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Explanatory note to Draft Recommendation by ICCAT to Establish Minimum Standards and Program Requirements for the use of Electronic Monitoring Systems (EMS) in ICCAT Fisheries

(Submitted by the European Union, Canada, the United Kingdom and the United States)

Following its establishment in 2022, the Electronic Monitoring Systems (EMS) Working Group adopted as one of its main objectives the development of EMS minimum standards for possible adoption at the Annual meeting in 2023.

For the drafting, an informal drafting group opened to all interested CPCs was set up. Five drafting sessions took place. In addition, some technical discussions also took place in the EMS Working Group itself.

The text presented here is the outcome of this work. The text has been consolidated taking into account the latest discussions at the fifth drafting session which took place after the Second Meeting of the EMS Working Group of 7 September 2023.

There are a small number of open points in brackets, reflecting parts on which no agreement has been reached yet, or proposed edits that have come after this fifth drafting session.

The EU would like to thank the participants to the drafting sessions for their most valuable input. On the basis of the work done in the drafting sessions, the EU trusts that the remaining outstanding points will be closed during this year's Annual meeting, so that this ambitious proposal can be adopted at the Annual meeting.

Draft Recommendation by ICCAT to Establish Minimum Standards and Program Requirements for the use of Electronic Monitoring Systems (EMS) in ICCAT Fisheries

(Submitted by the European Union, Canada, the United Kingdom and the United States)

TAKING INTO ACCOUNT the *Resolution by ICCAT for the establishing of an ICCAT Working Group on the use of Electronic Monitoring Systems (WG EMS)* (Res. 21-22), and that a primary objective of this Working Group is the establishment of EMS minimum standards for ICCAT fisheries;

RECOGNIZING that EMS can be used to improve control and constitutes a significant means for authorities to ensure compliance with the applicable rules;

RECOGNIZING that EMS can enhance the collection of fisheries data for scientific and management purposes;

RECALLING the SCRS conclusion that when used for scientific purposes, EMS cannot fully replace human scientific observer programs, and a minimum human observer's coverage is still necessary to collect certain information, in particular biological samples;

ACKNOWLEDGING that several ICCAT Recommendations currently contemplate the use of EMS, in particular, *the Recommendation by ICCAT on a multi-annual conservation and management program for tropical tunas* (Rec. 22-01)*, 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).

FURTHER ACKNOWLEDGING that some of these recommendations mandate the establishment of minimum standards for this technology, – standards that must be implemented before EMS can be used to meet certain ICCAT requirements, such as expanded observer coverage; and

NOTING that the development of EMS minimum program requirements and technical standards and specifications is fundamental to ensuring both a level playing field among CPCs and that, when these systems are used, they are effective in achieving their intended purpose.

THE INTERNATIONAL COMMISSION FOR THE CONSERVATION
OF ATLANTIC TUNAS (ICCAT) RECOMMENDS THAT:

Purpose and Scope

1. The purpose of this recommendation is to establish minimum program requirements and technical standards and specifications for EMS used in ICCAT longline and purse seine fisheries to meet ICCAT requirements for scientific data collection and/or compliance monitoring and ensure that when EMS is used it is effective in achieving its intended purpose.

2. Notwithstanding paragraph 1, the implementation of EMS is optional, and this recommendation does not create any independent obligation for CPCs to implement EMS on board their fishing vessels.

3. CPCs that implement EMS in their fisheries pursuant to such ICCAT recommendations shall ensure that their EMS domestic programs meet the minimum program requirements and standards and specifications set out in this Recommendation.

3bis. Unless otherwise decided by the Commission based on SCRS advice provided pursuant to paragraph 13 of Rec. 16-14, CPCs shall ensure that they continue to meet the minimum human observer coverage required consistent with paragraph 4 of Rec. 16-14 and that, if they choose to implement EMS pursuant to this Recommendation for scientific purposes, it shall be used to complement that required minimum level of human observer coverage.

EMS minimum standards

4. EMS shall automatically and autonomously collect required data for each fishing trip and shall be tamper-evident.

5. EMS shall be capable of collecting data:

   a) on the position, and, unless the EMS uses cameras that will record continuously, the speed and course of the vessel;
   b) on starting and ending coordinates and date and time of the setting and haulback operations of each fishing set;
   c) allowing, where applicable, the estimation of fishing effort (i.e., number of sets, number of hooks);
   d) allowing the estimation of total catch, including bycatch and discards, per set, and, where possible, the disposition status (i.e., discarded dead, released alive) of discards;
   e) supporting species identification, and
   f) allowing, where necessary, for the measurement or estimation of the size of individual fish in the retained catch, including bycatch.

6. Minimum EMS components shall include:
   - electronic Monitoring (EM) control box/centre, including a satellite positioning system, e.g., the global positioning system (GPS) or equivalent, hereafter referred to as GPS;
   - video cameras;
   - sensors or other fishing activity recognition tools, unless system video cameras will run continuously;
   - battery and data storage backup systems;

7. The minimum technical requirements for an EMS (control box, sensors, and cameras) are detailed in **Annex 1**.

8. The specific data fields that shall be collected by EMS in longline and purse seine fisheries and those areas of longline and purse seine vessels that shall be subject to coverage by the EMS are listed under **Annex 2** and **Annex 3** respectively. These annexes also distinguish between the EMS requirements needed for compliance purposes versus scientific data collection purposes.

Other Program Requirements

Vessel Monitoring Plan (VMP)

9. CPCs shall ensure that a unique Vessel Monitoring Plan (VMP) for each individual vessel flying their flags on which EMS is to be installed is developed that shall allow the installation of the EMS to be adapted to each vessel's characteristics and describe how fishing operations on that vessel will be conducted to ensure effective monitoring of fishing activities onboard. The VMP shall cover all relevant minimum standards and technical specifications in this Recommendation while optimizing the quality of data the EMS collects from the vessel. A copy of the approved VMP shall be maintained aboard the vessel at all times during fishing operations. The VMP requirements are detailed in **Annex 4**.

Data Management

10. The requirements applicable to CPCs for data storage and retention, data transmission or retrieval and data review and reporting are detailed in **Annex 5**.

Obligations of the Vessel Master

11. The Master of the vessel shall ensure that:

    - the vessel does not leave port if the EMS is not operating properly unless, the flag CPC authorizes it to do so and ensures that any relevant data collection or other ICCAT obligations, such as minimum observer coverage requirements, can be met through other means;

- in case the EMS malfunctions, report the malfunction, including the display of any critical warning, to the flag CPC competent authorities, through automatic real time notification of the malfunction or manually, within a maximum of 24 hours or as soon as practicable;

- on-board physical access to the EMS components is provided if requested by an ICCAT or CPC-authorized observer and/or inspection personnel;

- in accordance with the VMP and the minimum areas of vessel coverage as specified in **Annexes 2** and **3**, the cameras have an un-obstructed view, and following pre-established protocols, the camera lenses are kept clean;

- the handling of the catch does not hinder the proper identification and estimation of the catch composition by the EMS, including by-catch;

- the transmission or retrieval of EMS data is carried out in accordance with the provisions of **Annex 5**;

- unless authorized and instructed by the flag CPC to take a specific action, the EMS is not tampered with (e.g., disconnect the system, rearrange, or obstruct the view of the cameras, disconnect cameras or sensors, switch-off the EMS manually, intentionally break the system, etc.).

Obligations of the flag CPC

12. CPCs that choose to implement EMS to meet ICCAT requirements specified in separate ICCAT recommendations (e.g., regarding observer coverage), shall ensure that the fishing vessels flying their flags meet the EMS minimum standards and requirements established in this Recommendation, including ensuring the following:

    - that domestic EMS programs are developed, and designed and implemented in a manner that ensures they are independent, transparent, and accountable, in accordance with requirements set out in this Recommendation;

    - that the analysis of the EMS data is done by CPC-authorized independent companies or by CPC institutions or CPC authorities, with the necessary knowledge, skills and abilities to ensure effective data analysis, including sufficiently accurate species identification;

    - that rules and procedures are established in case of EMS failure, including to ensure that any relevant data collection or other ICCAT obligations, such as minimum observer coverage requirements, can be met through other means;

    - that appropriate follow-up is undertaken if potential infringements of ICCAT conservation and management measures are detected through the CPC's EMS program.

13. A CPC that chooses to implement an EMS program in its longline and/or purse seine fisheries to meet ICCAT requirements for scientific data collection and/or compliance monitoring purposes shall develop <u>and describe</u> an EMS domestic program. The EMS domestic program shall <u>meet the requirements in this Recommendation and include</u> at least the following information:

    - an example of the VMPs used in the program;
    - responsibilities of fisheries authorities and vessel owner/crew with respect to installing and maintaining equipment, including routine cleaning of cameras, and responses to mechanical or technical failure of the EMS;
    - protocols for data storage and retrieval;
      […]
    - list of any ICCAT measur<u>es</u> where the use of EM<u>S is necessary for the CPC to meet the requirements of</u> ICCAT recommendation<u>(s) for monitoring compliance</u>, and the protocols for reporting and following up on potential infringements mentioned in **Annex 5**.

14. The EMS program description required in paragraph 13 above shall be submitted to the ICCAT Secretariat within 30 days of the adoption of such program. In addition, CPCs shall report any changes to their EMS domestic program to the ICCAT Secretariat whenever such changes occur.

15. A CPC that chooses to implement EMS in its longline or purse seine fisheries to meet ICCAT requirements for scientific data collection and/or compliance monitoring purposes, shall also:

    a) When EMS is used for scientific purposes, report to the SCRS each year, using the electronic formats that are developed by the SCRS, information collected through domestic EMS programs, in line with procedures in place for other data reporting requirements and consistent with domestic confidentiality requirements; and;
    b) report to the Commission in their Annual Report other relevant information on the results of the implementation of its EMS domestic program during the previous year, including, at least, the number of vessels or fishing effort monitored; the coverage levels achieved by fishery and gear type; details on how those coverage levels were calculated; and, where appropriate, information on compliance monitoring.

    […]

Commission roles and responsibilities

16. The WG-EMS shall:

    - review, with assistance of the SCRS where appropriate, the EMS domestic program submitted pursuant to paragraph 14, as well as the implementation of those programs and, if appropriate, suggest improvements and adjustment to such programs to ensure that ICCAT scientific data collection and/or compliance monitoring requirements are met.

17. The Commission shall:

    - explore the availability of sufficient financial resources to support, where needed, the effective introduction and implementation of ICCAT's EMS program requirements, standards and specifications contained in this Recommendation, including by developing CPCs;

    - engage in coordination on EMS activities and programs with other tuna RFMOs.

    - the Commission may delegate this responsibility to the WG-EMS.

Secretariat roles and responsibilities

18. The Secretariat shall:

    - collaborate with the CPCs implementing EMS domestic programs to ensure that they can meet the applicable ICCAT reporting obligations;

    - summarize and provide annual reports to the Commission about the progress of CPCs in implementing EMS domestic programs.

Periodic review

19. The Commission shall review this Recommendation in 2026 and at least every four years thereafter to evaluate its effectiveness in fulfilling its purpose and consider the need for revisions, taking into account, inter alia, relevant information provided by CPCs on the introduction and implementation of their EMS domestic programs as well as any new technological developments.

Minimum Technical Requirements for Longline and Purse Seine Vessels

A. Minimum requirements for Control Box or EM Control Centre

The EM control centre is an on-board computer that acquires and stores all sensor collected information and imagery footage.

A.1. The following minimum technical requirements shall be required:

- GPS sensor or equivalent capable of automatically recording the position and, unless the EMS uses cameras that will record continuously, the speed and course of the vessel.
- Sufficient data storage capability to store both sensors, where appropriate, and imagery footage for the entire trip.
- At least one removable/swappable back-up data storage device, or equivalent data storage mechanism, to ensure that data are not lost if a storage device fails.
- On-board screen, or equivalent interface, to allow verification by the Master/crew of the correct functioning of the system.
- Uninterrupted power supply (UPS) including a battery backup or other backup power system with capacity to provide power if the main power source from the vessel fails and allowing the continuation of recording for relevant timespan (for e.g., 15 minutes) and all recorded data are saved.
- Controlled shutdown, preventing the system from being switched off accidentally.
- Digital signature, in accordance with domestic legislation, (date and time stamp, vessel name, vessel registration and GPS coordinates).
- Automatic real-time malfunction system alerts.
- Control box shall prohibit tampering with registered vessel information and system setup. Administration rights shall be required to access and modify these settings.
- Radio frequency interference from EMS with other on-board vessel communication, navigation, safety, geolocation devices (e.g., VMS) or fishing equipment should be minimised.

A.2. The following technical requirements are recommended (optional):

- Cooling system, with high temperature cut out.
- The ability to encrypt and compress sensor and imagery data where necessary.
- GPS sensor or equivalent should be able to automatically record data at configurable time intervals from 1 minute.
- Automatic real-time malfunction notification to the flag CPC.
- Near-real-time remote online "health statements" that assure that the data are recorded during the trip, and alerts when there is evidence of tampering.
- 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.

[…]

B. Minimum technical requirements of cameras

The cameras shall be capable to resist rough conditions at-sea on board, and be resistant to tampering to the extent possible, and be tamper-evident. The video cameras shall be mounted and placed to provide clear and unobstructed views of the areas that are being covered. Crew assistance shall be required to clean the camera lenses when appropriate and necessary.

There shall be sufficient lighting to illuminate the area being recorded and the individual specimens captured. If vessels fish at night and use artificial lights to illuminate the deck, the quality of images shall be checked to ensure there is not excessive glare.

The following minimum technical specifications for cameras, video recording and analysis, as a part of an EMS, shall be required:

- Resolution: sufficient resolution to meet the purpose of each camera. For cameras used for species identification, no less than 720p, with a minimum frame rate of 5-10 FPS. Still images shall have a resolution of no less than 2MP.
- Measuring capability: capability to obtain fish length measurements from relevant camera images.

The following technical specifications for cameras, video recording and analysis, as a part of an EMS, are recommended (optional):

- Ingress Protection: IP66 Rating. A higher IP for cameras exposed to heavy weather conditions is recommended.
- Compression: supports standard video compression formats. Minimum H264.
- Automatic switching between day/night lighting conditions. Colour/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

C. Minimum technical requirements for sensors

Sensors and/or other fishing activity recognition tools (e.g., winch rotation, hydraulic sensors, GPS, Computer Vision, Artificial Intelligence) shall automatically identify a fishing related activity, including setting and hauling gear, sorting catch, etc., and if image recording of the EMS is not continuous, trigger the start of the image recording, as well as assisting in the revision and analysis of the video footage.

Description of the vessel areas coverage and data fields to be collected when using EMS on longline vessels

EMS cameras, and where appropriate sensors, shall be installed to properly capture all relevant fishing activity, including those in **Table 1** below.

Table 1. General configuration and areas/activities covered by an EMS onboard longli*ne vessels.*

Area covered	*Action covered*	*Data fields*
Setting area (Usually stern camera)	Setting operation	- Setting date, time, and position - Use of by-catch mitigation measures or techniques - Total number of hooks set, where applicable - Hook type, where applicable
Hauling area	Hauling operation	Hauling date, time, and position
Catch handling area – Working deck	Retained catches, including bycatch	- Number of individuals by species - Length and weight, where applicable
Surrounding water area near hauling area	Estimation of discards, including bycatches	- Number of discards by species - Condition of discards

Table 2. Data fields for ICCAT longline activities to be collected and reported when a CPC chooses to implement an EMS domestic program based on an ICCAT requirement to use EMS to monitor compliance. These data can be identified by the EMS or estimated through data analysis.

Data field name	*Data field description*
1. Setting and hauling information	
Start setting date, time, and position	For those fishing operations that are to be analysed. Date, time and position the first buoy is thrown into the water to start the setting of the line. Use Coordinated Universal Time (UTC). Preferably hh:mm and YYYY/MM/DD.
End setting date, time, and position	For those fishing operations that are to be analysed. Date, time and position the last buoy (usually has radio beacon attached) at the end of the mainline thrown into the water. Use Coordinated Universal Time (UTC). Preferably hh:mm and YYYY/MM/DD.
Start hauling date, time, and position	For those fishing operations that are to be analysed. Date, time, and position when the first buoy is hauled back on-board to start hauling the line. Use Coordinated Universal Time (UTC). Preferably hh:mm and YYYY/MM/DD.
End hauling date, time, and position	For those fishing operations that are to be analysed. Date, time, and position when the last component of the longline gear (usually buoy with radio beacon attached) is hauled back on-board. Use Coordinated Universal Time (UTC). Preferably hh:mm and YYYY/MM/DD.
Use of by-catch mitigation measures or techniques	Where there are specific requirements in an ICCAT recommendation on the use of by-catch mitigation techniques or devices as well as an ICCAT requirement to use EMS to monitor compliance with the applicable mitigation technique or device. Identify the use of mitigation measures or techniques, I.e., tori lines, low light night setting, branch line weighted, bird scaring lines, hook-shielding devices, acoustic deterrents…
Total number of hooks set	Where there are specific requirements on the total number of hooks in the applicable ICCAT recommendation.
Hook type	Where there are specific requirements on the type of hooks in the applicable ICCAT recommendation.
GPS position/track	Including a review of whether fishing activity may have occurred in closed areas or closed periods.
2. Catching details	
Catch number retained on board by species, including bycatch	Record/estimate the number of individuals per species caught and taken on board. Use 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.
Length of fish retained on board	Where there are specific requirements on the length of fish retained in the applicable ICCAT recommendation. 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. Specify units (preferably cm).
Catch weight retained on board by species, including bycatch	When using length estimation, use the length-weight relationship established by ICCAT. For species where this relationship has not been established, indicate the correlation used and cite the source. Specify units (preferably Kg).
Catches discarded or released, including bycatch	Where there are specific requirements on discards in an ICCAT Recommendation as well as an ICCAT requirement to use EMS to monitor compliance with discards requirements. Record/estimate the number of individuals per species.
Condition of catches discarded or released, including bycatch	Where there are specific requirements on discards in an ICCAT Recommendation as well as an ICCAT requirement to use EMS to monitor compliance with discards requirements. Distinguish at least between: Alive or dead

Table 3. Data fields for ICCAT longline activities to be collected and reported when a CPC chooses to implement an EMS program for ICCAT scientific data collection purposes. These data can be identified by the EMS or estimated through data analysis.

Data field name	*Data field description and notes*
1. Temporal and geographical attributes	
Flag of Vessel	Flag of the vessel. Reported to ICCAT in A3ISO coding
Base port/zone	Base port/zone of the vessel that the set(s) refers to.
Vessel (size class)	Vessel LOA Class. Usually aggregated in 10m size classes for reporting to ICCAT.
Vessel (carrying capacity)	Carrying capacity of the vessel.
Year	Year that the set(s) data refers to.
Time period	Time Period. Data reported set-by-set, monthly or quarterly.
Square type	Grid Resolution. Data reported in: exact location (latitude & longitude in decimal degrees), aggregated in 1x1 degrees, or aggregated in 5x5 degrees.
Latitude	Centroid of the latitude of the set(s) that the data refers to. Reported as the centroid in decimal degrees (±dd.ddd).
Longitude	Centroid of the longitude of the set(s) that the data refers to. Reported as the centroid in decimal degrees (±dd.ddd).
2. Effort attributes	
Nº fishing operations (total)	Total number of fishing operations that were carried out.
Nº fishing operations (recorded)	Number of fishing operations that were recorded in the EM System.
Nº fishing operations (processed and reported)	Number of fishing operations that were observed and processed from the EMS recordings, and for which the reported data refers to.
Fishing operation Type	Fishing Operation Type: “Set type” usually used for longlines, purse seines, lines, gillnets; “Haul type” usually for trawls. If “Other type” need to specify in notes.
LL type	Specify the longline set type. Examples in ICCAT coding system are: LL-B (Longline: Bottom or Deep longliners); LL-Shrk (Longline: Targeting sharks); LL-surf (Longline: Surface); LLALB (Longline: Targeting ALB); LLAMS (Longline: American style); LLBFT (Longline: Targeting BFT); LLJAP (Longline: Japanese type); LLMB (Longline: With mother boat); LLMESO (Longline: Mesopelagic); LLPB (Longline: "Stone-ball"); LLSWO (Longline: Targeting SWO).
N° hooks (total)	Total number of hooks of the longline fishing set(s).
Nº hooks (recorded)	Number of hooks in the longline fishing set(s) that were recorded by the EM System.
N° hooks (processed and reported)	Number of hooks that were observed and processed from the EMS recordings, and for which the reported data refers to.
Hook type	Type of hook that was used in the set(s). Current codes in the ICCAT databases are: Circle hook, J hook, Tuna hook, Mixed hooks, Other (specified in notes). (Note: might need integration with additional information from logbooks or the skipper).
Set depth	Set depth of the hooks in the fishing set(s). In some cases, the hooks per basket are used as a proxy for depth. Depth classes currently categorized for reporting to ICCAT are: <100m; >=100m & < 200m; >=200m.
3. Mitigation measures on bycatch species	
Seabirds’ mitigation measures	Mitigation measures that were used in the set(s), both related with seabirds as well as other bycatch. Current classes in ICCAT for reporting mitigation measures on seabirds and other bycatch are: Night setting of the fishing operation; Streamer lines used; Weighted branchlines used; Whole finfish bait used; Seabird scaring lines used; large circle hooks used; Seabirds (unharmed) promptly released; Sea turtles (unharmed) promptly released; Sharks (unharmed) promptly released; Sea mammals (unharmed) promptly release. If other measures are used, need to specify in notes (e.g., hook shielding devices).
Other bycatch mitigation measures	

4. Catch composition by fishing operation	
Species	Species FAO Code.
Targeted (Y/N) (*)	Specify if the species is targeted or not. (Note: this field might need integration with additional information from logbooks and/or the skipper).
Catches retained – Number	Number (N) of specimens, by species, that are retained in the catch, in each fishing set(s).
Catches retained – Weight (*)	Weight of the specimens, by species, that are retained in the catch in each of the fishing set(s). (Note: If the vessels have scales or a camera adapted to take measurements of individuals retained on board, it might be possible to adapt cameras facing the scales or connect the scales to the EMS directly).
Product type (*)	Product type that the weight of the catches refers to. Examples currently used to report to ICCAT are: Live (round) weight; Gilled & gutted; Fillet; Dressed weight; Belly meat; Other (specify it in notes). (Note: similarly to the catches retained in Weight, this field might be possible to collect only in vessels that have scales, either with the adaptation of cameras facing the scales, or connecting the scales to the EMS directly).
Discard – Number	Number of specimens that are discarded. Should be reported by species, if possible, or alternatively for higher taxonomic groups (e.g., genus or family) if not possible to detect the species of specimens discarded in the water. (Note: needs cameras in specific positions to cover all areas where specimens are released).
Discard – Condition at the time of discarding (*)	Condition of the specimens that are discarded. Current ICCAT codes are: Alive; Dead; Unknown. (Note: The EMS would need cameras or other systems in specific positions to determine specimen condition at release. It would also require video and not only still images, to determine if the specimens are alive/swimming when released).
5. Biological data (optional)	
Species	Species FAO Code.
Sex (*)	Sex of the specimens. (Note: might be possible to collect for elasmobranchs with specific specimen position by the crew and cameras).
Length (cm)	Size of the individual specimens that are brought onboard (Note: will need calibrated areas and support from the crew to position the specimens in those calibrated areas).
Size class type	Codes for the size class type reported in the length (cm) field. Current codes used in ICCAT are: Straight fork length, Curved Fork Length, Lower Jaw to 1st Dorsal Length, Straight lower jaw fork length, Curved lower jaw fork length, Posterior edge of eye socket to Fork Length, Total length, Other (specified it in notes).
Weight (kg) (*)	Weight of the individual specimens, reported in Kg (Note: If the vessels have scales or a camera adapted to take measurements of individuals retained on board, it might be possible to adapt cameras facing the scales, or connect the scales to the EMS directly).
Product weight and product type (*)	Product type that the weight of the individual specimens refers to. Examples currently used to report to ICCAT are: Live (round) weight; Gilled & gutted; Fillet; Dressed weight; Belly meat; Other (specify it in notes) (Note: similarly to the catches retained in Weight, this field might be possible to collect only in vessels that have scales, either with the adaptation of cameras facing the scales, or connecting the scales to the EMS directly).
Released (Y/N)	Record if the specimen was released (Yes/No) (Note: for specimens discarded in the water the operation is visualized by filming the surrounding water. It is not always possible to reach species level in such cases and might be needed to only report at the level of genus or family. For specimens that are hoisted to the vessel (e.g., to remove the hooks), it should be possible to record the species level in most cases.
External injuries (scale) (*)	Injuries of the specimens that are released. Injury scale used at ICCAT: Unknow (undetermined); Alive: Perfect (no visual injuries); Alive: Moderate (superficial injuries); Alive: Severe (could affect survival); Dead (release). (Note: Injuries from depredation or from the fishing process can only be seen sometimes. It will be more difficult and only occasionally detected when the specimens are released in the water).

(*) Items marked with an asterisk reflect ST-09 data fields that may not be possible to collect through EMS without specific system or fish handling adaptations. In the absence of such adaptations, these data should be collected and reported through human observer programs or other appropriate means.

Description of the vessel areas coverage and data fields to be collected when a CPC chooses to use EMS on purse seine vessels

Table 1. Minimum areas and actions that shall be monitored.

Area covered	*Action covered*	*Data fields*
Work deck (port side)	Brailing	- Total catch by set - Species composition
	Discards	Total discards by set
	Bycatch handling	Bycatch estimation
Work deck (starboard side)	Bycatch handling	Bycatch estimation
	Bycatch release	Total bycatch by set
In-water purse seine area	Fishing set. Brailing. Net hauling	Total catch by set
	Bycatch handling of big species (whale sharks, manta rays…)	- Total bycatch by set - Bycatch condition - Application of handling and safe release best practices
	Bycatch release of big species (whale sharks, manta rays…)	- Total bycatch by set - Bycatch condition - Application of safe-release best practices
Foredeck or amidships	FAD activity (deploying, replacement, reparation…)	Total number of FAD deployments, FAD design and FAD activities by trip
Well deck and conveyor belt	Catch well sorting	Species composition
	Bycatch handling	Best practices
	Bycatch discarded, released or retained	- Total bycatch by set - Species composition - Application of handling and safe-release best practices

Table 2. Data fields for ICCAT longline activities to be collected and reported when a CPC chooses to implement an EMS domestic program based on an ICCAT requirement to use EMS to monitor compliance. These data can be identified by the EMS or estimated through data analysis.

Data field name	*Data field description*
1. Setting information	
Set type	Free school set, FAD set,
Start setting date, time and position	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).
Use of by-catch mitigation measures or techniques	Where there are specific requirements in an ICCAT recommendation on the use of by-catch mitigation techniques or devices as well as an ICCAT requirement to use EMS to monitor compliance with the applicable mitigation technique or device.
Time start brailing	Date and time (hh:mm and YYYY/MM/DD) that brailing starts.
Time end brailing	Date and time that brailing ends (hh:mm and YYYY/MM/DD).
GPS position	Including a review of whether fishing activity may have occurred in closed areas or closed periods
2. Catching details	
Total catch weight retained on board, including bycatch	Total weight caught and taken on board. Specify units (preferably Kg).
Estimation of catch weight retained on board by species, including bycatch	Use 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. Specify units (preferably Kg).
Catches discarded or released, including bycatch	Where there are specific requirements on discards in an ICCAT recommendation, as well as an ICCAT requirement to use EMS to monitor compliance with discards requirements. Estimated weight by species (for large fish, record number of individuals). Specify units (preferably Kg). Indicate fate (discarded or release)
Condition of catches discarded or released, including bycatch	Where there are specific requirements on the condition of discards in an ICCAT recommendation, as well as an ICCAT requirement to use EMS to monitor compliance with discards requirements Distinguish at least between: alive, injured, dead
3. FAD activities	
Type	Type of floating object (flotsam, natural object, FAD)
FAD activity: deployment	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is deployed
FAD activity: visit	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is visited
FAD activity: retrieving	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is retrieved
FAD ID	When possible and if FAD is marked
Buoy ID	When possible. For every activity involving FADs equipped with a buoy (i.e., buoy marking or any information allowing identifying the owner).

Table 3. Data fields for ICCAT purse seine activities to be collected and reported when an EMS is to be implemented for science purposes. These data can be identified by the EMS or estimated through data analysis.

Data field name	*Data field description and notes*
1. Temporal and geographical attributes fishing operation	
Flag of Vessel	Flag of the vessel. Reported to ICCAT in A3ISO coding.
Base port/zone	Base port/zone of the vessel that the set(s) refers to.
Vessel (size class)	Vessel LOA Class. Usually aggregated in 10m size classes for reporting to ICCAT.
Vessel (carrying capacity)	Carrying capacity of the vessel.
Year	Year that the data refers to.
Time period	Time Period. Data reported set-by-set, monthly or quarterly.
Square type	Grid Resolution. Data reported in: exact location (latitude & longitude in decimal degrees), aggregated in 1x1 degrees, or aggregated in 5x5 degrees.
Latitude	Centroid of the latitude of the set(s) that the data refers to. Reported as the centroid in decimal degrees (±dd.ddd).
Longitude	Centroid of the longitude of the set(s) that the data refers to. Reported as the centroid in decimal degrees (±dd.ddd).
2. Effort attributes	
Nº fishing operations (total)	Total number of fishing operations that were carried out.
Nº fishing operations (recorded)	Number of fishing operations that were recorded by the EM System.
Nº fishing operations (processed and reported)	Number of fishing operations that were observed and processed from the EMS recording, and for which the reported data refers to.
Fish Oper. Type	Fishing Operation Type: "Set type" usually used for purse seines, lines, gillnets; "Haul type" usually for trawls. If "Other type" need to specify in notes.
School type	School type for purse seine set(s): Categories currently used for reporting to ICCAT are: Fish Aggregating Devices (FADs); Free School (FSC), other (specified in notes).
3. Mitigation measures on bycatch species	
Bycatch mitigation measures	Current categories for reporting mitigation measures on bycatch that could be applicable to PS are: Seabirds (unharmed) promptly released; Sea turtles (unharmed) promptly released; Sharks (unharmed) promptly released; Sea mammals (unharmed) promptly release. If other measures are used, need to specify in notes.
4. Catch composition by fishing operation	
Species	Species FAO Code (Note: normally it is possible to collect species-specific identification, but there could be difficulties in identifying specimens at species-specific level in some groups during purse seine operations. High-resolution cameras should improve species identification. For some taxonomic groups (e.g., turtles) the crew could be required to place the specimens in designated areas (e.g., calibrated areas) that would improve species identification and allow taking additional information as sizes and condition).
Targeted (Y/N) (*)	Specify if the species is targeted or not. (Note: this field likely needs integration with additional information from logbooks and/or the skipper).
Catches retained – Weight	Catches by species that are retained in weight and numbers. Report of retained catch data in weight is mandatory, and in numbers is optional. (Notes: technical data as total brail capacity and wells capacity should be known previously for each vessel. EMS trials have tried to estimate species composition by set, but mostly without consistent results to date. It is noted that human observers have the same difficulty when estimating species composition in purse seine operations, due to the large catch volumes that can result in a set, and the speed with which the fish are put into the wells. As such, for retained catch by species, it might be necessary to integrate with additional information from logbooks
Catches retained - Number (*)	

	and/or port-sampling. Artificial intelligence applied on the conveyor belt has been showing preliminary promising results so such methods might be increasingly applied in the future).
Product type	Product type that the weight of the retained catches refers to. Examples currently used to report to ICCAT are: Live (round) weight; Gilled & gutted; Fillet; Dressed weight; Belly meat; Other (specify it in notes).
Discards – Number	Number of specimens that are discarded. Should be reported by species, if possible, or alternatively for higher taxonomic groups (e.g., genus or family) if not possible to detect the species. (Note: In purse seine operations, specimens can be released in various areas, so it will be necessary to either have more cameras or require that the releases are always done in the same place, although there may be logistic difficulties. Observers also face similar difficulties, as they cannot monitor the main and wells' decks simultaneously).
Discard – Condition at the time of discarding (*)	Condition of the specimens that are discarded. Current ICCAT codes are: Alive; Dead; Unknown. (Note: Discards of tunas in purse seines are usually composed of dead discards and might be estimated. The condition of other discarded species (e.g., sharks) might be doubtful).
5.FAD activities	
Type/structure	Type of floating object (flotsam, natural object, FAD).
FAD activity: deployment	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is deployed.
FAD activity: visit	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is visited.
FAD activity: hauling	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is hauled.
FAD activity: retrieving	Date, time (hh:mm and YYYY/MM/DD) and position when the FAD is retrieved.
FAD ID (*)	When possible and if FAD is marked.
Buoy ID (*)	When possible. For every activity involving FADs equipped with a buoy (i.e., buoy marking or any information allowing identifying the owner).
6. Biological data (optional)	
Species	Species FAO code. (Note: normally it is possible to collect species-specific ID, but there could be difficulties in reaching the species level in some species groups. High-resolution cameras should improve species identification. For some taxonomic groups (e.g., turtles) and when they are brought onboard, the crew could be required to place the specimens in designated areas (e.g., calibrated areas) that would improve species identification and allow taking additional information as size and condition).
Sex (*)	Sex of the specimens (Male/Female/Unknown). (Note: handling bycatch in purse seine operations is complex as the bycatch can be processed in several different places onboard. The sex of the specimens might in some cases be observed for elasmobranchs and turtles (visible externally). Additional cameras would be needed in specific and various places where bycatch is released. For the target tunas it is not possible to collect sex information (no external characters) with either Human observers or EMS).
Length (cm) (*)	Size of the specimens (cm). (Notes: retained specimens are passed through one specific area (i.e., conveyor belt) so it could be possible to have a calibrated area defined for taking size samples. For discarded specimens, as they can be released in various areas, it would be necessary to either have more cameras or require that the releases are always done in the same place, although there may be logistical difficulties).
Size class type (*)	Codes for the size class type reported in the length (cm) field. Current codes used in ICCAT are: Straight fork length, Curved Fork Length, Lower Jaw to 1st Dorsal Length, Straight lower jaw fork length, Curved lower jaw fork length, Posterior edge of eye socket to Fork Length, Total length, Other (specified it in notes).
Weight (kg) (*)	Weight of the specimens (Kg). (Note: both human observers and EMS can only take individual weights in vessels that have scales. Most vessels don't have these onboard. If the vessels have scales then the human observers can take weights directly. For EMS, it might be possible to put cameras facing the scales, or there might be a way to connect the scales to the EMS directly).

Product weight and product type (*)	Product type that the weight of the individual specimens refers to. Examples currently used to report to ICCAT are: Live (round) weight; Gilled & gutted; Fillet; Dressed weight; Belly meat; Other (specify it in notes). (Note: similarly to the catches retained in Weight, this field might be possible to collect only in vessels that have scales, either with the adaptation of cameras facing the scales, or connecting the scales to the EMS directly)
Released (Y/N)	Record if the specimen was released (Yes/No). (Notes: Discarded specimens in purse seine operations can be released in various areas, so it might be necessary to either have more cameras or require that the releases are always done in the same place, although there may be logistical difficulties).
External injuries (scale) (*)	Condition and injuries of the specimens that are released. Injury scale used at ICCAT: Unknow (undetermined); Alive: Perfect (no visual injuries); Alive: Moderate (superficial injuries); Alive: Severe (could affect survival); Dead (release). (Notes: discards of tunas are usually composed of dead discards. The condition and injuries of other discarded species (e.g., sharks, turtles) can be doubtful).

(*) Items marked with an asterisk reflect ST-09 data fields that may not be possible to collect through EMS without specific system or fish handling adaptations. In the absence of such adaptations, these data should be collected and reported through human observer programs or other appropriate means.

Description of the Vessel Monitoring Plan (VMP)

The VMP shall meet the following conditions:

1. The VMP shall be developed for each vessel on which EMS is to be installed and shall be delivered to the flag CPC competent authorities.

2. The VMP shall be developed in collaboration with the EMS service provider, vessel owner and relevant CPC fishing authorities.

3. A survey of the vessel to be fitted with EMS shall be carried out by the EMS provider and/or CPC fishing authorities and the following factors shall be taken into consideration in the development of the VMP, with a view to ensuring the system meets the minimum data collection requirements laid out in **Annex 2** or **3**:
   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 and areas of discards or release.

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, such as time running, number of cameras, settings of the cameras (frame rate and resolution), 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.
   - A shot and image taken by each camera shall be inserted in the VMP.

5. Any physical changes on the vessel, fishery, categorization of the vessel (fleet segmentation), catch handling deck, etc., shall be reported to the Flag CPC authorities, and the VMP should be updated accordingly before the next fishing trip.

6. The VMP shall be signed off by the vessel owner and approved by the Flag CPC competent authority.

7. The EMS equipment shall not adversely affect vessel stability by posing risk to vessel operations, crew, or environment, nor shall it impede the vessel's safe navigation.

An example template of a VMP is detailed in **Appendix 1**. CPCs may choose another template of a VMP.

Data management

Data storage and retention

EM service/technology providers and EM analyst shall treat as confidential all information with respect to the fishing operations of the vessel and accept this requirement in writing.

Standards for where, how, and how long video footage will be stored after it has been reviewed, shall be specified in the EMS domestic programs. Storage decisions shall 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.

Once footage is reviewed, it shall be stored for at least 3 years, except if national data retention regulations require a shorter period. When the system is to be used for enforcement purposes, the data collected by the EMS shall be stored for as long as necessary until the possible infringement proceedings have been finalized.

EMS shall have sufficient autonomy and capacity to safeguard and store all recorded images and, where appropriate, sensor information for at least the duration of a complete fishing trip.

EMS records shall have an output format that is compatible with the standardized electronic codes list developed by the SCRS to ensure collected information is consistent with current ICCAT data reporting requirements.

EMS video records shall contain at least the following information: 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 and EM system status, where available, and images.

Data transmission or retrieval

When EMS records are retrieved by extracting the memory device or when a memory device is replaced between trips, traceability of every memory device and information recorded on board shall be guaranteed. The chain of custody of the EMS memory device shall be assured.

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 monitoring plan by both the vessel owner, the respective authorities.

When EMS records are transmitted (via WI-FI, mobile data network or satellite), the transmission of the data shall be done at the end of the fishing trip where possible. If not possible the data shall be securely stored and transmitted without delay/at the earliest opportunity. This type of transmission shall ensure proper encrypted data, when required/decided by national authorities.

Data review and reporting

The EMS shall have dedicated software to assist in data review. This software shall permit the analysis of all the stored data, images, and sensor data where appropriate, in a synchronized way. CPCs shall ensure that data analysis procedures ensure a good traceability and effective analysis of data. At a minimum, analysis software shall allow for the report of the following:

- identification of fishing operations date/time;
- identification of set type;
- estimation of the catch by set, including bycatch;
- estimation of species catch composition and sizes;
- estimation of discards or release species, and its condition;
- FAD deployment (for purse seine vessels).

The CPC shall appoint analysts that have the following qualifications to accomplish their responsibilities:

a) Sufficient knowledge and experience to understand relevant fishing operations and catch handling, identify species, and collect information on different fishing activities. In this regard, previous at sea observer experience is valuable.
b) Satisfactory knowledge of the ICCAT conservation and management measures if the EMS domestic program is being used for compliance monitoring purposes.
c) The ability to use properly the dedicated analysis software and observe and record accurately data to be collected under the program.
d) Not be an employee of a fishing vessel company involved in the observed fishery or have other direct conflicts of interest.

When EMS is used for scientific data collection purposes, CPCs shall submit relevant data to ICCAT in a format that is compatible with (1) any data collected and reporting pursuant to their domestic scientific observer programs (including observer's databases), as well as (2) ICCAT data reporting requirements and templates for data submission.

When the EMS is to be used for compliance monitoring purposes, data analysis shall be based on risk assessment.

Taking into account ICCAT recommendations that authorize or require the use EMS to monitor compliance with certain conservation and management measures, CPCs shall provide a list of relevant ICCAT measures for which it is using EMS for this purpose, to CPC appointed analysts. Each CPC shall establish a protocol for reporting and following up on potential infringements of ICCAT requirements detected using EMS.

Example Template of a Vessel Monitoring Plan
This example is not binding and is provided only for reference purposes

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 flag CPC competent authority and to be validated by the flag CPC competent authority)

1. Vessel image

2. System Configuration

a) System Operation – General Description

Sensor recording, where applicable:	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:

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

Sorting Area Measurement Details

Part C

(To be completed by the service provider)

1. EM User Guide

    a) Description on how to retrieve memory devices
    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:

Name and Last Name	*Phone*	*Email*	*Office address*

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 EMS installed on the vessel, and that the operator agrees to comply to the 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: _____