
Sea Surface Temperature (SST) gauge	
Weather facsimile	
Global Positioning System (GPS)	
Fisheries information services	
5. Special gear equipment or machinery	
Line setter	
Line hauler	
Bait casting machine	Indicate Yes or No. Most vessels manually deploy branch lines with the bait. However, there are a number of vessels that use automatic bait casting machines.
6. General gear attributes	
Mainline length	
Branch line configuration number	
Branch line storage	If the branch lines are coiled up and packed into baskets (BSK), or layered out in tubs (TBS), or coiled up onto reels (RLS).
Mitigation devices	Record depredation mitigation device/s DMDs used by the vessel.
7. Trip details	
Trip number	Trip unique identifier. Could be internally generated.
Trip duration	Date and place of the start and end of the fishing trip.
Port of departure	
Landing	Date and place of landing.
8. Human observer on board	
Name	First and last name.
ICCAT registration number	Registration number allocated by the ICCAT Secretariat.
Nationality	
9. Observed trip summary	
Number of fishing events/sets conducted by the vessel	Record the total number of fishing events/sets conducted by the vessel, independently of their success in catching.
Number of fishing events/sets reviewed	Record the total number of fishing sets/events monitored by the analyst.
Number of days searching	Record the total number of days that the vessel was engaged in actively searching for fish (this includes active fishing days).
Number active fishing days	Record the total number of days that the vessel actually fished (i.e., when the vessel had gear in the water).
Number of days in the fishing area	Record the number of days the vessel spent in the fishing area. This does not include transit time even if the area being transited is within the fishing area.
Number of days transiting	Record the number of days the vessel spent steaming or transiting to/between/from fishing areas.

Description of a Vessel Monitor Plan

Part A

(Shall be handed over by the vessel owner)

1. Information provided by the owner of the vessel

External registration		Main fishery(es)	
Vessel name		Gear type(s)	
ICCAT Fleet register No.		Crew size	
IRCS		May carry an observer	
Home port		Name of the owner(s) representative	
Vessel length		Phone No.	
Vessel type		E-mail	

2. Description of the crew fish handling and any other useful details

3. If available, copy or image of the vessel general arrangement plan

4. General layout and handling (not necessarily to scale)

5. General remarks

Part B

(Responsibility of the competent authority and to be validated by the competent authority)

1. Vessel image
2. System Configuration

a) System Operation – General Description

Sensor recording:	Description of the settings:
Video recording:	Description of the settings:

b) System Components Location

Control box: - Image of location of the control box	User Interface:
GPS: - Image of location of the GPS	GPS details:
Drum Rotation Sensor: - Image of location of the Drum Sensor	Drum Rotation Sensor details:
Hydraulic Pressure Sensor: - Image of location of the Hydraulic Pressure Sensor	Hydraulic Pressure Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:

Sensor XX - Image of location of the XX Sensor	XX Sensor details:
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Camera 1 - Deck Camera	
Image of Location of Camera 1	View and Objectives
Image deck camera	Camera Settings
Camera 2 - Retain/General View Camera	
Image of Location of Camera 2	View and Objectives
Image Retain/General View Camera	Camera Settings
Camera 3 - Sorting Belt Camera	
Image of Location of Camera 3	View and Objectives
Image Sorting Belt Camera	Camera Settings
Camera 4 - Discard Camera	
Image of Location of Camera 4	View and Objectives
Image Discard Camera	Camera Settings

Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings

Control Box Setting Summary Main Configuration Screen	Camera Setting Summary
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Sorting Area Measurement Details

Part C

(To be completed by the service provider)

1. EM User Guide
 - a) Description on how to retrieve hard drives
 - b) Description on how to power up the system
 - c) Description on how to do a function test

2. Vessel-specific handling protocols

Description of any special protocols that may apply to the vessel referred in the VMP

- a) Description and diagrams of control points with specific procedures carried out. For each area description, there must be a protocol on how to ensure the catch remains in camera view.

Part D

(To be completed by the service provider)

List of EMS service providers contact information:

<i>Name and Last Name</i>	<i>Phone</i>	<i>Email</i>	<i>Office address</i>

Part E

(To be completed by the vessel owner and the service provider)

This part should certify that the vessel owner/operators have been trained in the function and operation on the Electronic Monitoring System (EMS) system installed on the vessel, and that the operator agrees to comply to the Vessel Monitoring Plan (VMP).

Vessel operator name and last name: _____

Vessel owner/operator signature: _____

Date and time: _____

EMS Service provider Name and Last name: _____

EMS Service provider signature: _____

Date and time: _____