INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

COMMISSION INTERNATIONALE POUR LA CONSERVATION DES THONIDES DE L'ATLANTIQUE

COMISION INTERNACIONAL PARA LA CONSERVACION DEL ATUN ATLANTICO

Madrid, 6 September 2022

ICCAT CIRCULAR #6705/22

SUBJECT: CALL FOR TENDERS – TERMS OF REFERENCE – PILOT PROJECT ON A REMOTE ELECTRONIC MONITORING (REM) SYSTEM FOR BLUEFIN TUNA PROCESSING VESSELS

I should like to transmit to you the attached Terms of Reference for a Call for tenders for a Pilot project of a Remote Electronic Monitoring (REM) system for Bluefin tuna processing vessels.

I would be grateful if you could distribute this Call for Tenders to qualified people and institutions that might be interested.

Please accept the assurances of my highest consideration.

Executive Secretary

Camille Jean Pierre Manel

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Attachment: Terms of Reference.

CALL FOR TENDERS - TERMS OF REFERENCE

PILOT PROJECT ON A REMOTE ELECTRONIC MONITORING (REM) SYSTEM FOR BLUEFIN TUNA PROCESSING VESSELS

1. Background and Objectives

Most of the International Commission for the Conservation of Atlantic Tunas (ICCAT) bluefin tuna (BFT) quota is allocated to purse seiners, which cage the BFT in farms where they are fattened. When the fattening process is over, the vast majority of these fish is harvested in the farms and then transferred to the processing vessel, where they are processed and frozen. A similar situation occurs with fish caught by tuna traps.

All this makes the processing vessels a critical point in the chain from a control point of view, since a large majority of the BFT that is caught passes through them. Effective control of these vessels is therefore essential in order to be able to detect, for example, possible irregularities in terms of the quantities harvested by farms and traps.

BFT harvesting from farms and traps and the associated transshipments are difficult to control effectively. These operations take place at sea, underwater, and can occur at any time of a day. Although the presence of an ICCAT Regional Observer (ROB) is mandatory for all harvesting operations from farms, the observer is usually deployed on board the processing vessel at the request of the operator and depends on the operator's means to reach the farm/trap or the processing vessel. It can therefore be difficult for an ICCAT Observer to detect or prevent possible illegal harvesting operations.

The ICCAT Working Group on Bluefin Tuna (BFT) Control and Traceability Measures met on 2-4 March 2020 to discuss possible improvements to the ICCAT Recommendation 19-04 and other related provisions on control and traceability of eastern Atlantic and Mediterranean BFT destined to farms. One of these measures was the control of processing vessels.

At the 2021 Annual meeting of the Commission, a pilot project was proposed by the EU and approved by ICCAT by means of the Resolution by ICCAT establishing a pilot project for the implementation of Remote Electronic Monitoring (REM) on bluefin tuna processing vessels (Res. 21-17).

A REM system is a system that acquires data and video footage using GPS, sensors, and CCTV cameras, providing 24/7 monitoring of the fishing activity of the vessel. Most systems can store sensor data and video footage from several consecutive months activities and some for a whole year.

The main objective of this pilot project is to contribute to close some of the remaining identified loopholes in the bluefin tuna control system. Furthermore, this pilot project will also allow to explore the use of REM on a type of vessel where it has not been tested so far. This technology has been extensively tested on fishing vessels, but never on processing vessels (similar to reefers vessels), which also represents an opportunity to improve control on this type of vessels that play a crucial role in several ICCAT fisheries.

2. Contractor Tasks

The contractor tasks are to develop the activities set in the **Annex 1** - ***Minimum technical standards for an ICCAT system of Remote Electronic Monitoring (REM) for bluefin tuna processing vessels*** - of this Call for Tenders.

3. Deliverables

1) REM systems - The successful bidder shall provide to the ICCAT Secretariat by **30 October 2022**, a description of the two REM systems that live up to the minimum requirements given in **Annex 1**, including a general description of the system configuration and system operation.

2) Vessel Monitoring Plans (VMP) - Before the start of the sea trial the successful bidder shall provide to the ICCAT Secretariat REM Vessel Monitoring Plan (VMP) for each of the vessels to be involved in the pilot project, to be developed in cooperation with the vessel owner or master and the REM system provider, the successful bidder and/or ICCAT (for details see **Annex 1**). These VMPs shall be provided no later than **30 October 2022**. Before the start of the sea trial, the successful bidder shall also make him/herself available for a meeting with the team overseeing the project to agree on some details of the trials that could not be specified in this document.

3) 1st Interim technical report - After the purchase and set of all the equipment describe in **Annex 1** of this Call for Tenders on two vessels from the list, and before the start of the sea trials the successful bidder shall provide to the ICCAT Secretariat in an interim technical report with a detailed explanation of the work done and of the equipment installed, together with physical evidence of the equipment installed (pictures, including of the brand, model and serial number).

4) 2nd interim technical report - After the conclusion of the sea trials, the successful bidder shall provide to the ICCAT Secretariat a 2nd interim technical report with a detailed explanation of the field work carried out, a detailed summary of the data collected (including digital record of all data collected), with a description of any issues identified during the sea trials and suggestions of possible solutions. This 2nd interim technical report shall be provided no later than **15 June 2023**.

5) Final technical report - Once the analysis of the data collected is concluded, the successful bidder shall provide to the ICCAT Secretariat a draft technical final report, that shall include information related to all the above deliverables, plus the detailed analysis of the data collected, with a special focus on the alerts and issues identified and recommendation on any improvement to the made to the REM system. This draft final technical report shall be provided no later than **30 September 2023**.

4. Contractor Minimum Qualifications

- Documented multi-year experience in Remote Electronic Monitoring (REM) systems onboard vessels;

- Previous experience in REM systems of fishing vessels is preferred.

- Excellent working knowledge of English. A high level of knowledge of the two other ICCAT official languages (French and Spanish) is desirable.

5. Submission of proposals

Scientists and public or private Scientific Institutes or companies interested shall submit detailed offer(s) only to the attention of Mr. Camille Jean Pierre Manel, the Executive Secretary of ICCAT, at the following address: camille.manel@iccat.int and Cc'ing Ms. Ana Martinez (ana.martinez@iccat.int) by **23 September 2022 (18:00h Madrid time) at the latest**, including:

a) A description of methodology to be used;

b) A detailed budget proposal (including a possible 12 month extension to repeat the field work and analysis of the collected data);

c) A detailed Curriculum vitae of the tender;

d) A detailed list of any subcontracting activities;

e) The name, address, and telephone number of the tendering body;

f) The institutional and administrative background of the tendering body (e.g., statutes, type of institution, annual budget, budget control procedures, etc.), if applicable;

g) Acknowledgement of this Call for Tenders;

h) A statement specifying the extent of agreement with all terms, conditions, and provisions herein included.

i) Details about the following technical issues:

- a proposal for how the storage and transmission and/or retrieval of information will be organised during the trial

- how the data collected by the system during the trial (sensors and video) will be analysed.

If the tender is submitted by an institute/University, it must indicate the expert(s) who will be dedicated to the completion of the tasks and that he/she be available to present the work to the Commission or one of its subsidiary bodies.

Offers sent after the deadline and/or that fail to furnish the required documentation or information or reject the terms and conditions of the Call for Tenders will not be considered.

Applicants shall provide a detailed budget and clearly identify costs related to main activities of the work (e.g., labour, including estimated number of days of work; travelling and subsistence, equipment, system setting and maintenance).

6. Selection of proposals

The ICCAT Secretariat will make a revision of the offer(s). Following the revision process, the ICCAT Executive Secretary will notify the entity selected for the contract as soon as the selection process is completed. Contract will be awarded on the basis of competitive tendering and the evaluation of proposals will be undertaken objectively, consistently and without bias towards particular suppliers. Proposal(s) will be evaluated against a pre-determined set of criteria, which include: (i) cost; (ii) proven track record; (iii) technical merit based on work plan; and, (iv) flexibility to future changes to requirements.

7. Duration of the contract

The work under this contract shall be concluded by **20 October 2023** at the latest**.** If required and strictly necessary, the contract may be is opened for extension, depending on funding availability.

8. Payment details

Disbursements will be made according to the following schedule:

1) 30% of the total amount of the contract upon signing of the contract and after receiving a regular invoice which may be submitted at the latest 30 days after the signature of the contract;

2) 20% of the total amount of the contract upon the acceptance by the Secretariat of deliverables #1 (description of REM systems), #2 (Vessel Monitoring Plans (VMP)) and #3 (1st interim technical report). These three deliverables will be revised by the Steering Committee in consultation with the ICCAT Secretariat. The review will include all submissions of the contract deliverables and communicate any necessary revisions (if applicable) to the Contractor and/or inform of approval within 5 days of the submission(s). The Contractor shall submit the revised final documents (if changes are request) together with the regular invoice, within 10 days after the request.

3) 10% after the provision of the deliverables #4 (2nd interim technical report), which will be revised by the Steering Committee in consultation with the ICCAT Secretariat. The Secretariat will communicate to the Contractor and/or inform of approval within 5 days of the submission(s). The Contractor shall submit the revised final documents (if changes are request) together with the regular invoice, within 10 days after the request.

4) 20% after the provision of deliverable #5 draft final report, which will be revised by the Steering Committee in consultation with the ICCAT Secretariat. The review will include all submissions of the contract five deliverables and communicate any necessary revisions (if applicable) to the Contractor and/or inform of approval within 10 days of the submission(s). The Contractor shall submit the revised final documents (if changes are request) together with a complete set of the documents concerning the expenses incurred under the contract and the regular invoice, within 10 days after the request.

5) 10% after the provision of the acceptance of the final report together with the regular invoice, within 10 days after the notification of acceptance of the final report.

9. Logistics

The text report shall be in MS Word or compatible software. All other documents provided by the Contractor must be in Open Office, Latex or compatible software. All documents submitted must be in English.

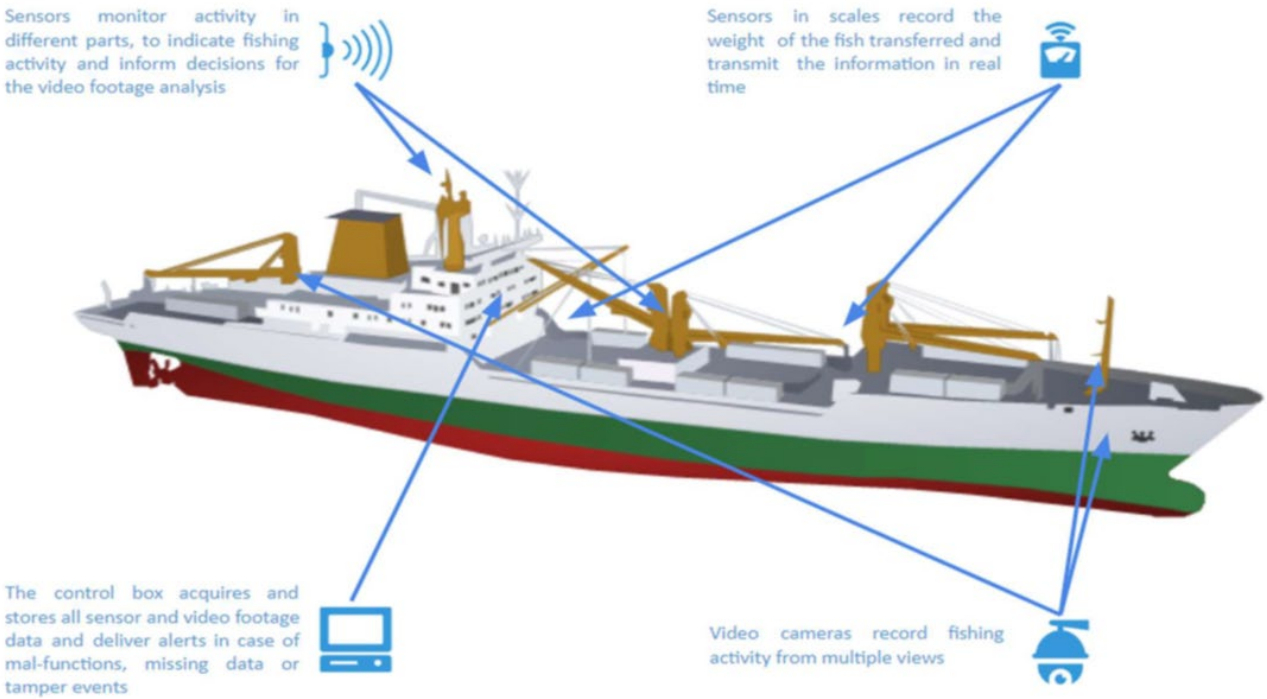
10. Copyright

All the material produced by the Contractor will remain the property of ICCAT. All software written by the Contractor will be licensed under GLP or similar open-source license.

For additional information concerning this Call for Tenders, please contact ICCAT Secretariat at the following address: miguel.santos@iccat.int and alberto.parrilla@iccat.int.

Annex 1

Minimum technical standards for an ICCAT system of Remote Electronic Monitoring (rem) for bluefin tuna processing vessels



September 2022

Contents

1. Introduction

The scope of this **Annex 1** is to describe the minimum technical requirements and standards for an REM system designed to control transshipment and processing operations of BFT in the ICCAT region.

2. Objectives

This **Annex 1** includes a description of the minimum technical requirements and standards for REM systems, including the design of an operational plan, to be used for this pilot project to be conducted with the aim of surveillance and control of transhipment to and from tuna processing vessels. It has two major components:

1. Test the use of a Remote Electronic Monitoring (REM) system, including Closed-Circuit Television (CCTV) onboard bluefin tuna processing vessels operating in the bluefin tuna fishery in the eastern Atlantic and Mediterranean Sea.

2. Test the REM system and evaluate the added value of this technology in improving the monitoring and control of processing vessels, the cost-efficiency of the system and its capacity to collect comprehensive and accurate data and its subsequent analysis.

The duration of the Pilot Project should be one year, with the possibility of extending it for a further year. The project should be implemented on at least 2 of the active processing vessels listed in the table below.

The pilot project would be considered as a testing phase and the information collected in it may only be used to achieve the objectives of the project, but in no case for control or enforcement purposes.

Vessel name	*ICCAT No.*	*IMO*	*Flag*	*Tonnage (GT)*	*LOA (m)*
ASTRAEA	AT000PAN00234	9832523	PAN	2164	71.1
GOUTA MARU	AT000JPN00653	9746827	JPN	4865	97.45
KENTA MARU	AT000JPN00660	9788772	JPN	5846	122.2
KURIKOMA	AT000PAN00153	9145920	PAN	4177	105.5
LADY TUNA	AT000PAN00199	9453418	PAN	4538	113.4
PALOMA REEFER	AT000PAN00032	9309681	PAN	1267	62.6
PRINCESA GUASIMARA	AT000PAN00155	9442237	PAN	1877	72.1
REINA CRISTINA	AT000PAN00154	9011301	PAN	1176	61.33
TUNA PRINCESS	AT000PAN00185	9314612	PAN	4522	113.4
TUNA QUEEN	AT000PAN00145	9278612	PAN	4449	113.4

3. Minimum requirements for a standard REM system - Technical specification

A REM system to be installed on board processing vessels should consist of a control box (a modified computer with possibilities for connecting a number of different sensors and a number of cameras), sensors, and cameras. It is a system that can store sensor data and video footage on embedded solid hard drives and display all information on a screen in the wheelhouse. A precondition for the REM system is that it can communicate with the land-based service provider and/or with ICCAT. Such systems are of-the-shelf products and can supplied by several providers.

3.1 Control box

The control box is the on-board computer that acquires and stores all sensor data and video footage. Below is a list of the recommended minimal requirements for such unit, acknowledging that the following technical specifications do not have to be physically integrated inside the unit and may be connected to it externally.

A. Power input must match supply from vessel (12, 24, 60V DC, or 110, 220V AC).
B. Passive cooling – with high temperature cut out.
C. Control box must prohibit users on the processing vessel to tamper with registered vessel information and system setup. Administration rights must be required to access and modify these settings.
D. High-resolution position sensor (GPS or equivalent). The system must be able to record vessel position, speed, and course at a configurable time interval from 10 seconds and up.
E. Data transfer to ICCAT storage servers and/or the service provider. The system must be able 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).
F. Wired connection of the components for the system on board to allow the communication between the different element of the REM system (central unit, sensors, cameras).
G. Wireless capabilities (e.g., Wi-Fi (802.11ac or faster)/Bluetooth) to allow interconnection between some or all the element of the REM system (central unit, sensors, cameras).
H. Utilization of existing on-board satellite data connection for live sensor data transmission.
I. Automatic prioritisation of best suitable connection for data transfer and remote access.
J. Sufficient onboard data storage capability for storing sensor data and video footage. Minimum data storage capacity depends on the vessel activity (number of days at sea away from high-speed connections – e.g., 4G/5G), the number of cameras, the resolution and frame rate of the video footage, the compression algorithm, the minimal data storage duration, etc. The control box must support no less than 2 HDD/SDD, with at least one primary and one backup.
K. At least one removable/swappable back-up data storage of variable sizes.
L. Support the required number cameras.
M. Onboard screen connection for verification including keyboard and mouse, and/or a touch screen.
N. UPS (Uninterruptible Power Supply) of controlled shutdown, preventing damage from power loss. If possible, the UPS should enable the continuation of recording for relevant timespan (for e.g., 15 minutes). Information on any power failure should automatically be recorded for subsequent verification. UPS must include surge protection. UPS must be passively cooled.
O. Digital signature (date and time stamp, vessel name, vessel registration, and GPS coordinates).
P. All the REM data stored onboard and transmitted to the outside must be securely encrypted and compressed where relevant (e.g., video footage).
Q. If data transmission is temporarily not possible, the request shall be stored on the control box and the requested data shall be secured to prevent possible deletion or tampering. The requested data shall be automatically transmitted when data transmission is feasible.
R. The system should be able to upload all (or parts of, if required) the recorded data automatically at specific intervals or when connectivity prioritisation allows.
S. Transmission of encrypted data should be done using secure communication protocols (FTPS, HTTPS).
T. Build-in remote access must be possible for system configuration, updates, and verification of system health if required.
U. Remote access should include access to health checks of the camera and configuration (e.g., modify frame rate and resolution, etc.).
V. Possibility for remote access to support transmission requests of all or parts of recorded sensor data and video footage should be made.

3.2 Cameras

The number and field of view of the cameras must guarantee that the integrity of the transhipment operations taking place onboard the vessel can be effectively monitored. For this, the REM system must enable the monitoring of all the areas where tuna can be loaded, processed, or weighed, and ensure in particular that all the areas where tuna can be transferred on board are covered, leaving no hidden area where possible irregularities might occur.

As a general setup, the position of the camera should cover both sides of the vessel, allow the number of specimens of tuna transferred on board to be counted and permit the identification of the vessels that tranship tuna to the processing vessel. Since all receiving and processing operations of tuna take place on the main ship's deck, a camera with a general overview of the deck would ensure such effective control.

An additional camera installed in the deck area, where the fish is received and processed, would allow to count the number of transhipped individuals, in case it was not possible to do so when the tuna is lifted by the crane. The system should ensure that one of the cameras is equipped with measuring capability (lens dependable) to allowing for the automatic determination of the sizes of the individuals taken onboard or a representative sample of them. For the measurement of individuals, a protocol will be provided to the participating processing vessels prior to the start of the project to enable these measurements to be taken.

The cameras and the camera housing need to be constructed in a material that can resist the harsh at-sea environment and the construction must be tamper-proof. In general, the use of small cameras is recommended and should be prioritized. Camera closure fittings need to be robust and durable. To maximize video footage quality, the transparent covering of the housing (i.e., the housing glass) should be easy to clean, scratch-resistant, and covered with a long-lasting water-repellent coating. It is recommended that the cameras should fulfil the following minimum technical specifications:

A. Type: Digital IP Cameras (IP = Internet Protocol).

B. Ingress Protection: IP68 Rating minimum.

C. Cabling: Minimum CAT 5e Ethernet cable, preferably CAT 6 (or more) SFTP cable.

D. Resolution: Minimum 2MP (1080P), depending on the purpose of each camera.

E. Lens: Specified range of fixed and zoom lens option cameras, with replaceable lenses.

F. Housing: Replaceable camera dome / housing glass.

G. Video:

- Compression: Supports standard video compression formats. Minimum H.264.
- Remote configuration: Capability to configure the following parameters both remotely and on board (onboard configuration needs to be secured and any changes should be logged):

  i. FPS - Frames per second (adjustable from 1 FPS to 50 FPS depending on camera purpose.
  ii. Image Resolution
  iii. Image Quality (Bitrate)
  iv. Digital/optical zoom level
  v. Automatic switching between day/night lighting conditions. Color / BW
  vi. Option for automatic face blurring (see point I. below)

H. Measuring capability: Capability to measure fish length for relevant cameras (lens dependable).

I. Masking capability: to protect workers' anonymity, 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.

J. The system should be able to function in the environmental conditions (e.g., temperature, humidity, salinity) where the vessel will be operating.

The minimum requirements for the cameras to be used depend on the location of the camera and what the camera is intended to capture. As a general setup, cameras should capture the following views:

→ all part of the deck areas where tuna can be transferred on board the processing vessels and the deck area where tuna is handled;
→ the areas at starboard and port board side of the tuna processing vessel in order to record the vessels that transship to and from the vessel;
→ all cranes.

For determining which type of camera is needed, a number of parameters should be taken into account:

→ The distance between the camera and the object / focus area of interest;
→ The aperture and focal length of the lens;
→ The required resolution needed for the purpose of the camera.

In most cases, a camera of minimum 2 MP (1080P) would be sufficient to ensure the needed resolution/quality of the video footage, incl. digitally zooming in the footage during the analyzing process. The standard setting and the range of the lens of a camera thus depends on the area that must be captured. It is important that the resolution, quality, and frame rates match such needs and are easy to (re)configure if needed, since these parameters have a high influence on the size of the stored video data. Ultimately, the goal is to obtain sufficiently detailed quality data to allow the effective reviewing of the entire fishing activity, at the lowest possible size on the storage drive. For cameras positioned at a distance from their target, either an optical zoom lens should be used to focus on the area of interest, or a higher resolution camera (e.g., 5 MP) should be installed in such a way that zooming digitally on the picture would display the wanted field of view at the required resolution. The frame rate setting should be set according to the relative size in the picture of the objects to review (here, the tunas) and the speed at which they pass the cameras view. In general, deck and overview cameras should be set to 1-5 fps (frames per second), and on more active areas cameras should be set to 5-15 fps.

For the deck overview the set-up should ensure the identification of any activity, including in darkness. This can be achieved using both infrared lighting and white-light.

3.3 Sensors

The minimum requirements for sensors are based on a generic vessel type. The control box system specified in 3.1 above should support both digital and analogue sensor input options.

The system should support the following sensor data as a minimum:

A. GPS.
B. Temperature recordings of the fish hold freezers.
C. Motion sensor in the freezing tunnels.
D. Sensor to detect opening of freezer doors.
E. Lux measurement sensor.
F. Crane weight load cells. Accuracy 5 kg or less. Wi-Fi or Bluetooth connection to the control box.
G. Hydraulic pressure sensor (for measuring crane activity).
H. Fish hatch/door open/close sensor.

Final specifications, protocols, and output for each of the other sensors needs to be defined in cooperation with the REM system provider.

Additionally, a data-bus connection should be available for future expansions and for integration with general sensors and instruments already installed on-board the vessel (e.g., CAN, RS485 and NMEA 2000). Sensors to estimate the weight of the load of tuna transferred on board (aka. load cells) are of-the-shelf products. The data stemming from the load cells (through a wireless connection) needs to be incorporated to the REM system software.

3.4 System diagnostics

The REM system should be able to deliver to the master of the vessel, ICCAT, and the service provider system health messages created on-demand via a data request, which should include at least:

A. General health of controller.

B. GPS position and user range accuracy (URE).

C. System temperature.

D. Available free space on hard disc.

E. Individual camera configuration.

F. Camera image check including a still picture from each camera to check cleanness.

G. Sensor operation check.

H. Warnings for missing data (sensors and/or video). These should display both on the on-board system and within the analysing software.

I. A list of tampering events.

The master of the vessel shall preform a system health check / diagnostics prior to departure from port and at least once a day when at sea. Data and pictures from each camera must be recorded in the sensor event data file and immediately sent to ICCAT and/or the service provider and be presented to the master of the vessel.

The master must report to ICCAT and/or the service provider any critical warnings displayed on the control screen, as well as any system or power failures that would prevent the REM system to operate as intended.

4. Data storage and data handling by the service provider

All the REM data, including video footage, sensor data, and other information relative to the functioning of the REM system, should be stored in the control box and the requested data should be secured to prevent possible deletion or tampering. In addition, a backup must be made automatically stored on an external hard drive for security reasons. All data being stored or transmitted could be compressed for saving storage space and must be securely encrypted.

The format of the data, both from sensors and video footage, should be compatible with the REM data analyser.

4.1 Data retrieval

Different methods of retrieving the information and video footage acquired by the REM systems can be used. Simply collecting hard drives from the trial processing vessels at fixed intervals could be an alternative option for technical and logistic reasons. An approach where all sensor data is automatically transmitted over mobile networks or satellite and video footage is only transferred on request by ICCAT or the service provider is recommended. This request should be based on a manual or semi-automatic pre-analysis of the sensor data made by the service. In most cases, using this methodology would allow keeping the quantities of transmitted video footage at a minimum, and thus reducing the transmission costs significantly. Further, it is important to futureproof these requirements as retrieval of data and video footage using satellite communication may be more economically viable in the near future, allowing the possibility to request images or video via satellite, as decided by the competent authority.

If large amounts of data/all data and video footage should be analyzed it is recommended to examine possibilities for using the rapidly growing possibilities of image analysis and machine learning algorithms. The sensor data can electronically be pushed at regular intervals e.g. daily or by swopping hard drives e.g. once a month. Hard disks retrieval every, at least, 1 month is the preferred method for this case. Periodic replacement of hard disks and storage of retrieved information shall be considered as system maintenance work, which is the responsibility of the contractor in charge of installation and maintenance of the REM system.

4.2 Data analysis software

REM systems on board the tuna processing vessels should be able to deliver the sensor data and video footage in a specified common format for exchange (output). The analyzing software (REM analyzer) should be able to analyze the data and video footage delivered in this format.

The current advantage for REM providers is that they control both the software on board the vessel and the analyzing software, which gives them the possibility to innovate and develop. "You cannot develop it, when you do not control it".

Minimum standards for the "Analyzer software"

The minimum standards for the analyzer software are:

- Sensor data must automatically be linked to video footage to facilitate easy analysis.
- Graphic presentation of sensor data (e.g., timeline).
- Graphic presentation of vessel track (map) and sensor data (timeline) in the same or in separate window(s).
- Search option to search for sensor activity and request video download for specified periods.
- Capability to review video/sensor based on geo-fence areas.
- Capability to indicate where data are missing in order to analyze events around that time e.g. when a fishing operation reported in a logbook does not match with any existing activity in the REM data.
- Zoom function of the video footage, while playing and paused.
- Playback speed: x0.1 to x10.
- Synchronized playback of all video streams.
- Analysts must be able to annotate observations at the date/time the observations relate to.
- This includes different types of annotations for different events.
- Capability to measure fish length (regardless of direction of fish) for conversion from length to weight estimation.
- Capability to export a subset of sensor data and related video footage (sensor data file and video file).
- Capability to make a final printed report showing video still images, annotations, and sensor data graphs.

- Capability to export final report annotations, video stills and sensor images (NAFO format, including filenames of video still and sensor image).
- Software user interface must be multi-lingual. Any help, guides, manuals must be in multi-lingual or in English.
- Capability to store reviews for later retrieval.
- Capability to delete reviews, sensor data, and video files (Administrator rights required).
- Option for automatic face blurring.
- Option for automatic image recognition of catches.

4.3 Data storage and retention

The estimated size of video footage for one year of fishing activity of a large active vessel would be around 4-6 TB and for the trial period of three to four month around 1-2 TB. For an 8-camera vessel, the needed storage capacity is approximately 1 TB per month which for this trial of three month will sum up app. 3 TB. Storing this volume of data and especially video footage by the service provider and/or ICCAT is considered manageable. Furthermore, the strictest privacy and data protection legislation would be required for video footage to comply with the EU General Data Protection Regulation (GDPR) standards.

Sensor data and video footage will be stored only for the period necessary for the implementation of this pilot project and in any case for a maximum of 2 years, unless there are stricter requirements in the applicable legislation.

5. Vessel monitoring plan

Tuna processing vessels are different in size and in configurations, therefore, a REM Vessel Monitoring Plan (VMP) is necessary for each individual vessel in order to cover all monitoring needs and to optimize the quality of REM data and especially of the video footage. The VMP should be made in cooperation between the vessel owner or master and the REM system provider, the service provider and/or ICCAT. After installation of the equipment, feedback must be provided following the first days of trial in real fishing conditions, so that, if necessary, a repositioning of the hardware, and especially repositioning of the cameras, will be made. Following this, the final VMP document should be created as it may be used by the service provider when analyzing REM data, and especially the video footage.

In order to optimize video footage capture on-board a vessel, several factors have to be considered such as the positioning of cameras and camera settings. A layout of camera positions should be based on a survey of the vessel prior to installation of the REM system. The main purpose of such a vessel survey is to be able to secure optimal camera layout solution, which will allow reliable monitoring of the transhipment activities.

When a VMP is established, the vessel owner should provide some basic initial information, including a general plan of the vessel to the flag state competent authority. A predefined template is provided (see **Annex 1 part A**).

Based on the information provided in the VMP part A, the REM system provider, the service provider, and/or ICCAT will establish an installation plan with layout schematics. A predefined template is provided (see **Annex 1 part B**).

The initial phase of operation of the vessel after the installation should be considered a testing stage. Changes to the VMP may be proposed to the authorities during this stage.

The VMP should be signed off by the vessel master/owner and finally approved by ICCAT.

Any physical changes on a vessel should be reported to ICCAT. The VMP should be updated and approved again by ICCAT.

6. Running the trial

The REM system should be setup in a way that the system should capture video footage of all activities that takes place at the deck – meaning all activities where tuna is transferred on board. At the same time, the system setup should reduce data and video footage storage at the system on-board the tuna-processing vessel as much as possible.

The REM system setup should as a minimum guarantee that:

- Sensor data is recorded and stored 24/7 at a 10-seconds frequency. A frequency of 1 to 10 second might be needed for securing right registration of the data from the load cells.
- Video is recorded and stored at 15min sequence intervals. This in order to be able automatically to delete video sequences where no transshipment activity takes place for reducing storage of video footage.
- If no deck activity (no movement in specific predefined areas) takes place, the video footage sequence could be deleted.
- If deck activities occur, the video footage sequence is stored at the REM system on-board the processing vessel.
- During periods when the sensors do not indicate activity, graphical confirmation should be ensured by periodic snapshots camera of the camera covering the vessel's deck.

Based on data from the trial period, camera and video recording settings may be changed for optimization reasons.

The REM system on board the vessels should allow the vessel master at all times to carry out a system check to ensure it is fully functional and meets the requirements. It should be required that the vessel master carry out a REM system test before leaving port and at least once a day when at sea to ensure that the system is fully functional. The system test should include at least checks on position, memory status, camera image, and sensor operation. The system should log the date and time every time a REM system test is conducted. The system should give alerts to the vessel master if any malfunctioning occurs. When the system health check is carried out a system health check report should automatically be transmitted to ICCAT and the service provider.

The vessel master should report to ICCAT and the service provider when in port or at sea if the system diagnostic fails, or if warnings that affect the capture of the data and the video footage as specified in the VMP have been displayed. The vessel master should report any system or power failures to ICCAT and the service provider.

Sensor data and video footage captured by the REM systems on board the vessels. All sensor data may be transmitted using wireless transmission as well as selected video footage sequences. Data and video transmission via satellite connection may be an option depending on the communication systems on board the vessels. In rare instances, hard drives can be swapped at landing if needed.

Transmission of sensor data and video footage from vessels to ICCAT and/or the service provider can be done directly from the vessel to ICCAT and/or the service provider or indirectly via the REM system provider. Both approaches can work well but there are pros and cons for both. An approach where data and video footage is transmitted through the REM system provider enables the possibility that the REM provider can analyze data for any errors.

Experiences from other REM trials have shown that all video footage can be easily transmitted electronically directly from the vessels to ICCAT and/or the service provider by the use of e.g., the GSM network (3G, 4 G, or 5G), and/or satellite connection. Furthermore, all of the REM providers that can provide the required standards would have the expertise in helping ICCAT and/or the service provider in setting up the web service and setting up the servers to be used for analyzing and storing the data and video footage.

As the number of tuna-processing vessels is limited, it is recommended to choose the indirect data transmission approach for sensor data, as the REM providers have the expertise and can more easily support and troubleshoot the REM systems on board the vessels as well as support ICCAT and/or the service provider.

Sensor data and video footage will be stored only for the period necessary for the implementation of this pilot project and in any case for a maximum of 2 years, unless there are stricter requirements in the applicable legislation. Analyzing sensor data and reviewing video footage should be standardized and compliance reports and summaries of data should be developed.

It is recommended that data and video footage during the trial period is electronically transmitted or by swopping hard drives once a month for making it possible randomly to select a number of transhipment to be analyzed for securing that data and video footage is in the standard required.

As the main aim of the project is to test the use of REM system and evaluate the added value of this technology in improving the monitoring and control of processing vessels, the cost-efficiency of the system and its capacity to collect comprehensive and accurate data and ensure its subsequent analysis, it should be a prerequisite that the "Analyzer" software has some additional features such as fish length measurement options that would enable the possibility for weight estimation by converting fish length to weight for e.g., tunas.

When analyzing data (sensor data and video footage) with the aim of estimating weight and numbers of tuna transferred on board, at least the following should be done:

a) Comparison between the documents on recordings of number of BFT individuals and its weight taken on-board, with estimates based on video footage reviews and the recording from the crane weight load cells (the relevant information will be provided).

b) Estimates of the size of individuals transferred on board, or a representative sample thereof, and their weight using the length-weight conversion rate established by ICCAT. Comparison with the weight obtained by the load cells.

c) Check for any possible non-authorised transhipment during the trial. The analyst would receive a list of days and times when authorised operations have taken place.

Appendix 1

Glossary

"4G": 4G is the fourth generation of broadband cellular network technology / Long-Term Evolution standards.

"CAN": A Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other in applications without a host computer.

"CAT 5e": Category 5 cable, commonly referred to as Cat 5, is a twisted pair cable for computer networks. The CAT 5 is superseded by the category 5e

"FTPS": An extension to the commonly used File Transfer Protocol (FTP) that adds support for the Transport Layer Security (TLS) and, formerly, the Secure Sockets Layer (SSL, which is now prohibited by RFC7568) cryptographic protocols.

"GPS": Global Positioning System sensor.

"HTTPS": Hypertext Transfer Protocol Secure (HTTPS) is an extension of the Hypertext Transfer Protocol (HTTP) for secure communication over a computer network, and is widely used on the Internet.

"IP camera": A type of digital video camera commonly employed for surveillance, and which, unlike analogue closed-circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet.

"NMEA 2000": A plug-and-play communications standard used for connecting marine sensors and display units within ships and boats.

"RS-485": A standard defining the electrical characteristics of drivers and receivers for use in serial communications systems.

"MP": A measure of information e.g. size of a file.

"UPS": Uninterruptible power supply.

''VMP'': Vessel Monitoring Plan

"Service provider": Company or individual that is analyzing collected sensor data and video footage

Appendix 2

Vessel Monitoring Plan Templates

Vessel Monitoring Plan Remote Electronic Monitoring (REM) - Part A

Information to be provided by the vessel owner

Vessel Name:	
ICCAT No.:	
IMO:	
Flag:	
Home port:	
Vessel Length:	
Vessel type:	
Crew Size:	
Name of the owner or owner's representative:	
Phone no:	
E-mail:	

Description of how the crew is handling the tune where tuna is transferred on board the vessel and any other useful details

If available copy or image of vessel general arrangement plan.

General remarks

Appendix 3

Vessel Monitoring Plan Remote Electronic Monitoring (REM) - Part B

Responsibility of the REM system provider and to be validated by ICCAT and/or service provider

VESSEL IMAGE

System Configuration

System Operation - General Description

Sensor Recording:	Description of the settings
Video Recording:	Description of the settings

System Components Location

Control Box Image of location of the control box	User Interface
GPS Image of location of the GPS	GPS Details

Load sensor Image of location of the load sensors	Load Senor Details
Freezer Temperature Sensor in the fish hold Image of location of the temperature sensor	Freezer Temperature Sensor Details
Motion sensor the freezing tunnels for monitoring any activity Image of location of the motion sensor	Motion sensor details
Sensor to detect opening of freezer doors. Image of location of the door sensor	Door sensor details
Lux measurement sensor Image of location of the door sensor	Lux measurement sensor details

Hydraulic pressure sensor (for measuring crane activities) Image of location of the hydraulic pressure sensor	Hydraulic pressure sensor details
Fish hatch/door open/close sensor Image of Fish hatch/door sensor	A. Fish hatch/door sensor details

Camera 1 – Deck camera	
Image of location of camera 1	View and objectives
Image deck camera	Camera settings
Camera 2 – Deck camera	
Image of location of camera 2	View and objectives
Image retain/General View Camera	Camera settings
Camera 3 – Deck camera	
Image of location of camera 3	View and objectives

Image sorting belt camera	Camera settings
Camera 4 – Deck 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

Control Box Setting Summary Main Configuration Screen	Camera Settings Summary

General remarks
